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PUBLIC SECTOR INVESTMENT APPRAISAL

The Place of Flexibility in the Decision Making Process

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Thesis submitted for the degree of Doctor of Philosophy

The University of Aston in Birmingham

September 1983

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SUMMARY

This thesis reviews the main methodological developments in public sector investment appraisal and finds growing evidence that appraisal techniques are not fulfilling their earlier promise. It is suggested that an important reason for this failure lies in the inability of these techniques to handle uncertainty except in a highly circumscribed fashion. It is argued that a more fruitful approach is to strive for flexibility. Investment projects should be formulated with a view to making them responsive to a wide range of possible future events, rather than embodying a solution which is optimal for one configuration of circumstances only. The distinction drawn in economics between the short and the long run is used to examine the nature of flexibility. The concept of long run flexibility is applied to the pre-investment range of choice open to the decisionmaker. It is demonstrated that flexibility is reduced at a very early stage of decisionmaking by the conventional system of appraisal which evaluates only a small number of options. The pre-appraisal filtering process is considered further in relation to decisionmaking models. It is argued that for public sector projects the narrowing down of options is best understood in relation to an amended mixed scanning model which places importance on the process by which the 'national interest' is determined. Short run flexibility deals with operational characteristics, the degree to which particular projects may respond to changing demands when the basic investment is already in place. The tension between flexibility and cost is noted. A short case study on the choice of electricity generating plant is presented. The thesis concludes with a brief examination of the approaches used by successive British governments to public sector investment, particularly in relation to the nationalised industries.

appraisal; flexibility; project; decision; national

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PREFACE

Some of the ideas explored in this thesis have their roots in my own experience of project appraisal, first of all as a member of the economic planning staff at the Ministry of Overseas Development, then with the Department of Technical and Economic Co-operation in Thailand and with the Bureau of Agricultural Economics in Canberra. In all these places I was fortunate enough to work with colleagues whose wide experience and continuing interest in the subject provided a stimulating and thought-provoking environment.

Later, Ernest Braun as head of the Technology Policy Unit at the University of Aston, gave me the opportunity to reflect on this experience and to pursue the ideas further. My thanks are due to him and to my supervisor David Collingridge for his care in reading earlier drafts and for his many helpful comments.

Most recently, my colleagues in the Economics Department at Wolverhampton Polytechnic have provided very tangible support in bearing heavier teaching loads that I might have a lighter one. Sandra Oliver and Marilyn Mansell have typed this manuscript with care and efficiency.

Above all I am happy to have this opportunity to acknowledge the debt I owe my family. I cannot adequately express my thanks to my mother and aunt whose support stretches back to my childhood, to my own children who have shown a tolerance and understanding beyond their years, and most of all to David without whose help and encouragement the task would have proved insuperable.

CHAPTER 1 - Introduction: Problems and Issues

The principal problem addressed in this study is the current dissatisfaction with that area of decisionmaking which may generally be described as public sector investment analysis - dissatisfaction with both the end results of this decisionmaking, the projects which are implemented and therefore, by implication, with the framework within which decisions concerning national capital expenditure are taken.

Examples of specific projects which have become the focus of extreme dissatisfaction spring readily to mind and are well documented: Concorde; the Sydney Opera House; the Aswan High Dam; the Humber bridge; the AGR programme; ... More generally, hospitals are built and only half utilised, lacking necessary equipment and staff, housing developments are demolished decades before their initial capital charges will be cleared by the unfortunate authorities responsible, processing plants are built and the raw material input never eventuates, and so the list lengthens. The common thread running through all these public investments is, to put it at its most basic, that they did not fulfill the expectations which prevailed at the time they were initiated, although the individual reasons for this may appear to vary widely - excessive cost of execution, functional incapacity, technical unsuitability or simply lack of demand for their product. Nor can this view be dismissed merely as stemming

from tabloid journalism which loves to highlight the one failure out of a hundred successes¹. Where monitoring and ex-post evaluation of more routine projects has been undertaken, findings here, too, have been less than encouraging. Where encouragement may be derived it appears to be due mainly, not to superior planning ability or the use of more sophisticated appraisal techniques but rather to the ability of project controllers to modify and adapt the project to take account of changed circumstances which were not and in many cases could not have been foreseen at the outset. Although this characteristic of flexibility or adaptability has in the past been more likely to be the result of a fortunate accident rather than deliberate design², it is nevertheless a crucially important indicator of the direction in which we should seek ways of improving public sector analysis and decision-making.

The justification for according a significant role to flexibility in the overall objective of selecting what will eventually be perceived as good or satisfactory projects, together with an examination of the means by which this may be achieved, is the central theme of this thesis. As a preliminary, it is necessary to examine the existing framework of

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- 1 See for example the academically respectable P.D.Henderson, "Two British Errors: Their Probable Size and Some Possible Lessons", Oxford Economic Papers, Vol.29, No.2, 1976-77; P.D.Hall, Great Planning Disasters, London, Weidenfeld and Nicolson, 1980; B.A.Turner, Man-Made Disasters, London, Wykeham Publications, 1978; and most recently: O.P.Kharbanda and E.A.Stallworthy, How to Learn from Project Disasters, London, Gower, 1983. Analyses of individual projects are too numerous to mention. For example, Concorde, which figures in all of the above is the subject of: J.G.U.Adams and N.Haigh, "Booming Discorde", Geographical Magazine, 44, 1972; C.E.Edwards, Concorde: Ten Years and a Billion Pounds Later, London, Pluto Press, 1972; A.Wilson, The Concorde Fiasco, Harmondsworth, Penguin, 1973.
 - 2 In this context see A.O.Hirschman, Development Projects Observed, Washington, The Brooking Institution, 1967.

public sector decisionmaking, the rationale for this type of government intervention in the economy and the theoretical foundations on which present techniques of analysis are based. An outline of the argument is advanced below.

The type of analysis I have mainly in mind by the term public sector investment appraisal has at its centre what has elsewhere been termed rational analysis³ - an umbrella term for a variety of techniques which have developed from the profit and loss accounting of private enterprise, the most well-known of these being cost-benefit analysis. They depend for their rationale on the extent to which the free market economic environment fails to convey accurate information about the real costs and returns to society of the alternate use of resources. To the extent that the public sector is controlled by the government on behalf of the nation as a whole, it is this general body of techniques which has been developed as the appropriate analytical tool of public sector appraisals. However, as I shall examine later, one of the sources of dissatisfaction with this framework which has been identified and given considerable attention over the last decade, has been the failure of appraisal techniques to take adequate account of the political, social and administrative aspects of public decisions. In part this may be attributed to the attention given to and the degree of sophistication achieved by the techniques in the late 1950s and throughout the 1960s.

3 Michael Carley, Rational Techniques in Policy Analysis, London, Heinemann Educational Books, 1980.

They held out such promise⁴ that the other dimensions of public sector investment decisions were overshadowed⁵.

I therefore include within the term public sector investment appraisal all the dimensions appropriate to a decision to commit national resources to a particular project. I have also chosen it as a term less burdened by use than the more common cost-benefit analysis. However, it is important to recognise that an investment decision is still very firmly grounded in the area of economic analysis. Among other reasons this is because of the high direct costs and benefits involved. But economic policy guidance of this kind bears an uneasy and often unclear relationship to economic theory proper, and it is to say the least questionable, whether a direct transition may be made between the two. It is my contention that some of the assumptions of orthodox economic analysis, whilst necessitated by the high degree of abstraction and simplification required in the development of "high theory" which often means general equilibrium theory, is a very inappropriate basis for the development of decisionmaking techniques and is in large part responsible for the dissatisfaction stemming from the use of such techniques⁶.

4 Thus Peter Hall was able to talk of "a practical concept of economic planning which may prove in a few years time to be as revolutionary in its policy implications as was the Keynesian revolution in economics thirty years ago", P.Hall, Labour's New Frontiers, London, Andre Deutsch, 1964.

5 Early recognition of the need for multi-dimensional analysis came in Allison's examination of the Cuban Missile Crisis as seen through three different 'lenses' - rational, political and bureaucratic. This work has become a classic in the field. R.D.Allison, Essence of Decision: Explaining the Cuban Missile Crisis, Boston, Little, Brown and Company, 1971.

6 Hutchison refers to this conflict between theory and practice as a deep seated methodological paradox or tension in the subject. T.W.Hutchison, Knowledge and Ignorance in Economics, Oxford, Basil Blackwell, 1977, pp.2-3.

At one level it may be argued that there will always be some groups who will be dissatisfied with public projects. Even in a democracy, minority groups may suffer under the general approach of the greatest good for the greatest number, while under less representative systems national interest becomes synonymous with the interest of a dominant social group. Any realistic assessment of national decisionmaking founders without an appreciation of the existence of conflicting interests and any policy tool must take note of this. Nor are such conflicts easily categorised as present or absent, rather they may be considered as more or less significant and the more important and far-reaching is any particular proposal, the more likely it is to trigger such conflicts. Democratic political systems set out to handle these overall differences of values between different societal groups using procedures such as finite term governments, open elections and universal suffrage. The degree to which these procedures produce the desired consensus on individual issues is open to question. What is very apparent, however, is that such considerations find no place in orthodox appraisal methodology which assumes knowledge of an aggregate social welfare function and the neutrality of government. One task of this study will be to query this paradigm.

At a less general level, economic policies have been categorised as generally having a 'trinity of aims' irrespective of party political differences⁷. These are the allocation and efficiency of use of economic

7 Rodney Cross, "The Objectives and Instruments of Macroeconomic Policy in the U.K.", in Grant and Shaw (ed), Current Issues in Economic Policy, 2nd edition, Oxford, Philip Allan, 1980, pp.213-252.

resources; the distribution of income and wealth; and the stabilisation of economic activity. It is in the first of these categories that the appraisal of public sector projects is usually placed: i.e. a dominant concern underlying the appraisal techniques employed is that of identifying the optimum choice within any particular investment area.

The concept of optimisation is itself at the heart of the prevailing orthodoxy of economic theory termed neo-classical economics⁸ and is an appropriate point at which to start this investigation.

Neo-classical theory attempts to give theoretical form to the mixed market economies which have developed in Western Europe and North America in the 20th Century. It has at its centre a model in which there is a large number of consumers variously endowed, and a large number of producers of a wide variety of goods and services. Each consumer's preferences are described by his utility function and each producer's range of technology by a production function. Fundamental to this model is the principle of marginal equivalences⁹. Consumers maximise their utility subject to their income constraint by equating utility and price at the margin. Similarly they sell the services of factors at their disposal by balancing disutility against the marginal rate of return. Producers, likewise, purchase factors of production by equating productivity and cost at the margin and their price and output decisions are motivated by a profit maximisation objective. Producing and consuming are the only

8 Blaug refers to "a ... program that is frequently called neo-classical economics, although 'mainstream, orthodox economics' would be just as good a label". Mark Blaug, The Methodology of Economics, Cambridge, Cambridge University Press, 1980, p.160.

9 Ibid, p.301.

occupations permitted by the model and when pursued singlemindedly yield an optimal allocation of resources¹⁰. The natural consequence of accepting such a model is that the only intervention in such a framework which can be rationally justified is one which is made when a distortion occurs, a situation where a market failure is said to exist. Such failure is deemed to have occurred, for example, where an industry has been monopolised (in other words, the precondition of many producers has been breached). Under monopoly conditions output is lower and price higher than would be the case if exactly the same industry were perfectly competitive. If the output from such an industry was another industry's input then too little of the good would be used in this second industry (since its market price would be higher than its true resource cost). This would lead to a further divergence from an optimal or efficient allocation of resources if it went uncorrected. Further problems occur where some of the inputs and output of production and consumption activities are not traded, in other words where markets do not exist.

But the reality of the mixed economy is such that this is only one of the reasons for government intervention as the need has been perceived in post-war western economies. In the U.K. by 1939, Keynes' views were becoming acceptable and it was recognised that market forces both at home and in world markets were not enough to ensure the full use of the country's existing capacity, while the post-war Labour government as a matter of policy formalised the structure of public ownership of industries which had been more or less under the control of government for many years¹¹.

10 i.e. Pareto optimal in that no reallocation would make any participant better off without making another worse off.

11 For example electricity, coal, transport.

Publicly owned companies of this kind were in many important respects modelled on their commercial equivalents and as business management techniques in private industry became more sophisticated, this trend was reflected in the desire for similar techniques to be employed in the public sector. The main proviso was that efficiency was to be judged in terms of the public interest rather than private profit¹².

That the public sector was then and continues to be a significant part of the total economy (both in relative and absolute terms) may be briefly demonstrated by reference to recent figures given for the nationalised industries alone: "The nationalised industries employ about 1,700,000 people of 7% of the country's total labour force. Their total investment this year and next is about £3,500,000,000 at 1977 prices, and in 1976 they accounted for 14% of total fixed investment. In 1976 they contributed about 10% of the total output of the U.K. economy"¹³.

Looking at the rationale behind a government intervening in the economy as an operator rather than in its wider role as regulator, three distinct motives may be identified. These are not necessarily mutually exclusive. There may be an ideological or political motive whereby the government becomes the owner of capital and hence the recipient of profit returned to that capital, so that the welfare of the nation as a whole is enhanced and not just the welfare of private capitalists. Also included in this category would be cases where firms were taken into public ownership because of threatened bankruptcies. In this case concern would be with unacceptably high job losses or threat to the country's industrial base

12 At this early stage, the philosophical divergence between the two was not so great since national interest was identified as national profitability, i.e. in terms of GNP.

13 Cmdnd 7131, The Nationalised Industries, HMSO, 1978.

or export prospects. Secondly there is the motive of providing public goods. These are collective consumption goods which once provided are freely available to everyone. They would not be produced by the free market because of the difficulty of the supplier obtaining sufficient compensation for the cost of provision. The most notable example in this sphere is defence, where, it is argued, the outcome of defence expenditure, the protection provided, could not be afforded only to that proportion of the community willing to pay for it. The third category is where the public sector provides goods and services which are then sold on the open market at prices which cover their full cost. The motivation behind this role of government as quasi-commercial producer is more diffuse. Control may be sought solely because of overall political philosophy or it may be stimulated by considerations of efficient resource allocation. This in turn may either be because a natural monopoly is perceived to exist as in the case of postal services or electricity generation, or because a broader perspective is thought to lead to a more integrated and efficient system, for example when an overall transport or energy policy is possible because all the individual industries are within the public sector, thus permitting any spillovers of individual industries to be internalised in a centralised decision framework.

In practice, in the post-war U.K. economy, both major political parties have until recently pursued fairly similar approaches to public ownership despite different ideological perspectives¹⁴. To this extent the investment

14 In other words Labour governments, whilst maintaining Clause IV within the Party constitution, have in practice restricted nationalisation to those areas which might be justified by appeal to resource allocation considerations. Conservative governments have accepted similar arguments and maintained most nationalised industries. They were also prepared to mount rescue operations where necessary, for example at Rolls Royce and ICL. This consensus has now been overturned by the Thatcher governments' much stronger privatisation policies.

appraisal techniques which have been required have been based on the idea of re-creating the results of the competitive environment rather than pursuing overtly, objectives which are at variance with the efficient resource allocation aim of the neo-classical model¹⁵.

The underlying assumptions of the neo-classical model have been identified in varying ways by different commentators. For example, Hollis and Nell pick out five main assumptions:¹⁶

- (1) All economic activity is reduced to 'production' and 'consumption';
- (2) Perfect information exists;
- (3) Maximisation of benefits is the objective of economic activity;
- (4) Perfect factor substitutability exists in the production process and technical inefficiency is assumed to be non-existent;
- (5) Pre-reconciliation of choices, or at least a common time horizon, exists.

Latsis¹⁷ identifies the 'hard core' of the neo-classical research program in business behaviour as comprising four assumptions:

- (1) profit maximisation;
- (2) perfect knowledge;
- (3) independence of decisions;
- (4) perfect markets.

15 For example if a government aimed to change the distribution of income by its investment policies this would be at variance with the neo-classical model which provides an optimum allocation subject to the existing income distribution.

16 Hollis and Nell, Rational Economic Man, London, Cambridge University Press, 1975, pp.209-213.

17 Spiro J.Latsis, "A Research Programme in Economics", in Method and Appraisal in Economics, Latsis (ed), Cambridge, Cambridge University Press, 1976, p.23.

It is common, however, to abstract even further from these assumptions and to refer to the maximisation under certainty principle as being at the heart of the neo-classical model. This is a convenient shorthand but it fails to encompass what I believe to be a third underlying assumption - that of the flexibility which is assumed to exist in the system. Flexibility is supposedly demonstrated in the working of the price mechanism which identifies quickly and sensitively any change which occurs and provokes the responses necessary to reallocate resources optimally. The existence of flexibility is assumed also in production processes which enables these responses to occur smoothly and costlessly except within a very elementary system of constraints.

At the theoretical level, the individual assumptions of the neo-classical model have been under attack from different quarters and amendments suggested. Certainty has been replaced by strictly limited uncertainty where probabilities are attached to each of an exhaustive listing of possible outcomes and expected values calculated. Herbert Simon has advanced satisficing as a more appropriate assumption of business behaviour than optimising. Yet the link between the analysis and its implications for future decisions and decisionmaking techniques is difficult to determine. To quote Blaug: "Even Herbert Simon, with his concept of 'bounded rationality' as a constructive replacement for the notion of maximisation under certainty does not pretend to be capable as yet of making general pronouncements on the decision making process in business organisations"¹⁸. He continues, "In short the call to abandon

18 M.Blaug, The Methodology of Economics, Cambridge, Cambridge University Press, 1980, p.186.

the maximisation-under-certainty postulate has not so far been attended by any really convincing proposal to put something else in its place"¹⁹.

The failure identified here, though, is attributable at least in part to the demands imposed by a general equilibrium framework. Wildsmith has remarked, "Non maximising models may offer useful insights but they will be ultimately unsatisfactory if they fail to yield identifiable equilibrium conditions"²⁰. This point, I think, brings us to the heart of the problem with which we are faced. On the one hand economics as a discipline is concerned with providing analyses of different modes of economic organisation which are logical, consistent and exhaustive. As such these analyses owe as much to deductive logic and internal consistency as they do to real world relevance. They meet overall methodological requirements to the extent that they provide predictions that can in principle be tested²¹ but their prescriptive possibilities are undermined when the world fails to exhibit the initial conditions required for such testing²². Less damaging but more inexcusable is the impression that economists have in general shown a marked lack of interest in such testing even where feasible²³. For these reasons, however, the transition to prescription, to providing guidelines for decisions concerning future courses of action, as in the case of public sector investment appraisal,

19 Ibid.

20 J.R.Wildsmith, Managerial Theories of the Firm, London, Martin Robertson, 1973, p.30.

21 Most but not all economists would accept this as a necessary requirement; cf. post-war debate on operationalism. See M.Blaug, op.cit., pp.99-103 for a more detailed commentary on this debate.

22 Ibid, p.186. "In respect of the traditional theory of the firm, however, the vital question remains that of testing its predictions in a world that rarely satisfies the conditions required to apply it."

23 Ibid, p.178.

is extremely difficult. This step involves transferring the assumptions and interrelationships developed in a highly formalised context into the very much more complex and uncertain real world. Because of this the analytical techniques themselves prove less than capable of fulfilling their role of assisting in 'good' choices. What is being attempted is somewhat akin to trying to utilise the theorems of a non-Euclidean geometry in the day to day world. It is hardly surprising that less than satisfactory outcomes are achieved from employing appraisal techniques based on perfect information and flexible responses which lead to optimal solutions, when in reality situations are characterised by ignorance and rigidity and where, as I hope to demonstrate, flexibility has to be positively sought. In this case the best outcome may lie in choosing projects which are easy to change in response to future unforeseen circumstances.

That economics has had notorious difficulties in accommodating the dual aspects of analysis and prescription is recognised in methodological debates if not in the mainstream of the subject: "The distinction between positive and normative economics, between 'scientific' economics and practical advice on economic policy questions, is now 150 years old, going back to the writings of Nassau Senior and John Stuart Mill. Somewhere in the latter half of the nineteenth century this familiar distinction became entangled and almost identified with, a distinction among philosophical positivists between 'is' and 'ought', between facts and values, between supposedly objective declarative statements about the world and prescriptive evaluations of states of the world".²⁴

24 Ibid, p.129.

In addition, I have already referred to criticisms directed against the unidimensional nature of early appraisal techniques developed for 'prescriptive evaluation' purposes, where it was assumed that a single growth objective was to be maximised. Here it has become increasingly recognised that decisions like those on national investment involve a complex balancing of qualitative and quantitative economic, political and administrative factors. These views have been instrumental in the formation of the newer area of academic investigation termed policy studies. But, policy studies still acknowledges²⁵, rightly I believe, the place of rational analysis in the appraisal process. In the light of my earlier arguments the question which must therefore be tackled is how these techniques may be modified to improve the decisionmaking process.

The power of numbers is well known. If investment proposals are appraised using techniques which promise an optimal solution, an appearance of spurious accuracy is conferred on what is likely to be a very uncertain situation. If, however, certainty or strictly limited uncertainty is dropped as an underlying assumption of the analysis, and hence optimisation replaced by the more realistic aim of finding a satisfactory solution, then flexibility becomes the crucially important characteristic to link satisfactorily the pre and post decision states. In other words, true uncertainty implies that only partial information is available to the decisionmaker but also, more strongly, that only partial information can be available at the time of decision since future states of the world will generate new information over a project's gestation period and lifetime. In order to be judged satisfactory under these conditions, a project must be capable of adapting to changed circumstances and even in

25 Carley (1982), op.cit.

some cases to changed objectives. The longer the time between decision and implementation the greater is the likelihood that significant adaptation will be needed. The most significant problem therefore is to find ways of giving due importance to flexibility in the appraisal process. It is essentially the difference between static and dynamic analysis.

Finally a word should be said about what is to be understood by the term flexibility, and the need, if any, to attempt a precise definition. The most comprehensive survey in this respect has been carried out by Evans²⁶ who examines a very wide range of subject areas which use the concept. He has also identified seven other terms which are used interchangeably with flexibility. These are adaptability; elasticity; liquidity; plasticity; resilience; robustness; and versatility.

One lesson to be drawn from this survey is that while there are very many characteristics which may come under the umbrella of flexibility only a few of these may be applicable to any given situation. In its broadest interpretation flexibility may be seen as the ability of decisionmakers to retain control over projects and to respond to unforeseen situations. It is the opposite of being rigid, of being locked into a situation in which there is no freedom of action. There are, however, many different ways in which flexibility may be embodied in particular projects, and generalisations at this level are extremely difficult to make. In one context a flexible investment may imply the purchase of programmable, multipurpose machines rather than task-specific

26 J.S.Evans, Flexibility in Policy Formation, University of Aston Ph.D. Thesis, September 1982.

ones. In another it may embrace the learning by using concept²⁷ which in turn means that the original investment must be capable of modification to incorporate the lessons learned²⁸. In yet another flexibility may be increased by breaking up a monolithic investment proposal into smaller component parts.

For all these reasons therefore I have not tried to impose a very definite and precise meaning to the term. However, one distinction which it did seem very useful to make in the context of investment proposals was between the long and the short run or between ex-ante and ex-post flexibility. In the case of the former, flexibility has the connotation of keeping options open, of not rushing precipitately into one course of action, whereas once a decision is implemented and capital is in place, flexibility takes on the different meaning of being able to perform tolerably well under a variety of circumstances.

This distinction also mirrors two different levels of decisionmaking. The first, I suggest, is concerned with eliminating inappropriate solutions to a problem; the second with what is normally considered to be the subject matter of investment appraisal, the detailed evaluation and comparison of a few alternatives. Recognition of these two stages is, I believe, a necessary pre-condition to a better understanding of public sector

27 Kenneth Arrow, "The Economic Implications of Learning by Doing", Review of Economic Studies, Vol.29, No.2, June 1962.

28 For example, in a recent study of clinical analysers, von Hippel and Finkelstein show that those designs most amenable to user modification have achieved most commercial success. E.von Hippel and S.N.Finkelstein, "Product Designs which Encourage - or Discourage - Related Innovation by Users: An Analysis of Innovation in Automated Clinical Chemistry Analysers", Working Paper 1011-78 July 1978, quoted in N.Rosenberg, Inside the Black Box: Technology and Economics, Cambridge, Cambridge University Press, 1982, p.123.

decisionmaking of which investment decisions are an important part. This argument is developed in detail in Chapters III and IV and leads on to a consideration of operational flexibility in Chapter V, together with a short case study. However, as a basis for the development of these ideas Chapter II which follows reviews the development of investment appraisal methodology and techniques over the post war period and evaluates their outcomes in the light of available post investment evidence.

All governments intervene in their economies, some to the extent of virtually complete central control, others to a much lesser degree. It would be impossible to find an example of a completely free market economy, yet in the neo-classical world of economic theory this ideal still acts as a benchmark against which economic behaviour is measured and as a foundation for the development of some of the intervention techniques themselves. The intervention of government may take place at many different levels - from overall macro-economic management techniques through the planning and structural alteration of industries, specific involvement in particular areas of expertise or localities, or, most directly, as the provider of final goods and services as in the nationalized industries. All these types of intervention carry the implicit assumption that market forces alone cannot be relied on to allocate resources efficiently.¹

I. C. R. Byatt² has usefully categorized public sector

¹"Intervention is thus based on a belief that the impact of market forces on economic development in a modern mixed economy will be erratic, and that a government needs to be ready to act to correct what it sees as emerging imbalances." Stephen Young with A. V. Lowe, Intervention in the Mixed Economy. London Croom Helm 1974 p. 178.

²I.C.R. Byatt, 'Theoretical Issues in Expenditure Decisions' in M. V. Posner (ed) Public Expenditure Cambridge C.U.P. 1977 p.17.

activities into 4 types:

- (i) Public utilities and other trading or quasi-trading activities.
- (ii) Provision of public goods.
- (iii) Support of industry, regional policy etc.
- (iv) Income transfers and social security.

It is category (i) which is of most significance in the context of this study. It covers activities where the public sector is producing a marketable good or service. Nationalized industry capital expenditure, road building local authority housing investment etc. come into this category. Annual public expenditure in the mid-seventies in this area was around £4½ billion (15% of total public expenditure) but more significantly it was primarily capital investment.³

This is the area of public expenditure where investment analysis of the cost benefit type plays the major role⁴ since here investment is generally of the specific project type rather than in the form of programmes or support schemes. Indeed it was precisely to deal with investment decisions of this type that cost benefit analysis, and the more recent additions to this body of theory which come under the umbrella of the term, rational analytical techniques, was developed.

³Byatt *ibid* p.20-21. Figures from Cmnd 5519, Public Expenditure to 1977-78 HMSO.

⁴*Ibid*.

Development of Investment Appraisal Techniques

Although antecedents to the cost benefit techniques of project analysis stretch as far back as Dupuit's work in the early nineteenth century⁵. The most significant pre-war development of such techniques was undertaken by U.S. Federal Government Agencies, in particular those concerned with water development projects. At this time the test of whether investment should be undertaken was "if the benefits to whomsoever they may accrue are in excess of the estimated costs",⁶ although a secondary purpose in developing a nation's appraisal framework was to help decide who should pay.⁷

The U.S. government maintained its lead in this area in the immediate post war period. In 1950 the inter-agency River Basin Committee produced the famous 'Green Book'⁸ which was an attempt to codify and agree general principles. However fifteen years later when Prest and Turvey compiled their review article on the state of the art, it was abundantly clear that investment analysis of this type had

⁵ J. Dupuit "On The Measurement of Utility of Public Works" International Economic Papers Vol.2.

⁶ A. R. Prest and R. Turvey, 'Cost Benefit Analysis: A Survey' Economic Journal Vol. 75 December 1965 p.684.

⁷ Ibid.

⁸ Inter-Agency River Basin Committee (Sub-Committee on Costs and Budgets) Proposed Practices for Economic Analysis of River Basin Projects. Washington D.C. 1950.

moved away from particular agencies anxious to develop methodologies for their own specific investments, into the wider arena of economic theory.⁹ The authors cite as the main reason for this development the growth of the public sector in general in the post war period,¹⁰ the growth in size of individual investment projects and the concurrent development of such techniques as operations research and systems analysis.

As the idea of government in controlling new investments grew so too did responsibility to pursue policies in the "national interest". A growing need was perceived for a sound methodology within which to compare and evaluate projects in terms of the objective or objectives which reflected this "national interest", and to provide a selection procedure by which those that contributed most to it could be identified. Cost-benefit analysis (or social cost benefit analysis as some writers insist on calling it to emphasize the point) was developed to fulfil this need by valuing project inputs and output from the point of view of national resource costs rather than commercial values. In

⁹ Prest and Turvey themselves draw attention to the number of references cited in the bibliography and their date of publication. I would also draw attention to their place of publication i.e. academic journals rather than government publishing offices.

¹⁰ In the U.K., in the twenty-five years from 1938-1963 the public sector's percentage of gross fixed investment grew from 33% to 45%.

this general context it is not surprising that the Guardian at about this time described cost benefit analysis as "currently the most fashionable branch of economics."¹¹

Prest and Turvey summarize the state of the art as it was perceived at that time:

"Cost benefit analysis is a way of setting out the factors which need to be taken into account in making certain economic choices. Most of the choices to which it has been applied involve investment projects and decisions - whether or not a particular project is worthwhile, which is the best of several alternative projects, or when to undertake a particular project As choice involves maximization we have to discuss what it is that decisionmakers want to maximize".¹²

Another economist much involved with the subject at this time, Martin Feldstein emphasized the efficiency criterion even more starkly:

"If such investment (public investment) is to be made efficiently, economics must provide criteria for evaluating the desirability of undertaking particular projects and for choosing between competing public investment options"¹³

Having concluded that the aim is to attain the maximum

¹¹Quoted in G. H. Peters, Cost Benefit Analysis and Public Expenditure. Eaton Paper No.8, 3rd ed. 1973 p.12.

¹²Prest and Turvey op cit p.686 my emphasis.

¹³M. S. Feldstein, 'Opportunity Cost Calculations in Cost Benefit Analysis'. Public Finance Vol.19 1964 pp.117-139.

net present value possible subject to specified constraints
Prest and Turvey set out four questions which indicate the
general area of investigation of cost benefit analysis:

1. Which costs and benefits are to be included?
2. How are they to be valued?
3. At what interest rate are they to be discounted?
4. What are the relevant constraints?¹⁴

Thus some complex issues are incorporated within this
framework - the possibility of secondary costs and benefits
is acknowledged (question 1) and the need for shadow pricing
(question 2); the thorny problem of choosing a discount rate
(the focus of some extremely powerful theoretical
developments at this time¹⁵) is acknowledged (question 3)
and by this time an exhaustive classification of types of
constraint likely to impinge on the appraisal of a project
had been formulated by Eckstein¹⁶ (question 4). However, as
I sought to emphasise in the quotation from Prest and Turvey
above, the objective of project appraisal at that time was
seen as the maximisation of net discounted benefits - that is

¹⁴ Ibid.

¹⁵ For example the problem of choosing a discount rate was
extended to the even more theoretically complex issue of
whether a single rate could be used to measure both the
social opportunity cost of capital and the social time
preference rate. See M.S.Feldstein "The Social Time
Preference Discount Rate in Cost Benefit Analysis", Economic
Journal, Vol.LXXIV, June 1964.

¹⁶ O.Eckstein, "A Survey of the Theory of Public Expenditure
Criteria", in Buchanan (ed), Public Finances: Needs, Success
and Utilization, Princeton, Princeton University Press, 1961.

maximization of a single (monetary) figure¹⁷ relating to an investment opportunity.

The period between 1968 and the early 1970's saw a further stage in the development of public investment appraisal techniques. This is the time when the newly emergent states of the Third World became anxious to get to grips with the problems of their traditional peasant based economies, and saw the answer to many of their problems in investment in modern industrial technology. Since this was not something that could be left to market forces, as markets in this sense were often non-existent or at least only embryonic, it was obvious that such activity would have to be undertaken by central governments. This was the era of the appraisal manuals - UNIDO's, Guidelines for Project Evaluation, OECD's, Manual of Industrial Investment Appraisal for Developing Countries, and others by the British Ministry of Overseas Development and the World Bank.¹⁸ The development of

¹⁷ Albeit with adjustments from purely market valuations.

¹⁸ United Nations Industrial Development Organization, Guidelines for Project Evaluation, (by P. Dasgupta, A. Sen and S. Marglin), New York 1972

Organization for Economic Cooperation and Development, Manual Industrial Project Analysis in Developing Countries by Ian M.D. Little and James A. Mirrlees, Paris 1968. HMSO.

World Bank, Economic Analysis of Projects by Lyn Squires and Herman G. van der Fak, Baltimore, Johns Hopkins University Press, 1975.

Ministry of Overseas Development, A Guide to the Economic Appraisal of Projects in Developing Countries, London 1973 Revised 1977 HMSO.

investment appraisal techniques in this context high-lighted many problems which although very relevant also to developed economies, were brought into prominence by third World development problems.¹⁹

In particular it became increasingly recognized by the early nineteen seventies that the assumption of a single (national income) objective to be maximized was not an appropriate recognition of the several objectives that governments wished to pursue. There was a growing body of world opinion that suggested that economic growth neither was nor should be regarded as constituting the only goal in national economic policy.

For example the UNIDO manual identified six important areas in which a country may commonly wish to pursue certain goals:

- (1) Aggregate consumption
- (2) Income redistribution
- (3) Growth of national income
- (4) Employment
- (5) Self reliance
- (6) Provision of merit goods

¹⁹ For example, where unemployment exists in an economy then a market determined wage rate in any particular sector is not a true measure of resource cost unless labour skills of a specific type are totally unavailable. Thus a shadow price for labour needs to be introduced in appraisals undertaken from the national point of view. This is just as true for a developed as for an underdeveloped country but it was the extent of the problem of unemployment and underemployment in the latter that led to methods of shadow pricing to take this situation into account in economic decisionmaking. See Little and Mirrlees op cit Vol.2 Chapter 13.

The manual accepted the need to take account of multiple objectives,

"Project selection has to be done in terms of benefits and costs reflecting several objectives of economic decisions"20

The UNIDO approach was to frame appraisals in terms of average aggregate present consumption initially, and wherever possible to reflect other objectives in terms of the aggregate consumption objective. For example employment creation was to be reflected mainly through the aggregate consumption objective. Greater employment of a particular social group would increase a component of aggregate consumption which could be further weighted to value the redistribution involved. In the case of merit wants, for example women's employment, it might eventually be possible to infer weights from policy makers' choice of projects:

"We regard national weights as being initially unknowns in the planning process. What precise values these national weights will take will, it is hoped, emerge from the policymakers selection of projects. But their logic lies essentially in the policy makers ethical values"21

The UNIDO approach, therefore in keeping with its function as an appraisal manual, was essentially pragmatic.

By this time three main theoretical approaches to developing expanded analytical methods to assist project

²⁰UNIDO op cit p.99.

²¹Ibid p.106.

selection decisions were emerging in the literature. The first approach was a logical progression from the successive attempts in the United States to formalise and standardise the use of benefit cost analysis in project evaluation. A Task Force Report for the U.S. Water Resources Council in June 1969 proposed principles and standards to establish uniform criteria and procedures for multiple-objective planning in the development of water resources.²² The fundamental elements of this multiple-objective planning model were to delineate and display the impact of alternative plans on the objectives of national economic development, environmental quality, regional development and social well-being. A four account system was proposed to measure respectively, the extent of a public project's impact on each of the four objectives.²³ Maximization was still perceived as the aim of the exercise, but the trade-offs between objectives involved in the selection of the 'best' project was left implicit in the decisionmakers final choice of project.

A second approach on the same lines but which placed far greater emphasis on the measurement of these implied

²²U.S. Water Resources Council Special Task Force, Procedures for Evaluation of Water and Related Land Resources Projects, Washington D.C. June 1969.

²³Problems of the development and implementation of this type of planning is to be found in ECAFE Secretariat, Multiple-Objective Planning in the Development of Water Resources and its Ramifications with respect to Implementation, Report presented to ECAFE, Regional Conference on Water Resources Development, Tenth Session Manila, September 1972.

trade-offs was developed by McColl and Throsby in Australia.²⁴ These authors were particularly concerned with the regional aspects of project appraisal and attempted to provide a framework within which trade-offs between national income (efficient resource allocation) goals and regional income (distribution) goals, could be measured in public investment projects.

A third approach made use of mathematical programming models to incorporate multiple objectives into project appraisal. This was a development of earlier techniques based on the use of linear programming as a systematic methodology to assist in the analysis of capital budgeting problems, which are concerned with choices among alternative investment opportunities.²⁵ These earlier models did not, however, discuss the problem of multiple goals in capital budgeting. However in the early seventies the approach was

²⁴G. D. McColl and C. D. Throsby 'Multiple Objective Benefit Cost Analysis and Regional Development' Economic Record Vol.48 June 1972, 201-219.

²⁵See for example:
W. J. Baumol and R. E. Quandt 'Investment and Discount Rates Under Capital Rationing - A Programming Approach'. Economic Journal Vol. 75 pp.317-329 June 1965.

developed to encompass multiple goals.²⁶

The overall significance of these developments is that while the approaches varied in detail or in the particular trade-offs they chose to highlight, they all attempted to incorporate competing objectives within the optimization process. Previously, while it had been acknowledged that in practice many different considerations would form part of the final decision, a project's contribution to other objectives was appended in a descriptive form to the analysis rather than incorporated within it.

From this point two quite distinct approaches have emerged in relation to making project selection techniques generate "better" answers. The first was to pursue the multi-objective approach detailed above and to attempt to give it operational validity. However this procedure often met difficulties in getting decisionmakers to actually specify the trade-offs with which they wished to operate.²⁷ Even if the decisionmaker was in principle

²⁶ W. Candler and M. Boehlje 'Use of Linear Programming in Capital Budgeting with multiple Goals' American Journal of Agricultural Economics Vol.53 May 1971 pp.325-330.

R. W. Cartwright 'Simultaneous Consideration of Economic and Ecological Goals in Public Project Evaluation and Selection', paper presented to ANZAAS Conference, Sydney, August 1972.

R. W. Cartwright, Procedures for Establishing Research Priorities and Allocating Public Research Funds. Market Research Centre, Massey University, July 1972.

²⁷ Politicians often convey the idea that they both wish and are able to maximise all objectives. See for example UNIDO Manual op cit p.137.

willing to specify trade-offs the sheer difficulty of obtaining accurate weights was shown to involve immense resources of time and effort. Keeney's multi-attribute analysis is particularly significant in this respect.²⁸

²⁸ Keeney attempted to construct a multi-attribute utility function over eleven measures of effectiveness used to indicate the environmental impact of alternative energy development scenarios in Wisconsin. Originally Professor Wes Foell of Wisconsin had specified possible consequences of several energy alternatives. Keeney attempted to quantify the preference structure for the decisionmakers involved. At the outset a set of desired energy policy objectives were generated. Then attributes were specified (i.e. measures of effectiveness) to measure the degree to which these several objectives were met. The analysis was simpler than it might have been in the sense that for all attributes except electricity generated (e.g. fatalities associated with different techniques, loss of usable land) less of an attribute was preferred to more. In order to assess a multi attribute utility function the assessor asks the decisionmaker a series of questions about his/her preferences. First, questions are asked to determine the general shape of the utility function, then more specific questions are used to quantify a specific utility function. Finally consistency checks are carried out and any necessary modifications made. In the case of the electricity choice problem referred to above Keeney estimated that eight hours were necessary in order to reveal the 'decisionmakers' multi attribute utility function. However, the decisionmaker was another academic (Bill Buehring) closely associated with the general project. Keeney (rightly) points out that given the millions of dollars being spent to model such crucial questions it should be possible to free a real decisionmaker with a comprehensive knowledge of the problem area for a week or so. The problem may not be so simple however. (1) A policymaker might need considerably more than a week to understand the process of analysis. (2) The idea of a single decisionmaker who would feel able to specify such trade-offs may not be met in reality. This general technique has however had some use most particularly in conjunction with Delphi techniques.

R. L. Keeney, Paper presented to IIASA, Laxenburg, Austria 1976.

Other writers sought to show that a system of multi-objective weights was too blunt an instrument to commend general agreement even if the operational difficulties could be ironed out.²⁹

²⁹An amusing example in the context of changing income distribution is given by Harberger.

"An example I found useful for conveying the essential elements of this sort of transfer is a project to send ice cream on camelback across the desert from a richer oasis to a poorer one. If λ is equal to 1 and the richer oasis has twice the per capita income or consumption of the country as a whole (this makes its $\phi_i = 1/2$), while the poorer oasis has a per capita income equal to half the national average (for a ϕ_i of 2), it would be possible for up to three-fourths of the ice cream to melt en route without causing the project to fail the distributionally weighted cost-benefit test. (The resource costs of the camel transport are neglected in this example.) If λ were equal to 3, the ϕ_i of the richer oasis would be 1/8 and that of the poorer one would be 8. In this case (again neglecting the resource costs of transport), up to 63/64 of the ice cream could melt away without causing the project to fail the test.

The lesson from these examples is clear: When distributional weights are used together with weighting functions of the type most commonly employed in writings on the subject, the result is to open the door to projects and programs whose degree of inefficiency by more traditional (unweighted) cost-benefit measures would (I feel confident) be unacceptable to the vast majority of economists and of the informed public."

Arnold C. Harberger, 'On the Use of Distributional Weights in Social Cost Benefit Analysis', Journal of Political Economy Vol.86 No.2, 1978, p. 113.

A slightly different line is taken by Byatt who argues that to introduce weights, for example for income distribution purposes, runs the risk that numbers will be invented to justify a decision taken on other grounds.
I.C.R. Byatt op cit p.25.

The central problem facing investment analysis in the seventies was therefore perceived as being the need to take into account the clearly observable fact that governments were concerned with more than a single growth of national income objective in their public expenditure programmes.

Quite a different approach to that outlined above is shown in that area of studies termed policy analysis. Here rational analysis of the cost benefit type is accorded a place in the general evaluation of public projects but as one of a range of considerations. The overall approach is to acknowledge the complexity of any decision taken in the public interest not only because of the difficulty of determining the objectives which make up the perceived national interest and their relationship to each other, but, as importantly, the fact that the idea of the single decisionmaker implicit in the rational analytic type of analysis misunderstands the political and bureaucratic processes. In addition to direct economic analysis these other dimensions will have considerable significance in public sector decisions, even in those areas where the direct evaluation of capital investment sums and tangible outputs are of very great importance through their size alone.

Perhaps the most striking analytical demonstration of this is to be found not in a public expenditure text but in a foreign policy analyst's work in decision theory. G. T. Allison³⁰ evaluated, with the benefit of hindsight, the Cuban

³⁰ G. T. Allison, Essence of Decision: Explaining the Cuban Missile Crisis, Boston, Little Brown Company 1971.

missile crisis using three quite distinct frameworks - a national actor paradigm, an organizational paradigm and a bureaucratic politics paradigm. In the first model (which corresponds closely to rational economic decisionmaking models) the outcome or end result is seen to be generated by rational action undertaken by a unified decision executive based on a pre-determined objective.

In the two other models the implications of Model I, that monoliths perform large actions for large reasons is substantially rejected. In Model II the decisionmaker is not a single entity (government) but a loose alliance of semi-independent organizations functioning according to regular patterns of behaviour. In Model III choice, or outcome is characterized as a resultant of various bargaining games among players in the national government.

Allison's concern is to show that, when each of these conceptual lenses is focused on a single event (the Cuban missile crisis) three quite different analyses will result.³¹ The conceptual models are much more than simple angles of vision. Each consists of a cluster of assumptions and categories that influence what is identified as needing explanation, how questions are formulated, what type of information is sought and where it is sought, and what is produced, finally, as an answer.³¹ Allison highlights each

³¹ Ibid p.4-7.

³² Ibid p.245

model's tendency to produce different answers to the same questions. Equally striking is the difference in the ways analysts of each type "conceive of the problem, shape the puzzle, inpack the summary questions and pick up pieces of the world in search of an answer".³³

Although Allison's analysis is retrospective his findings indicate quite clearly how ex-ante decisions of the project appraisal type will be viewed in different ways by different decisionmakers and their analysts all having justifiable claim to be part of the decisionmaking process.

The problem is not ignored by all public investment analysts but nowhere is it spotlighted. Thus A. J. Harrison³⁴ writing on decisions in the transport sector comments critically on the fact that both theoretical and applied studies of the application of rational techniques to the evaluation of public-sector expenditure have paid little attention to the context in which the analysis is to be used. The implicit assumption is often that of a single decisionmaker which in turn enhances the view of a single major decision. "In the real world" suggests Harrison "decision processes are complex involving not only the interplay between various parts of an organization but also interaction between organizations and between

³³ Ibid p.249

³⁴ A. J. Harrison, 'Decisions in the Transport Sector' in M. V. Posner, Public Expenditure op cit p.133-159.

organizations and the outside factors affecting them. They typically last a long time and involve a great number of stages"³⁵

Thus Harrison characterizes the decision process as a lengthy business, broken up into sub-decisions which are taken with regard to a variety of criteria.

"The initial decision may be set off by a large number of states of the world, and once this decision has been taken, and the next stage is reached, the original states of the world (in which one includes expectations) may no longer exist. These decisions will be delegated to officials of one kind or another; initially perhaps an engineer later to an administrator and at both stages economic analysis may (or may not) give its blessing. Finally the decision will be taken by a politician but his 'decision' or choice is shaped if not determined, by what has gone before."³⁶

What conclusions are we to draw from this apparently realistic assessment of the context within which public sector decisions are taken in a moderately unauthoritarian, decentralised state? It suggests first of all that the development of even more sophisticated multi-objective decisionmaking techniques may be something of a cul-de-sac as far as practical application goes. If more than one

³⁵ Ibid p.142.

³⁶ Ibid.

decisionmaker is involved in the decision process then the establishment of trade-offs between objectives may be impossible to determine. This does not necessarily imply that representatives of a government exhibit specific disagreement on the objectives that constitute the national interest, it is sufficient that in any decision situation different members are employing different "conceptual lenses". Secondly, even those potential projects identified as 'big' or 'monolithic' are not characterized by a single, firm decision. As I shall argue in Chapters III and IV below, at least two significantly separate decision stages are involved in any public sector project choice, the selection of the range of projects from which choice is to be made, and then the appraisal of the shortlisted projects.

Within these categories the various "gears and levers" of the highly differentiated decisionmaking structure are at work also. If the process of making choices is seen as dynamic rather than fixed, appraisal methods which can be incorporated into an iterative pattern - a learning process to aid the move from general strategy to specific projects - become necessary. This requirement inevitably values methods which provide general guidance (for example, that indicate the general direction of search may be ill-advised) as well as those that embody specific selection procedures.³⁷

³⁷ American work in this area has given rise to some wonderfully expressive metaphors: appraisal techniques have first to establish that the analyst is in the right ball park before being used to assess who is going to win the game!

This is a different emphasis to the approach of grafting on social and environmental considerations to an assessment of monetary costs and benefits. It accords much more importance to the context within which decisions are made and its impact on the decisionmaking process. However if such an approach were merely to push rational appraisal techniques back into a modified type of profitability assessment (albeit of a social rather than commercial type) then it is not a response adequate enough to lay the unease which led to the desire for some form of multi-objective analysis in the first place.

A related point is made forcefully by Dasgupta, Sen and Marglin in the UNIDO guidelines, where they stress the need for explicit specification of the parameters of project assessment that directly reflect political judgements:

"It is in effect necessary for technicians to take the initiative and to force political leaders to reveal their value judgements."³⁹ However the authors see the easiest way of achieving this not by attempting to specify values prior to evaluation, but by "confronting the political leadership with alternatives that emphasize the various dimensions of social welfare in differing degrees."³⁹ Thus "technicians will make it impossible to maintain the pretence that project analysis is technical and apolitical"⁴⁰ The authors then go on to

³⁸ UNIDO op cit p.258.

³⁹ Ibid.

⁴⁰ Ibid.

express the hope that eventually sufficient information will accumulate to permit pre-specification of the weights to be attached to project parameters, at which point a "top down planning procedure" becomes feasible and calculations reduced to a 'single number'. This development seems neither desirable nor feasible. It restricts the flexibility of project formulation and also embodies the assumption that the objectives - information about which must be collected and appraised over time - are immutable, needing only to be revealed.

Yet it does highlight the problem facing those concerned with the development of public sector appraisal techniques. Recognition that more than a single objective has claim to be considered in public investment decisions, has served to emphasize how complex determination of the 'national interest' is. In particular how sensitive it is to the political and administrative framework within which decisions are made. It is becoming increasingly apparent that some means must be found of taking these factors into account.

However I do not wish to move too rapidly from a consideration of how public sector projects are appraised , to suggestions for amending or improving the process. Such a procedure needs to be substantiated by a clearer demonstration that there is at present dissatisfaction with the results being obtained from currently employed methods.

Post-Investment Studies

I referred in Chapter I to several examples of public

projects deemed in some sense to be failures. Some well documented examples of such public investment projects occur in P. D. Henderson's study of the AGR and Concorde projects in the U.K.⁴¹ and Peter Hall's more wide ranging study of worldwide planning disasters.⁴² Whether we prefer the term 'error' or the more emotive word 'disaster' the implication is the same. Somewhere along the long road from conception to implementation, expectation and reality diverged leading to dissatisfaction with the final product or outcome. The examples chosen in the above works were large and important projects and precisely because of this it was to be expected that if they were not regarded as successful they would be subjected to scrutiny. Post-investment evaluations of this kind will, it is hoped, provide useful insights into some of the reasons for their failure but the very prominence of the projects might be a source of some unease. It has generally been recognized that investment appraisal techniques of the cost-benefit kind are not applicable to very large and significant projects (large relative to a given economy). Prest and Turvey cite as an example of this a major dam project in a small country. Such a project would be "likely to alter the constellation of relative outputs and prices over the whole economy ... and nothing less than some sort of

⁴¹P. D. Henderson, 'Two British Errors; Their Probable Size and Some Possible Lessons', Oxford Economic Papers Vol.29 No.2, July 1977 pp.159-207.

⁴²Peter Hall, 1980 op cit.

general equilibrium approach would suffice in such cases."⁴³ In a similar way projects like the Sydney Opera House or the Third London Airport might be considered so unusual and one-off in character that any experience they provided might be considered to have little general relevance. This is, I believe, only partly true. Whilst particular conclusions regarding a project's impact might be considered unique, there is no reason to suppose that the methods and approach by which such investments have been appraised are not a reflection of a more general attitude to public investment evaluation. Nevertheless it would be preferable to have evidence on the performance of less glamorous public investment projects.

It would not seem an unreasonable assumption that, alongside the growth and development of appraisal techniques in the post war period, there would be a developing literature on the ex-post evaluation⁴⁴ of investment projects. With the growing significance of public sector investment and the realisation that such projects needed to be assessed on a different basis than straightforward profitability, such ex-post evaluation would seem to be an important source of

⁴³Prest and Turvey op cit p.685.

⁴⁴There have been some attempts to reserve 'evaluation' as a term only used for examining the performance of investments in relation to the analysis carried out before they were initiated. However this does not seem to be sufficiently universal to warrant dropping 'ex-post' from the description of this sort of assessment.

knowledge of the effectiveness of techniques and a guide to their future development. With some few exceptions which do prove illuminating and which I shall refer to in more detail below, this body of information has in fact not materialised.⁴⁵

What appear to be the reasons for this? It is not that the value of such studies have not been appreciated. D. Nyhart recognizes follow-up as one of the four phases of a project⁴⁶ but notes a tendency for it to be accorded insufficient importance. His particular focus is the investing agency (such as a development bank) in relation to the projects which are financed. He identified five main reasons for the neglect of follow-up (i) reluctance of borrowers to co-operate after they have received financial assistance; (ii) delay in the appearance of follow-up's full burden; (iii) novelty of the concept; (iv) relative lack of glamour compared to ex-ante appraisal; (iv) withdrawal from

⁴⁵ Most developments in both the theory and practice of ex-post evaluation occurs in the United States and in relation mainly to social programmes - education, health, community action etc.

See for example:

Francis C. Caro(ed) Readings in Evaluation Research
New York, Russel Sage Foundation 1971.

Carol H. Weiss, Evaluation Research, Englewood Cliffs,
New Jersey, Prentice Hall 1972.

⁴⁶ The other three being identification, selection and administration.

J. D. Nyhart 'Organization of Professional Cadres for Industrial Project Evaluation, Selection and Follow up' in UNIDO, Evaluation of Industrial Projects, NY 1968.

further involvement on the part of the lender. These difficulties may be interpreted as stemming mainly from the delicate relationship between international funding agencies and third world national governments, but the same result (if for different reasons) emerges from a study undertaken by the Economist Intelligence Unit to review project appraisal experience in the United States, the United Kingdom and France.⁴⁷ The survey covered not only public sector agencies but large commercial firms and, in the case of the United States some international agencies resident there.⁴⁸ It concluded that post-mortems were not usually carried out. "Few companies thought that the examination of individual projects was worth the cost of the investigation".⁴⁹ Few companies in France or the U.K. had any systematic procedure for follow-up, the main reason given that in retrospect it was often impossible to isolate the results of individual projects.⁵⁰ Other reasons given were: changing circumstances; cost inaccuracies; conflict of personalities; lack of managerial time.⁵¹ Even where post-mortems were part

⁴⁷ The Economist Intelligence Unit, 'Industrial Project Evaluation in the United States, The United Kingdom and France' in UNIDO (1968) *ibid* pp.198-228.

⁴⁸ *Ibid*. For example IBRD.

⁴⁹ *Ibid* p.200.

⁵⁰ *Ibid* p.219.

⁵¹ *Ibid*.

of a company procedure, they were limited in nature, although one French producer of natural gas observed that useful lessons could be drawn from ex-post evaluation in regard to new projects.⁵² In other cases post-mortems were only carried out if the project failed.⁵³ Although the precise method of assessing such failure was not made explicit, the implication was that it was equated with project collapse.

The UNIDO studies referred to above were compiled in the late sixties, but matters have not improved substantially in the last decade.

Brewer,⁵⁴ in the forward to Haveman's U.S. Water Resources Study, one of the few works to appear on ex-post evaluation, refers to the lack of post investment analysis as one of the weakest aspects of the planning process.

"Public resource development planning has been essentially a static ex-ante activity. To be sure, the methodology and empirical planning factors have been improved over time, but few public resource agencies have developed procedures for monitoring the economic performance of the projects they have undertaken."

⁵² Ibid.

⁵³ Ibid - in particular the international agencies followed this pattern AID; IBRD; IDB.

⁵⁴ Michael F. Brewer, Vice President Resources for the Future in the foreword to Robert H. Haveman, 'The Economic Performance of Public Investments: An Ex-Post Evaluation of Water Resources Investments', Baltimore, Johns Hopkins Press 1972.

While five years later Corti⁵⁵ in an assessment of the British experience makes a plea for, "something that economists are not too good at nor too keen on. It is more evidence of the track record, more studies concerned with trying to evaluate how things have turned out. If we think that CBA will assist decision taking . . . why are we not putting more effort into seeing whether and how much it has assisted decision taking?"

The point need not be laboured further. However it is important to point out, one of the crucial determinants of whether post investment appraisals or, more generally, the monitoring of project performance is carried out, is whether a real possibility exists of making revisions or rectifying errors. If such a possibility is either administratively, technically or economically infeasible then one important reason for follow-up studies is nullified. Nevertheless the second, more academic, justification for post-investment appraisal still remains - that of using experience as a means of improving assessment techniques - so that it is somewhat surprising that the evidence is as sparse and scattered as it appears to be.

Some does exist however, and I wish to make reference

⁵⁵G. C. Corti, 'Cost Benefit Analysis, The Way Ahead' in M. V. Posner(ed) 1977 op cit pp.260.

here to four examples⁵⁶ - different in their focus and approach but all motivated by the general view that systematic consideration of post investment experience can be a useful starting point in improving the performance of projects.

Haveman in 'The Economic Performance of Public Investments' is most directly concerned with developing and applying ex-post evaluation as a direct test of ex-ante appraisal techniques.⁵⁷ His analysis is based on selected water resource development projects because appraisal techniques in this area had reached an advanced stage of development.⁵⁸ He chose this type of project also to provide an illustration for that class of public investment projects characterized by lengthy construction periods and heavy net costs in the early years with a relatively long time elapsing between inception of the project and observable results.⁵⁹ Haveman conducts his

⁵⁶ Robert H. Haveman (1972) op cit.
- P. D. Henderson (1977) op cit.
- Peter Hall (1980) op cit.
- Albert O. Hirschman, Development Projects Observed, Washington DC Brookings Institution 1967.

⁵⁷ "Neither in the literature of public expenditure analysis nor in government practice should the efficacy of ex-ante benefit cost analysis continue to be accepted as a matter of a priori logic and faith" Haveman (1972) op cit p.2

⁵⁸ As we have seen earlier much path breaking analysis was developed in this area.

⁵⁹ Haveman op cit p.3-5.

analysis only in terms of a primary objective of national economic efficiency. He justifies this stance on the grounds that public works activities do not typically serve social functions other than the correction of market failure. In the light of earlier discussion on national objectives this now seems an unacceptable compartmentalising of goals and his secondary justification, on the grounds that there is more agreement on the measurement of variables within the efficiency model derives from the initial assumption rather than substantiates it. Nevertheless his further point that agreement on variables would not be readily forthcoming for multi-objective models certainly holds, and on pragmatic grounds alone one has some sympathy with his stance.

Haveman studied some eighty-six water resource projects (sub divided into three main categories) and attempted to draw some general conclusions. His results were not encouraging. He found that ex-post estimates of benefits often showed little relationship to their ex-ante counterparts⁶⁰ and that serious bias in terms of overstatement of benefits appeared to be incorporated into agency ex-ante evaluation procedures. There was also an enormous variance between estimated and realised costs - in almost 50% of projects the realised costs deviated by more than 20% from estimates although without systematic bias. Overall Haveman concluded that the evidence was such to indicate a serious need to reappraise the procedures of

⁶⁰ Ibid p.111.

benefit cost analysis as practiced by government agencies. The results posed serious questions about recent trends to broaden the scope of appraisal to incorporate objectives other than the efficiency one. Whilst acknowledging the relevance of other objectives to the overall decision, he concluded that attempts to incorporate them within analysis of the cost benefit type was ill-advised until more confidence could be placed on estimates of primary impacts.

The other three studies concentrate less on matching before and after statistics than on a more general interpretation of project experience in the light of what one author terms "an eclectic body of theory called from the borderland of political science, welfare economics, social psychology and ethics."⁶¹ Henderson in "Two British Errors: Their Probable Size and Some Possible Lessons" elects first of all to calculate the primary costs and benefits of two public expenditure programmes⁶² - Concorde and the AGR. The "error" of these two decisions is then interpreted as the total estimated programme loss £1,670-£2,320 million in the case of the Concorde and £1,640-£2,100 million in the case of the AGR.⁶³ This is a valuable exercise in itself since

⁶¹Hall op cit (ix).

⁶²They are referred to as programmes because of the assumed replication of the initial project - in the case of the nuclear programme 5 power stations each with two AGR reactors. Henderson p.161.

⁶³The figure varies according to assumptions about the discount rate to be used.

although feelings of dissatisfaction with both programmes were widespread by the time of writing⁶⁴ (1976) tangible evidence in the form of cost statistics were not readily available.⁶⁵

Henderson's general conclusions however rest more on his own intimate knowledge of institutional and bureaucratic practices. To the economics profession in general he warns of overconfidence in forecasting techniques and ignorance of actual outcomes of past expenditure programmes together with a disconcerting ignorance of technology. More specifically he identifies some British administrative conventions and characteristics which tend to increase the use of error in public investment decisions. Briefly they may be identified as decorum (i.e. excessive formality) in the form of (i) rigid definition of roles; (ii) impersonality; (iii) administrative tidyness and unbalanced incentives - especially in circumstances where it appeared that being right counted for nothing. Unbalanced incentives are reinforced by anonymity - few will ever know who was right, and secrecy, which further dilutes individual responsibility and makes it even more difficult to learn from experience.

The two other studies are longer and more wide

⁶⁴Ibid pp.163-164.

⁶⁵See Henderson's appendix on The Derivation of the Figures pp.194-205.

ranging. Peter Hall in Great Planning Disasters is most concerned to emphasize the multi-faceted nature of the decision process in the planning of public sector investment projects. He perceives the basic problem of poor decisionmaking as having two component parts. Firstly it results from poor forecasting, which he classifies⁶⁶ as resulting from three different types of uncertainty.⁶⁷ Secondly there is the difficulty of establishing common values in a diverse society.⁶⁸ In order to understand better past decisions (disasters) he develops a three group framework similar to Allison's models. These groups are the community, the bureaucracy and the politicians.⁶⁹ This provides him with a means of explanation for his case

⁶⁶ Using terminology developed by J. K. Friend and W. N. Jessop in Local Government and Strategic Choice, London Tavistock Publications 1969.

⁶⁷ Uncertainty in the planning environment, uncertainty in related decision areas and uncertainty about value judgements, Hall op cit pp.4-12.

⁶⁸ "How does a society composed of different individuals with different tastes and preferences, form rules that allow rational decisions to be made about the supply of public goods.
Ibid p.254.

⁶⁹ Ibid pp.199-241

studies⁷⁰ but is less helpful as a guide to improving future decisions.⁷¹

Hirschman's book, 'Development Projects Observed' is chronologically the earliest of the studies and hence was able to draw less advantage from theoretical developments in ex-ante techniques. It is based on the author's study of eleven World Bank funded projects. It does not however adopt a case study approach but depends more on eliciting themes from the projects actually reviewed, supplemented by a lifetime's study of policymaking in economic development. His main focus, therefore is not directed towards whether individual projects were successes or failures but rather in identifying particular characteristics which improve (or detract from) the chance of success.

Despite the wide variance in these four studies there are some common threads running through them. First of all, there is general agreement that the outturn of a project may be significantly different from that anticipated prior to its implementation. Haveman, Henderson and Hall use this as a criterion of error or failure - Haveman in so far as it undermines the faith one might have in ex-ante calculations

⁷⁰ Which range from the Third London Airport and Concorde in the U.K. to the Sydney Opera House and the San Francisco Rapid Transit System.

⁷¹ Hall himself says the framework provides "a convincing explanation of how decisions are bungled but not of how they might be taken with more foresight and more careful evaluation." Ibid p.248

of primary costs and benefits, Henderson and Hall as a more general indication that ex-ante methods have resulted in projects "which ought not to have been undertaken"⁷² or where the planning process was "perceived by many people to have gone wrong".⁷³ A crucial aspect of this divergence was seen to stem from problems of uncertainty and its relationship to forecasting ability. The point is made time and time again that the values assigned to variables in the ex-ante appraisals bore little relation to those which actually occurred when the projects were implemented. It is interesting that of the four only Hirschman presents this divergence between plan and outcome as having a positive as well as a negative aspect. Like the other authors Hirschman gives due prominence to the problem of uncertainty surrounding projects - especially as it relates to forecasting ability, but relates it to two sets of potential developments: (1) a set of possible and unsuspected threats to its profitability and existence and (2) a set of unsuspected remedial actions that can be taken should a

⁷²Henderson op cit p.163.

⁷³Hall op cit p.2.

threat become real.⁷⁴ To this extent Hirschman is propounding the view that unforeseen events are not totally destructive if they can provoke a creative response. Yet he fails to make the final connection between this and the positive value of flexibility in project formulation and operation. In other words for Hirschman human creativity is essentially an unplanned compensation for unforeseen and unforeseeable external events rather than the basis for systematic project preparation for these same external events.

Selecting the 'Best' Option: Ignorance and Optimization

Although the problem of forecasting future and hence uncertain events has been appreciated within the project appraisal literature for some time, attempts to deal with it

⁷⁴ A particular example of this duality is exhibited by the Karnaphuli pulp and paper mill in Pakistan.

The mill was planned to utilize the resources of the bamboo forest of the Chittagong Hill Tracts along the Karnaphuli River in what is now Bangladesh. It started to operate in 1953 and by 1959 was enjoying a measure of success. Then the bamboo began to flower and subsequently to die. (The bamboo flowers only once in a lifecycle of 50-75 years and then dies - the regeneration of the plant coming from the seeds) So much was not entirely unforeseeable in the sense that it was part of a known (but not accurately known) natural cycle. What was at this time unknown was that the dead bamboo would disintegrate on being transported by river and hence would be unusable. Further a period of several years was necessary for the seed generated shoots to grow sufficiently to permit commercial cutting and pulping. However, several creative responses were generated by this apparent disaster including a wider supply area utilizing existing cheap water transportation and several different approaches to diversify the raw material base of the mill.

Hirschman op cit 9-10.

at the theoretical level have remained highly circumscribed. Broadly speaking efforts have been mainly directed towards the use of probability distributions: either "objective" probabilities associated with the 'frequency' or classical approach, or 'subjective' probabilities in Bayesian analysis.⁷⁵ In the first case the decisionmaker is assumed to be able to compute from past experience the probability that any circumstance (from a complete listing of all possible circumstances) will occur. From this he can derive a probability distribution of outcomes for each decision, and then (assigning values) the probability distribution of utilities. In this case the simple single value discounting model which assumed certain knowledge of the values to be attached to all variables, has been replaced by a model using expected values. Such an approach depends absolutely on existing knowledge generating completely accurate frequency distributions from a stable population of events.⁷⁶ In other words the approach has not escaped at all from the assumption of perfect information.

⁷⁵ It is conventional to designate the former as a situation of risk and the latter as uncertainty but such a distinction is unnecessary here since neither category bears any resemblance to the ignorance of the future with which decisionmakers and analysts have to contend in real choice situations.

See David Collingridge, The Social Control of Technology, Milton Keynes Open University Press, 1980, pp.23-25.

B. J. Loasby, Choice Complexity and Ignorance, Cambridge, Cambridge University Press 1976 p.7-10.

⁷⁶ Loasby p.8.

A further modification, the subjective probability approach, allows for lack of past experience, lack of adequate data, attitude to risk on the part of the decisionmaker etc. Thus some events or outcomes are subjectively assessed as being more likely or probable than others. Such a concept as subjective probability only leads to an operationally meaningful theory if numerical values can be assigned to degrees of belief in a systematic manner.⁷⁷ Once this is done a determinate solution to the problem in terms of subjectively perfect risk assessment is achieved, but as Loasby⁷⁸ points out, like risk it requires a complete listing of all relevant outcomes and also a full listing of all possible courses of action. Loasby continues:

"When someone says he is uncertain, what he usually means is not just that he doesn't know the chances of various outcomes, but that he doesn't know what outcomes are possible. He may well be far from sure even of the structure of the problem that he faces. This normal state of partial ignorance is simply not defined in the theory of decisionmaking under uncertainty, in which 'uncertainty' acquires an esoteric meaning. This meaning serves to hide from the layman the fact that the economist, faced with a

⁷⁷ See for example, Dasgupta and Pearce op cit p.180-185. These authors consider various systems of axioms for consistent choice between uncertain prospects as developed by Ramsey, Von Neumann and Morgenstern, Savage and Marschak.

⁷⁸ Loasby op cit p.9.

very awkward problem, has succeeded, as so often, not in solving it, but in denying the legitimacy of its existence".⁷⁹

Given that all the authors of the post-investment studies considered earlier linked the problem of poor performance with pervasive uncertainty or ignorance in the pre-investment appraisal analysis, it is pertinent to ask why attempts to handle this problem have ended in such a blind alley. In order to pursue this question further it is, I feel, necessary to explore, albeit briefly, the theoretical foundations on which the appraisal techniques themselves are founded.

The development of public expenditure theory as an area of academic investigation which has gained prominence in the post-war period in Britain and other developed economies, mirrors the move, also most significant in this period, from the laissez-faire approach to economic management in the last century to the mixed market economy of the present day. The development of the mixed economy has recently been described as "a major contribution to postwar European thought. Other Europeans than ourselves have embraced the idea and have drawn strength from it ... The concept was a product of the aspirations of the period just before and after the war. It expressed above all a search for consensus that would put

⁷⁹ Ibid.

behind us the pre-war spectres of social, economic and political breakdown . . . it also pointed the way for a new relationship between polity and economy."⁸⁰

It is this relationship between polity and economy represented by a much more active interaction between government and the economy which is at the heart of the mixed economy. It is equally the relationship which has rendered exceedingly complex the links between economic theory as an analytical system and economic management techniques as one set of tools in the armoury of governmental policy making. It has also, eventually, provided stimulus to the development of the relatively new area of policy studies. The point I wish to establish in this context, however, is that certain of the economic decisionmaking techniques which have reached high levels of sophistication over the last twenty years are still rooted in the assumptions of the older laissez-faire system and in the value judgements of what is perceived to be the national interest implied thereby.

⁸⁰ Sir Peter Parker, 'A Utopian View of Government and National Industry' Jubilee Lecture delivered at the University of Leicester, May 12 1982.

The classical economists - Smith, Ricardo and Mill⁸¹ - advocated a laissez-faire system of economic organization. They believed that the pursuit of self interest hedged about by laws of property and contract would lead to high levels of national income, high rates of economic progress and would in general be more efficient than any government meddling.⁸² Although prepared to permit a minimum of tinkering with the framework of the economy⁸³ the general idea of intervening in the operation of the market was an alien one, though little analytical proof was offered that competition led to an optimum situation. Nevertheless economic development in this period was very firmly grounded in the need to take account of the structure of the external society to which the theory was meant to apply.

⁸¹ Adam Smith, An Enquiry into the Nature and Causes of the Wealth of Nations, Cannon edition London, Methuen 1961.

David Ricardo, Principles of Political Economy and Taxation (ed P. Staffa and M. D. Dobb 1951).

John Stuart Mill, Principles of Political Economy (ed V. W. Bladen 1965).

⁸² As might be expected with Mill an equally or more important consideration was that it was more conducive to liberty. For a succinct overview of the classical development of economic thought on this subject see David Collard, Prices, Markets and Welfare, especially Chapter 5.

⁸³ For example a minimum protection for the very poor as embodied in the New Poor Law of 1834 which while extolling the virtues of a free labour market nevertheless accepted the principle of a minimum of relief to bring the pauper to the level of the poorest agricultural labourer. Ibid p.44.

The whole tenor of classical economics was directed towards the better understanding of wealth - its production, accumulation and distribution and the limits imposed by non-reproducible resources. The analysis proceeded by taking note of the actual patterns of social organization which prevailed at the time, stress being laid on the class divisions. Thus Adam Smith based his analysis on a structure composed of workers capitalists and landlords,⁸⁴ giving rise to the production and division of wealth into wages, profits and rent, an analytic continued and developed by Ricardo. Mill continued in the same tradition which culminated in Marx's work. Whilst combining his economic analysis with a much wider ranging theory of history and society, Marx nevertheless, in the area of economics, owes much to earlier Ricardian work and can certainly be placed within the classical tradition.

In the eighteen-seventies neo-classical economics rapidly replaced the classical analysis. Joan Robinson⁸⁵ suggests that there were two main forces leading to this sudden emergence of similar ideas in different parts of Europe. First the failure of classical political economy to offer solutions to some theoretical

⁸⁴ Smith op cit Book 1, Ch XI.

⁸⁵ Joan Robinson and John Eatwell, An Introduction to Modern Economics, (Book 1 Economic Doctrines) Revised (ed) Maidenhead McGraw-Hill 1973.

problems⁸⁶ and secondly, and perhaps more importantly, the change in the political and ideological climate which made classical ideas appear very dangerous, since the whole thrust of the analysis served to stress the conflicts of economic interest between the social classes. Of even greater long term significance was a third force highlighted by Shackle.⁸⁷ This was the increasing desire of the developing discipline of economics to match the astonishing and prestigious record of the natural sciences:

"Economic theory for two hundred years modelled itself increasingly on the science of the inanimate creation; upon celestial mechanics for its large scale conception and upon the isolable, purifiable experiment for the small-scale. The end product was the neo-classical conception of general equilibrium, the economic system fully adjusted to an underlying body of complete relevant knowledge."⁸⁸

⁸⁶ In particular the so-called paradox of value. With the emergence of marginal analysis economists were finally able to provide an explanation for the divergence between value in use and value in exchange.

⁸⁷ G. L. S. Shackle, Epistemics and Economics, Cambridge, Cambridge University Press 1972 p.10.

⁸⁸ Shackle comments further that there was no a priori reason why economics should have chosen this axiomatic approach rather than the taxonomic approach of say medicine or law. Indeed "to have opted for the axiomatic mode as the appropriate one . . . was a bold and surprising stroke." Ibid p.38

These three forces combined in neo-classical theory⁸⁹ to produce a coherent and internally consistent theory of equilibrium in a stationary state based upon the position of the individual and his perception of his own welfare and on a theory of value based on the concept of marginal utility. 'Marginal' is the pivotal concept in this respect and the turn of the century development in economic theory is frequently referred to as the marginal revolution.⁹⁰ As suggested by the term utility, the analysis was first developed as part of consumption theory but was soon extended to the theory of production.⁹¹ It was marginal analysis which enabled the shift in problem perception from that of wealth and growth in classical economics to the efficient allocation of scarce resources. Efficiency in this context can be perfectly expressed by marginal equivalences so that for example a consumer has efficiently allocated his available budget when his marginal rate of subjective substitution related to a combination of purchases, is equal to the marginal rate of objective substitution in the form of their relative prices.

⁸⁹ M. Blaug, Economic Theory in Retrospect, London, Heinemann 1968 (2nd ed), examines a similar range of influences for the marginal revolution although hesitates to identify any as the basic explanation. pp.304-308.

⁹⁰ See for example Blaug (1968) Ibid chapter 8. T. H. Hutchinson, Review of Economic Doctrines 1870-1929, Oxford Clarendon Press, 1953.

⁹¹ Blaug (1968) Ibid p.299.

In order for such behaviour to occur it is only necessary to attribute a utility maximising motive to consumers and similarly a profit maximising motive to producers. Of such significance is this principle of equalizing marginal values that Blaug is able to say:

"The whole of neo-classical economics is nothing more than the spelling out of this principle in ever wider contexts joined with the demonstration that under definite conditions, perfect competition does in fact produce equimarginal allocation of expenditure and resources."⁹²

We may identify the conditions referred to as: many buyers and sellers; a homogenous product; perfect factor mobility; constant returns to scale; and knowledge of all relevant circumstances.

Whilst the use of marginal analysis could indicate efficient resource allocation solutions in particular markets it took Walrasian analysis to tackle the problem of whether the market mechanism could guarantee a convergence to a general equilibrium solution and whether such a solution would be either stable or unique.⁹³ Walras demonstrated that the interdependence of economic units is shown through a system of simultaneous equations where the number of independent equations is exactly equal to the number of

⁹² Ibid p.301.

⁹³ Ibid p.574.

unknowns to be determined - and thus that general equilibrium is in principle possible. Walras attempted to combine the theoretical statement with a consideration of how such a state may actually come about. His idea was of tatonnement - a process of all buyers and sellers haggling in the market place so that a set of prices and outputs based on individual optimization is arrived at before production and trade takes place. This is a less than convincing representation and illustrates a fortiori the results of pursuing an axiomatic method. General equilibrium theory as such makes no predictions: it attempts to establish only the logical possibility of its own existence without being able to demonstrate how it will be achieved. It has, especially in recent years, been the subject of intense attack.⁹⁴ Whilst its traditional defence was that statements of necessary and sufficient conditions required to produce general equilibrium would clarify how equilibrium might be attained in the real world,⁹⁵ now the defence has become entirely negative, i.e. it will serve to show why general equilibrium might not be attained.⁹⁶

⁹⁴ See for example
Hutchinson (1977) op cit p.81-87
Loasby (1976) op cit p.47-50.

also Blaug (1980) op cit devotes Chapter 8 to a critique of G. E. theory.

⁹⁵ Ibid p.198.

⁹⁶ Ibid
Blaug quotes in this context Arrow and Hahn, General Competitive Analysis, San Francisco, Holden Day 1971.

However if Walras showed the existence of a theoretical general equilibrium i.e. a position of optimum resource allocation, it remained to Pareto, another member of the Lausanne School to add a further dimension whereby the conditions of an optimum welfare position could also be deduced from marginal analysis. Whilst earlier writers⁹⁷ on utility questions had accepted the divide between 'science' and 'art' in political economy and rested the ethical premises for welfare judgements in the latter,⁹⁸ Pareto wished to combine the marginal analysis of competitive equilibrium with some yardstick against which to measure real world changes i.e. a criterion of improvements. But most importantly he was determined the analysis should remain within the field of positive economics. Pareto believed he had achieved this by relying on a single proposition, on which, he believed, consensus would be absolute, namely that any change which made at least one person better off and harmed no-one could be considered an unambiguous increase in welfare. Thus a perfectly competitive system in equilibrium would not only allocate resources efficiently but would maximise social welfare also.

It is now generally accepted that Pareto's approach is not the positive, ethics free system he believed.

⁹⁷ For example Senior and Mill.

⁹⁸ T. W. Hutchinson 'Positive' Economics & Policy Judgements, London, Allen and Unwin 1964 p.29-31.

In particular it measures optimality in terms of a pre-existing distribution of income, it disregards collective goals which are not somehow the sum of individual goals and it ignores the welfare of future generations except in so far as they are taken into account by individuals in the present generation. Yet the Pareto analysis has remained a remarkably seductive piece of analysis right through this century.⁹⁹

One defence by Hennipman¹⁰⁰ of its positive (as opposed to normative) character is based on the proposition that the Pareto criterion lays down no policy prescriptions. His argument is that to demonstrate the existence of a potential Pareto improvement in a particular set of economic conditions is quite different from recommending that change be initiated to reap that benefit. This line of reasoning is tortuous at best and can be of no help in moving from analysis to policy formulation.

A second line of argument follows closely Pareto's own. It is to attempt to play down the normative aspects of the Paretian system on the grounds that the basic postulates

⁹⁹ With some modifications it must be said. In particular the concept of a potential Pareto improvement (where it is only necessary that gainers must be more than able to compensate losers) was developed as a less stringent (i.e. more likely to be met) criterion of change in the real world.

¹⁰⁰ P. Hennipman, 'Pareto optimality: value judgements or analytical tool?' in Relevance and Precision, J. S. Cramer, A. Heertje & P. Venekamp (eds) Amsterdam, North Holland, 1976.

e.g. the individual as the best judge of his own welfare, are innocuous because they command either universal or almost universal assent.¹⁰¹ This argument is speedily demolished by Blaug who demonstrates that arguments from both the left and right of the political spectrum vindicate the view that there is much less acceptance of these judgements than economists like to think.¹⁰²

To summarize: The move from classical to neo-classical economics brought a shift of perspective away from accumulation and growth to a static delineation of the conditions under which resources would be allocated among competing ends to give optimal results. Smith's semi-intuitive idea of the co-ordinating force of the market mechanism, became the precisely specified conditions of perfect competition. Allied to this marginal analysis was Pareto's contribution to the welfare debate. When Pareto was able to equate an individual's pursuit of self-interest with a welfare optimum then as Mishan describes, it is

"The metaphor of the hidden hand discovered by Adam Smith which directs the forces of private greed so as to issue in social beneficence"¹⁰³

¹⁰¹ This argument is outlined though not supported by S. K. Nath in A Perspective of Welfare Economics, London, Macmillan, 1973 p.18.

¹⁰² Blaug 1980 op cit p.148-149.
also Nath op cit p.19-22.

¹⁰³ E. J. Mishan, Cost Benefit Analysis, London, Unwin 1971 p.6.

Also, in its attempts to be 'positive' and value free, Pareto's approach was much more in tune with the spirit of the times than the alternative Pigovian theory.¹⁰⁴ These two themes are still exhibited in investment appraisal techniques. As we saw earlier value judgements are not adequately provided for in current appraisal methodology. When 'national interest' was regarded as synonymous with efficient resource allocation then the problem remained hidden since the Pareto welfare assumption was subsumed within the analysis (modified along the lines of the Kaldor Hicks compensation principle¹⁰⁵). However when it is acknowledged that other objectives requiring value judgements are likely to be pursued then a specific provision needs to be made for these within the analysis. The link between appraisal techniques and the ideal of optimal resource allocation as exhibited by a system of perfect

¹⁰⁴ Although Pigou himself believed the premises from which he derived his theory of welfare to be self evident, his Economic of Welfare (London, Macmillan 1924) was the subject of Robbins' famous attack on value loaded welfare propositions

L. C. Robbins, An Essay on the Nature and Significance of Economic Science, London Macmillan 1932.

¹⁰⁵ That is, providing the beneficiaries of any change could more than compensate the losers a potential Pareto improvement exists and is used as a criterion of welfare gain.

competition is even more marked.¹⁰⁶

The ideal of perfect competition, obviating as it does the necessity of central planning and control to obtain an efficient allocation of resources, has been regarded as attractive since Adam Smith. However as it came to be realised the ideal of perfect competition lays down some stringent conditions which are unlikely to be met in the real world. Most significantly, if externalities are present either in production or consumption behaviour then market prices do not accurately reflect real resource values; equilibrium output is related to a specific pre-existing distribution of income; equilibrium quantities and prices in individual markets may not be 'Paretian ideal' if imperfections exist elsewhere (the second best problem) market based decisions can only represent present participants, so market behaviour only takes into account the welfare of future generations to the extent that members of

¹⁰⁶ It should be understood that in its strictest definition perfect competition is related only to equalities at the margin which will be generated by maximising behaviour on the part of the participants. It makes no assumptions about, for example, the ownership of production - private enterprise or socialist. Providing:

- (1) The marginal rate of substitution of any one good for another is the same for all consumers.
- (2) The marginal rate of technical substitution of one resource for another is the same in all production processes.
- (3) The marginal rate of substitution of products for any consumer must equal the marginal rate of technical transformation between them in production.

The conditions of perfect competition are fulfilled and a Pareto optimum will result.



the present generation identify their own interests with those of their heirs; most importantly the model of perfect competition is an abstract construction and there is no guarantee that economic agents will have sufficient knowledge to act in accordance with the ideal. As we have seen, the development of appraisal techniques has been directed towards resolving many of these problems. Where externalities exist market prices may be 'corrected' by using shadow prices. Society can indicate its trade off between present and future generations by the use of a social time preference rate. Particular income distribution considerations may be incorporated by a system of weights. Cost benefit analysis may in fact be seen as a specific response to the second best problem.¹⁰⁷

Yet all these techniques implicitly accept the overall rationale of the perfectly competitive economy - they aim at the "correction" of "market distortion" so that the corrected system will once again bring about an optimal allocation of resources. Even with the addition of an income distribution objective, optimality is still the aim, but in this case a combination of objectives is optimized.

The necessity for a significant number of adjustments of this kind marks the transition from a laissez-faire to a mixed market economy. What has not been affected at all in this move is the idea that, once ordered, the system will

¹⁰⁷ To the extent that it seeks to explore all significant ramifications of a proposed change.

still produce optimum solutions. Thus this amended system still needs to make the same assumptions of perfect foresight and co-ordination as did the earlier. It is therefore not difficult to appreciate why the consideration of uncertainty has been held within such rigid limits. To preserve the model, it has to be converted to quasi-certainty, "ignorance has to masquerade as knowledge so that choice may be made."¹⁰⁸

Flexibility

It was at one time a commonly held view that such idealised theoretical models which relied on assumptions such as perfectly informed choice were only first steps on the way to more realistic theory. It was usual to talk in terms of eventually removing the 'scaffolding' but by the 1970's it was beginning to become apparent that such a procedure would lead to the collapse of the edifice itself:

"It is the hallmark of the neo-classical economist to believe that, however severe the abstractions from which he is forced to start, he will 'win through' by the end of the day - bit by bit, if he only carries the analysis far enough, the scaffolding can be removed, leaving the basic structure intact. In fact these props are never removed; the removal of any one of a number of them . . . is sufficient to collapse like a pack of cards."¹⁰⁹

¹⁰⁸ Loasby op cit p.10.

¹⁰⁹ N. Kalder in G. C. Harcourt and N. F. Laing (ed) Capital and Growth, Penguin Readings 1971 p.296.

And Hutchinson¹¹⁰ goes further and identifies the most crucial prop, the "fundamental assumption" as that of full knowledge or correct expectations which excludes all possibility of ignorance or uncertainty. He continues

"The maximisation-under-certainty postulate has proved, as a piece of simplificatory scaffolding very difficult or virtually impossible to remove, while leaving standing any model or theory for which any significant degree of generality could be claimed. There is simply no general assumption to replace this oversimplified one. For there is, so to speak, only one set of correct expectations or state of adequate knowledge for each and every situation. But there is an endless variety of incorrect and inadequate ones which are constantly changing, and impossible to generalise about except in arbitrary terms."¹¹¹

Such a conclusion obviously has quite drastic implications for public investment methodology, whose results, as we have seen, suffer considerably from attempting to employ techniques stemming from the maximisation under certainty framework to conditions of uncertainty/ignorance. It is extremely questionable whether pleas for better

¹¹⁰ T. W. Hutchinson, Knowledge and Ignorance in Economics op cit p.79.

¹¹¹ Ibid p.80.

forecasting can have great validity,¹¹² and if future values of variables which need to be known to carry out an optimization exercise cannot be foreseen or forecasted then the problem must be formulated somewhat differently. Loasby points the way to a possible approach. He warns us:

"to expect the unexpected; to be prepared for changes, sometimes drastic, in plans and expectations, and to be wary of long-range plans or forecasts which depend upon present knowledge; that means all long-range plans and forecasts. It is often more useful to investigate, and prepare for, the consequences of possible future events than to refine estimates of their probability."¹¹³

How can public investment projects be made more responsive to change when it occurs? In other words how can the characteristics of flexibility or adaptability be valued as positive attributes in the selection of public projects? Although lip service is often paid to flexibility in very

¹¹²This is not to deny that advances which can be made should be made or to denigrate their value. Perhaps an analogy from the prime area of forecasting - meteorology, will clarify the point.

In the post war period weather forecasting has been characterized by the development of extremely sophisticated monitoring techniques and the tenfold increase in observation stations and weather satellites. The hope - indeed the expectation has been that forecasts would improve. This is partly true. Forty-eight hour forecasts now have as good a record of accuracy as did twenty-four hour forecasts in the immediate post war period. However the ability to forecast beyond a three day time horizon has not improved significantly at all.

¹¹³Loasby op cit p.221 my italics.

general terms, it was perhaps Hirschman of all the project analysts who came nearest to giving it operational significance in his identification of latitude and discipline as important attributes of projects.¹¹⁴ In the end however, he was unable to shake off his earlier view that the discipline imposed by relatively unalterable projects could be a positive benefit to the development process.¹¹⁵

However because the neo-classical model from which cost benefit and related analytical techniques have developed is so firmly grounded in the idea of optimal solutions, flexibility is not easily valued as a positive attribute by conventional techniques. Even if it is generally accepted that the 'absolutely best' project may not be identified, the supposition in conventional ranking procedures is that combinations approaching the optimal are being chosen. This approach, again emphasises the essentially static nature of the choice mechanism.

There are no easy answers on how change might be accomplished. It would be almost a contradiction in terms to

¹¹⁴Hirschman (1967) op cit Chapter 3 pp.86-127. Latitude and discipline might be interpreted as flexibility and rigidity.

¹¹⁵Not without some unease however:

"we are a long way from the attractive simplicity with which the concept was presented in my Strategy of Economic Development. There I celebrated lack of latitude . . . it would force an underdeveloped country to do a job right and teach it performance, maintenance and other virtues . . . we have now acquired a more qualified or perhaps an ambivalent position: while lack of latitude retains the great advantage of determinateness . . . the presence of latitude has in some situations been shown to foster training in rational decision making or the adaptation of imported models of economic behaviour to local conditions and requirements. Hirschman (1967) op cit pp.126-127.

expect a new model to replace the old¹¹⁶ and initially at least attempts to place a positive value on flexibility may depend more on pragmatism than a priori theoretical reasoning. As a first stage it may be more appropriate to accord flexibility the status of an objective in much the same way as other objectives which may be at variance with optimum efficiency. Valuing flexibility as a positive attribute of a project is an initial ad hoc way of moving from static conception of 'best' to a dynamic concept.

Such an approach will be deeply unsatisfactory to devotees of general equilibrium analysis.¹¹⁷ What is being valued in project design by this objective is ability to make sequential adjustment to each perceived medium term optimum¹¹⁸ in the knowledge that a hindsight view of the project's life will probably exhibit several occasions when adaptations of this kind were necessary. The greatest problem, of course, is that it is only with hindsight that the divergence from the static optimization approach can be judged to have been worthwhile or not. The more accurately that future situations can be forecast the less benefit will be attributable to the costs of increased adaptability.

¹¹⁶ Viz Hutchinson's arguments on the impossibility of modelling uncertainty.

¹¹⁷ Although in this context one might agree with Blaug's conclusion:

"The widespread belief that every economic theory must be fitted into the GE mold if it is to qualify as rigorous science has perhaps been more responsible than any other intellectual force for the purely abstract and non-empirical character of so much of modern economic reasoning."
Blaug (1980) p.192.

¹¹⁸ Similar to aiming at a moving target.

There is thus always the danger that sub-optimal decisions will be taken.¹¹⁹ Nevertheless from the little post investment analysis which has been undertaken the message is clear that the alternative algorithm has not been a noted success. Flexibility in this context occupies a slightly different position than other objectives we have considered: regional development, changes in income distribution etc. It should be regarded as a means rather than an end, a method of facilitating the achievement of other goals. In this interpretation it owes much to the fallibilistic approach to decisionmaking developed by David Collingridge in 'Critical Decisionmaking.'¹²⁰ This theory is founded on the Popperian approach to scientific enquiry which rejects absolutely the possibility of justifying hypotheses by empirical testing but assesses their strength by reference to the severity of attempts to falsify them. A similar theory of preference and decisionmaking is constructed. Thus although no decision is justifiable, attempts may be made to show how decisions may be criticized and reasons given for favouring one option over another based on such criticisms.¹²¹ However this in turn means that even if a decision maxim withstands critical scrutiny prior to being acted upon, the resulting decision, for example the choice of a particular public investment

¹¹⁹ On the assumption that the additional costs incurred to obtain flexibility proved unnecessary.

¹²⁰ David Collingridge, Critical Decisionmaking. A New Theory of Social Choice, London, Frances Pinter 1982.

¹²¹ Ibid p.83.

project may be shown to be mistaken after implementation. No amount of success in passing tests in the past can guarantee that this will not happen.¹²²

Thus flexibility provides a means of continuing the critical process throughout the project's life¹²³ providing that it can be given operational significance within the design of the project.

It is therefore possible to stress the importance of flexibility at two different levels in the process of choosing public sector projects. At the very general level it means valuing flexibility because there is no possible appraisal framework which can, in an uncertain world, guarantee to identify the best project at the outset. The overall ability to change, to adapt to new and different circumstances must under such condition be viewed as a significant advantage. In this sense valuing flexibility is indicative of using a different conceptual lense to that of "static optimization". But equally flexibility needs to be given operational significance at the particular project level. In other words individual projects must possess characteristics which have variously been identified as corrigibility, insensitivity to error, controllability, adaptibility, robustness, and resilience. These two levels of perception are intimately related - project formulators will not feel able to incur the extra cost of flexibility at the design stage unless they are aware of its adoption as an

¹²³ Ibid p.142.

¹²² Ibid p.141. My emphasis.

objective by decisionmakers; they in turn will do no more than pay lip service to it unless it can be translated into a tangible form.

Work on multi-objective decisionmaking models reviewed earlier in this chapter indicated the practical difficulties involved in attempting to subsume a variety of objectives within a single calculation, whilst lessons derived from the examination of the neo-classical foundations of appraisal techniques suggested that it would be unwise to do so and thus shore up the single optimum choice approach. Thus the aggressively rationalistic model where goals are defined, alternative means appraised in the light of these objectives and a choice made is not a realistic one.

In the following chapters I hope to consider some alternative perspectives and to examine ways in which flexibility may be incorporated more systematically into the selection process for public investment projects.

Long Run Flexibility: The Pre-Investment Range of Choice

A theoretical device much used by economists since its introduction by Marshall at the beginning of the century is the division of time into three distinct periods for the purpose of analysing decisions. These are defined as the short run, a period of time within which some of the factors of production (most usually capital) must be regarded as fixed; the long run, a time long enough for the inputs of all factors of production to be varied as desired but constrained by a fixed state of technological knowledge; the very long run, a sufficiently long period to permit changes in the state of technical knowledge and hence in the technological possibilities open to the producer. These periods are not of course related to numerical time but vary according to the production process and the technology in question. It is a particular feature of the type of investment decision to which this study is addressed, that the short run is often very long in numerical time since it comprises the time taken to evaluate the proposal, the lead time for construction and the ensuing economic life of the project. In the case of an electricity generating station this period would be in the region

of thirty five to fifty years.¹

This division is also significant in that certain assumptions about the flexibility (or lack of flexibility) in the economic environment are inherent within it. In the long run, it is assumed, total freedom of economic choice exists. That is, any decisionmaker prior to making a tangible investment in a production process is at liberty to select any production technique from a range of blueprints constrained only by the currently existing level of technological knowledge.² Conversely

¹Until the late 1970's the CEGB used to estimate the book life of a conventionally fired station at 25 years and that of a nuclear station at 20 years. Recently they have increased each of these estimates by 5 years to 30 years and 25 years respectively (CEGB Annual report 1979-80). In addition to this, "The lead time in the CEGB's planning is governed by the time taken to construct new main generating stations which, in normal circumstances is assumed to be about six years from the placing of main orders to the commissioning of the first unit. Prior to placing orders the CEGB must submit its proposals to preliminary planning and consultative procedures These procedures add several years to the lead time."

The Monopolies and Mergers Commission. Central Electricity Generating Board. A report on the operation by the Board of its system for the generation and supply of electricity in bulk. HC 315 20th May 1981.

It might be noted that the MMC queries whether these estimates might not be unduly optimistic in the light of past experience.

²The idea of a complete set of blue prints or a spectrum of techniques is usually attributed to Joan Robinson although it crops up in different guise in other authors. J. Robinson, Accumulation of Capital, London, Cambridge University Press 1956.

See also W. E. G. Salter, Productivity and Technical Change, Cambridge University Press 2nd ed (1969).

according to current interpretations, once investment is undertaken the situation changes dramatically and becomes totally rigid. Melvin Fuss has characterized this as the putty-clay model.³ However this sudden change from flexibility to rigidity is not a problem within the neo-classical framework, since perfect information about the range of choice available and perfect foresight which enables each option to be costed over its lifetime enables economic and technical possibilities to be combined in the form of the best practice technique. Thus there is no reason to suppose that anything but the optimum choice of project has been selected. If, however, as I have argued earlier, any such assumptions of certainty about present information or future forecasts is inappropriate, the idea that a best practice technique both exists and will be selected if all the sums are done correctly, is no longer tenable. I have argued that in the face of imperfect information and foresight, flexibility or adaptability needs to be given a positive value. This will be obviously important when we get to the short run - the rigid 'clay' of Fuss's model, but how does reality square with the ex ante flexibility assumed by the neo-classical model. It is this aspect of long run flexibility in relation to the investment appraisal techniques that I wish to consider further in this chapter.

³ M. A. Fuss, 'The Structure of Technology over Time: A Model for Testing the "Putty-Clay" Hypothesis', Econometrica Vol.45, No.8, November 1977.

An earlier interpretation of neo-classical ex-ante and ex-post production functions assumed capital to be fixed in quantity but still malleable ex-post. See Chapter V footnote 18 below.

By their very nature, any potential investments which are brought together for evaluation and selection fall into the long run category of decision.⁴ There are no constraints on the particular combination of factor inputs put forward for consideration, yet the prevailing technology must be adhered to, - it is not usually thought desirable to consider an investment which depends for its success on technological advances or solutions to currently unsolved problems.⁵ However a formal appraisal process whether of a straight cost utility type or one supplemented by impact analysis, social indicator research et al, can at best deal with a very limited number of alternatives. It is this initial pre-sifting process that discards far more potential projects than it provides in a short list for explicit evaluation, which I wish to identify as the first area where inflexibility is introduced into the decisionmaking framework of investment appraisal.

⁴ See for example, W. E. G. Salter, op cit p.8.

⁵ It might be noted however that several commentators feel that the CEEGB came close to this in accepting the Atomic Power Constructions (APC) design for Dungeness B. This AGR proposal which was one of three considered in the CEEGB's appraisal, and the one adopted, was little more than "a sketched out design". Roger Williams, The Nuclear Power Decisions, London, Croom Helen 1980 p.141.

and "(the APC) proposal showed so many changes from the prototype that it is surprising, in retrospect, that the CEEGB Appraisal described it as having fewer unproven features than its competitors . . . the whole design was, in fact, a considerable extrapolation beyond the limits of experience . . . nor were the untried features limited to the nuclear plant"

R. F. Pocock, Nuclear Power: its Development in the United Kingdom Woking, Unwin Bros and the Institution of Nuclear Engineers, 1977 p.169-170.

As a preliminary I wish to look briefly at the wider framework within which public investment is carried out in a mixed economy of the U.K. type. I alluded earlier⁶ to the idealised neo-classical world of orthodox economics and the rationale of appraisal techniques as tools for bringing the imperfect world nearer to ideal. However appraisal techniques themselves must often in turn be modified to take account of the prevailing economic environment - that pot pourri of historical accident, political convenience and formal planning which any practical decision method must be capable of coming to terms with if it is to survive.⁷

Dasgupta and Pearce⁸ classify the types of choice facing the decisionmaker as follows:

- (i) Accept-reject. Faced with a set of independent projects and no constraint on the number which can be undertaken, the decisionmaker must decide which, if any, is worthwhile.
- (ii) Ranking. If some input such as capital, is limited in supply it may well be that all 'acceptable' projects cannot be undertaken. In this case projects must be ranked or ordered in terms of the objective function

⁶ See Chapter II above.

⁷ Of course survival is not in itself sufficient if in the process all theoretical links which initially justified the technique are severed.

⁸ A. K. Dasgupta and D. W. Pearce, op cit p.160.

(iii) Choosing between exclusive projects. Frequently projects are not independent of each other. One form of interdependence exists when one project can only be undertaken to the exclusion of another project - e.g. two different ways of achieving the same objective A special case of mutual exclusion exists when any given project can be undertaken now or in a later period

However these divisions, especially types (i) and (ii) are more appropriate where the public sector is dominant in investment decisions - either for reasons of centralist ideology as in Eastern Europe or because of an underdeveloped private sector as in many Third World countries, rather than for mixed economies like the U.K.⁹ In practice public sector investment decisions in this latter type of economy fall into an amended type (iii) category i.e. the choice is between different ways of meeting the same objective, or in its more restrictive form, the choice as to whether a single project is satisfactory in achieving a given objective or not - a more limited application of the accept-reject category.

⁹Not all commentators would agree that the general equilibrium approach is appropriate even for countries with a high degree of central government responsibility for investment. The objection depends more on practical than theoretical misgivings. for example:

Footnote 9 continued:

"It is in principle at least, a conceivable goal to place the entire burden of co-ordination on (corrected) market prices and national parameters. One can imagine a day when all necessary value judgements have been articulated by policy makers, all shadow prices computed In this glorious future, the appropriate rule for project formulation and evaluation will be to adopt all projects for which the benefits, weighted according to objective and discounted to the present exceed the costs, similarly weighted and discounted. Where projects are mutually exclusive such as a thermal electric and a hydroelectric project, the rule becomes one of choosing the project for which benefits are most in excess of costs.

For many years to come however, nothing remotely resembling this state of affairs can be anticipated."

Dasgupta, Sen and Marglin for UNIDO, op cit p.238

From a theoretical viewpoint it might be argued that in mixed economies by far the largest part of direct public investment is concerned with the infrastructure of the economy. The fact that this area spans several sectors of the economy (agriculture, transport, mining etc.) might therefore be interpreted as necessitating either

- (a) that each project be assessed on its intrinsic merit as a national investment opportunity, or
- (b) that if funds are limited then since each individual project competes with all other public sector projects, all proposals need to be somehow placed in merit order.

In practice however, sectoral allocations of funds are usually made as the outcome of a complex bargaining process between the Treasury and other government ministries. This is further complicated by the fact that the nationalized industries have financial structures independent of the departments to whose minister they are responsible. For example in the case of the CEGB, the Board is set a financial target for an average return on net assets (1.8% p.a. 1980-83) external financing limits are imposed on it to set a ceiling for annual borrowing (£44m in 1979-80), and it is under obligation to contain capital expenditure in each year within the amount authorized by the Secretary of State.¹⁰

¹⁰ Monopolies and Mergers Commission, (1981) op cit p.3.

Hence by the stage when projects are actually formulated and appraised a variety of different and uneven capital constraints will have been imposed in the various sub-sectors. This negates to a greater or lesser extent according to the distortion incurred, the Treasury advocacy of a uniform discount rate.¹¹

More generally, it is perhaps interesting to note that the theoretical underpinnings of the framework for public investment appraisal techniques are weakened as we move down Dasgupta and Pearce's categories from (i) to (iii). The former is much easier to justify within the neo-classical model and the general equilibrium framework always supposing we are prepared to accept the intolerable burden this process places on the discount rate both as a means of obtaining an optimal allocation of resources between investment and consumption in society in its role as a measure of time preference and also as a means of efficiently allocating funds in its role as a measure of opportunity

¹¹ When the total amount of funds available for investment are pre-determined then a ranking procedure is needed to allocate these funds most commonly by using a discount rate which ensures that all worthwhile projects have positive npv's except for the marginal project which has a zero npv. However when additional constraints are placed on funds in particular sectors there are different implied discount rates which will just use up these funds. A recommended discount rate was replaced by the RRR (required rate of return on all investment) in 1978. Each nationalized industry can now choose its own discount rate for project appraisal providing it achieves the prescribed RRR (presently 5% in real terms) on its investment programme as a whole.

cost.¹² In category (ii) the optimization approach is weakened by the assumption of input scarcity. The allocation problem becomes one of constrained optimization. In category (iii) there is no a priori reason why the ex-ante sectoral allocation of funds actually made should approximate the ex-post allocation that would be observed if total investment were determined in some type of general equilibrium exercise. The severance of the links with a general equilibrium concept is therefore complete. Thus we arrive at the position where the most usual context within which investment options are handled is that one which is least justified by the neo-classical foundations of cost benefit analysis.

It is generally accepted that for any investment proposal a maximum of four alternatives will be subjected to detailed analysis.¹³ This may be seen in part as a practical restriction due not to the inability of the methodology to handle a larger

¹²The case against this, based on the divergence in the real world between opportunity cost and social time preference and hence the inapplicability of a single discount rate is well put in:

M. S. Feldstein, "The Social Opportunity Cost of Capital and the Social Time Preference Rate", Economic Journal 1964.

¹³See for example:

Michael J. Frost, How to Use Cost Benefit Analysis in Project Appraisal, Epping Gower Press 1975, p.36.

J. B. Heath, 'Cost Benefit Analysis, Airport Location' in M. G. Kendall(ed), Cost Benefit Analysis, London, English University Press, 1971.

number of alternatives, but to the cost of actually preparing detailed proposals. D. J. Clough explains¹⁴

"The major limitations in specifying feasible alternative plans such as alternative locations and sizes of dams is the cost of obtaining basic engineering data."

Fabrycky and Thuesen¹⁵ also in the area of water resource development agree on this practical operating constraint whilst recognizing the weakness in the selection procedure that it implies. They specify the full problem of selecting a dam site as being the total cost of constructing a dam at each point on a river and with a variety of storage capacities.¹⁶ However even at the preliminary stage the construction engineer would proceed with detailed cost estimates for only a few desirable alternatives. This selection would be based on the experience of the engineer.¹⁷ Approximate estimates would be made and from these a further sifting process would be undertaken to select two or three sites/storage capacities for detailed test borings. However the authors concede that,

¹⁴ D. J. Clough 'Cost Benefit Analysis for Water Resource Planning' in M. G. Kendall(ed) op cit.

¹⁵ W. J. Fabrycky and G. J. Thuesen, Economic Decision Analysis, Eaglewood Cliffs, New Jersey Prentice Hall, 1974, p.7.

¹⁶ Even this is not a full specification of the available alternatives if water could be brought to the end users by different means - for example tube wells.

¹⁷ Their word, my emphasis!

"alternatives that are not considered cannot be adopted no matter how desirable they might prove to be"¹⁸

Nearer to home, when the CEGB issued the enquiry specification for the Dungeness 'B' power station¹⁹ it had already been decided that this was to be a nuclear power station of a particular size (1100 mw).²⁰ The initial specification was even more restrictive than that which finally prevailed since it aimed to link tenders as closely as possible with the technology developed at Windscale for the demonstration AGR. Later this was widened to permit the British Consortia to offer proven designs of water moderated reactors.²¹

It is interesting to note that while the published appraisal also included comparative generating costs from Wylfa (the last Magnox station to be constructed) and Cottam (a coal fired station of contemporary design) these alternatives were in no sense part of the Dungeness B decision. At best they might be regarded as

¹⁸Fabrycky and Thuesen op cit p.10.

¹⁹CEGB 'An Appraisal of the Technical and Economic Aspects of Dungeness B Nuclear Power Station, London 1965.

²⁰Ibid p.2.

²¹In the event this was not significant.

providing an ex-post rationale for the enquiry specification.²²

Although we may therefore take three or four options as the practical size of a shortlist, often an appraisal will be even more restrictive in the options it considers. It is pertinent to ask why this even more constrained decision framework is adopted.

At the extreme a single project will be presented for evaluation and the question posed will be simply whether to undertake the project or not. Such projects appear to fall into two quite different categories. The first is that group of projects which appear to be sui generis. It is difficult at first sight to imagine what projects like the Channel Tunnel or the Sydney Opera House might have been measured against. However this may arise in part because of failure to make explicit or even to fully formulate the

²²In fact because different average lifetime load factor was a crucial element in the comparison and this in turn depended on information about the existing and future merit order known only to the CEGB, Jack Hartshorn in the PEP publication A Fuel Policy for Britain, London 1966, was led to comment,

"Criticism of the figures produced becomes impossible for an outsider. When a nationalized industry presents data which it alone is in a position to produce it seems necessary that it should produce more than a rather stark table and give a wide range of alternative assumptions which should be explicitly stated so that the implications of its esoteric calculations can be fully understood"

Quoted by Roger Williams in The Nuclear Power Decisions, London Croom Helm, 1980 p.143.

objective(s) which are being pursued.²³ If the objectives of investment are well specified, then alternative means of achieving them are indicated almost automatically. The Channel Tunnel Advisory Group was asked in 1974 to advise the Secretary of State for the Environment whether,

"the various economic and financial studies underway and planned provided an adequate basis for deciding whether the Tunnel was in broad economic and commercial terms more advantageous to the U.K. than continued reliance on air and sea services,"²⁴

²³We have the option of attributing this to ignorance,

"Over and over again one hears of cases where the problem the clients thought they had turned out not to be the problem they actually had and any OR or CBA practitioner who accepts the clients initial formulation of the problem uncritically is heading for disaster."

Alan Williams "Cost Benefit Analysis: Bastard Science and/or Insidious Poison in the Body Politick?", Journal of Public Economics 1, 1972.

or to something more sinister,

"The . . . most important reason why the political process discourages explicit quantification of political value judgements with respect to the goals underlying calculations of national economic profitability is that political leaders rely on the support of distinct interest groups that are partially (at least) in conflict with one another. In such circumstances ambiguity has obvious advantages."

UNIDO op cit p.137.

²⁴The Channel Tunnel and Alternative Cross Channel Services. A report presented to the Secretary of State for the Environment by the Channel Tunnel Advisory Group. London, HMSO, 1975.

This is a classic yes/no formulation. In the event the Project was cancelled (for the first time²⁵) before the report was completed but the Group was encouraged to comment more generally on the original project and on the methods of assessment to be used should the venture be revived in the future. The Group approached its task by spelling out the objective that the proposal was meant to serve, in a more enlightening way,

"Many of those who have argued fervently for or against the Channel Tunnel Project have ignored the need to view the proposals against the possible alternative solutions to the problems of carrying the increasing cross channel traffic There can . . . be little doubt that there will be a significant growth in cross channel traffic and that provision will have to be made to carry it by one means or another. Our task has been to advise on how to select the means."²⁶

It went on to identify four main options²⁷ - in addition the Group recognized that there were a number of other possibilities such as the revival of airships, or some other type of fixed link

²⁵ It was revived again in 1979 by the Conservative government but a report to the Transport Secretary, David Howell, by his adviser Sir Alec Cairncross in April 1982 recommends against pursuing the proposal further, Sunday Times Business News, April 11th 1982.

²⁶ The Channel Tunnel op cit para 2.1.1.

²⁷ The expansion of ferry services without Tunnel or hovercraft was taken as the base case and this was then compared to different methods of carrying the same volume of traffic. The Channel Tunnel - Ibid. 2.17.14.

e.g. a bridge or a submerged tube²⁸ but such suggestions had not been worked out in sufficient detail to enable a comparison with the four options listed.

The case of the Sydney Opera House is less tractable to this type of approach. It very quickly left the arena of a proposal to fulfil a small, well defined objective²⁹ and became, using a term coined by Hirschman, "inaugurable".³⁰ When a project is either conceived to bolster national prestige or becomes identified as playing this role, then it moves outside the investment appraisal framework. In the case of the Opera House the crucial turning point appears to have been the selection of the site on Bennelong Point.³¹

"Any structure on Bennelong Point would be displayed as few buildings in this world could ever hope to be, for it would stand completely clear of any other buildings; there is water on three sides of the site and the fourth is bounded by the grass and

²⁸ Ibid 2.5.7.

²⁹ The initial impetus for the Sydney Opera House came in the mid fifties because the city (the eleven square miles controlled by the Council of the City of Sydney) still did not have any big indoor centre for public assembly, other than the Town Hall. This was used for everything from symphony concerts to the Sydney Grammar School Speech Day.

John Yeomans The Other Taj Mahal, Camberwell, Victoria, Longman 1973.

³⁰ Albert O. Hirschman (1967) op cit p.101.

³¹ The Royal Australian Institute of Architects examined more than 30 possible sites in the metropolitan area. Yeomans op cit p.9.

trees of the Royal Botanic Gardens"³²

From this it was a relatively small step in the imagination³³ to "a search to find a design worthy of a site which could scarcely be equalled in any city in the world."³⁴ but this step effectively took it outside the ambit of investment appraisal.

The second type of project which is subjected to a one-off appraisal is far less striking than the Tunnel and Opera House projects referred to above. This is where individual projects form part of a programme, the overall value of which has been determined by the political procedure referred to above. Thus, the Australian National Water Resources Development Programme was allocated \$A50m in November 1966 and a further \$A100m three years later. In all 63 projects were evaluated in the period 1966-72.³⁵ It was recognized that the Programme provided an opportunity to

³²Ibid p.14.

³³Though unbelievably costly in implementation, Peter Hall includes it in "Great Planning Disasters" and says

"It sets some kind of world record against strong competition . . . for time delay in completion and for cost escalation. Originally estimated in 1957 to cost just over \$A7 million and to be completed by January 1963, it was in fact finished in October 1973 at a cost of \$A102 million"
Peter Hall, op cit 1980.

³⁴Yeomans op cit p.10.

³⁵Bureau of Agricultural Economics, Eton Irrigation Proposal, Water Resources Development Proposals No.2. Canberra 1973. Appendix A, National Water Resources Development Programme.

evaluate a number of alternative investment opportunities to rank them in order of priority. In fact it was specifically stated that in terms of achieving an efficient allocation of limited public funds it would have been preferable to rank them. However, in practice, each project was considered individually. The published reason for this was that it was necessary because of the limited time available to complete many of the investigations before a Government decision was required, and because of the different timing of submission from the states. These are general conditions likely to prevail whenever a public sector programme is announced. It is difficult to imagine any context within which it would be politically acceptable for a government having allocated funds for say a five year programme, to insist that no disbursements can be made until the end of the programme when all competing proposals have been evaluated. A further lesson may be drawn however. The acceptance of one by one appraisals is an acknowledgement of a satisficing rather than an optimizing approach. The use of a discount rate in this case serves to divide projects into good enough and not good enough categories. In addition the overall programme allocation may be perceived as being open to political bargaining. In the case of the Australian Programme referred to above it was originally \$A50m over 5 years but after the first three years it had already gone over budget and a further \$A100m was quickly allocated.

However the satisficing nature of the situation does not preclude the formulation and evaluation of options for each lower order objective within a given programme,

for example, "how can agricultural output be raised in area X" would be a preferred statement of objective to "build a dam of capacity y on river x". The latter might prove to be the best way of achieving the former but the more alternatives initially considered the better.

The lessons to be drawn from these examples is that apart from the type of decision which stands outside the normal appraisal process because it is unique in conception, no investment proposal need be formulated in a yes/no mode. If it is then it indicates that inevitably some of the decision making process has been pre-empted. The point may also be re-iterated that public sector investment appraisal invariably takes place at the sectoral or sub-sectoral level of the economy although this undermines to some degree the resource efficiency foundations of the techniques, and that the actual appraisals consider very few possible options available in any single investment decision.

This seems to leave plenty of room for distortion to arise in what is advocated as an orderly logical process which assists in decisionmaking.³⁶ Nevertheless, is it possible to say anything

³⁶ Michael Carley, Rational Techniques in Policy Analysis for the Policy Studies Institute by Heinemanne Educational Books, London 1980 p.6.

The stress on appraisal techniques as assisting the decision process is now commonplace see for example:

Williams 1972 op cit p.201.

R. M. Parish, 'The Scope of Benefit Cost Analysis' Economic Record Sept. 1976 p.313.

but nevertheless makes a change from the confident assertions of the previous decade.

more illuminating than that this is the inevitable divergence between theory and practice? Theoretically, informed choice involves the comprehensive listing and evaluation of all possible (conceivable) alternatives - a patently unreal assumption. Loasby sums it up thus:

"Choice within a complex system cannot be fully informed; neither can the study of a complex system from the outside For the unavoidable ignorance of both analyst and decisionmaker there are two major causes. One is the extent of the complexity of the phenomena around them, the complete analysis of which seems to require handling on a scale far more extensive and also far more detailed, than either can manage. The other is the very limited human ability to cope with such analysis Thus potentially dangerous simplification are unavoidable."³⁷

Loasby concludes that it is this 'bounded rationality' which is natural rationality,

"it is the assumption of infinite capacity to handle infinite quantities of data which is artificial"³⁸

Simon³⁹ has given us this term bounded rationality, but the concept of rationality itself has played such a central role in the development of economic theory that it is necessary to examine it further. As used in economics the term is far more precise than its normal everyday usage of "sensible, sane, moderate, not

³⁷ B. Loasby (1976) op cit p.2-3.

³⁸ Ibid p.3.

³⁹ See especially H. Simon "Rationality as Process and Product of Thought" American Economic Review Papers and Proceedings May 1978.

foolish or absurd or extreme"⁴⁰

In economics to behave rationally is to be a utility maximizer as a consumer or a profit maximizer as a producer.

The overall connotations of the term denote both measurability and optimization. The flavour is well captured by Marschak's⁴¹ explanation and example indicating as it does both the descriptive and prescriptive aspects and also the logical cum mathematical nature of the concept:

"The theory of rational behaviour is a set of propositions that can be regarded either as idealized approximations to the actual behaviour of men or as recommendations to be followed.

This can be shown in the following proposition:

'The rational man does not make logical and arithmetical errors' Or to give three particular examples 'if $x=2$ and $y=0.005$, the rational man concludes $xy=0.01$ '; 'if all A are B, the rational man concludes that non-B are non-A'; 'if P follows Q he concludes that non-Q follows from non-P but he does not conclude that Q follows from P'. Now, a large proportion of people, especially when in a hurry to answer and to act, are apt to disobey those rules . . . What is then the use . . .? The use is twofold: to describe approximately the behaviour of men who, it is believed,

⁴⁰ Concise Oxford Dictionary 4th ed (revised) 1982.

⁴¹ J. Marschak 'Rational Behaviour, Uncertain Prospects and Measurable Utility' first published 1948 as Ca.les Commission Discussion Paper, and presented to the Madison Meeting of the Econometric Society, September 1948. Reprinted in Jacob Marschak Selected Essays Vol. 1 Dordrecht-Holland D Reidel Publishing Co. 1974.

cannot be 'all fools all the time,' and to give advice on how to reach 'correct' conclusions"⁴²

Whilst conceding that fulfilment of these rules of logic and arithmetic are in themselves only necessary conditions for a decision to be advisable and that additional rules are needed "to 'prolong' logic and arithmetic into the realm of decision",⁴³ nevertheless the main thrust of the article is concerned with the conditions under which utility can be defined as a quantity whose mathematical expectation is maximized by the rational man.

Although few today would match the austere approach of Marschak, a general principle of rationality is crucial to widely differing approaches to economics and economic decisionmaking and this general principle continues to be one of maximization.⁴⁴ Simon⁴⁵ refers to this concept of rationality as economics' main export commodity in its trade with the other social sciences. But as Simon stresses, with the increased awareness of the problems raised by uncertainty or ignorance, a theory of rational behaviour is required that would be as concerned with the means by which rational individuals cope with ignorance and complexity as with the characteristics of the environment within which decisions are taken. Thus:

⁴² Ibid p.5.

⁴³ Ibid p.6.

⁴⁴ Either under certainty or a restricted class of uncertainty as we have seen in Chapter II above.

⁴⁵ H. Simon 1978 op cit.

"In such a world we must give an account not only of substantive rationality the extent to which appropriate courses of action are chosen - but also procedural rationality - the effectiveness in the light of human cognitive powers and limitations of the procedures used to choose actions."⁴⁶

However this has remained a need rather than an actuality and interest has remained with the end rather than the means - with what decisions are made rather than with how they are made.⁴⁷ One area that might have held out some hope in this respect is the theory of search which is meant to deal with problems where not all the alternatives are specified at the outset. But once again the pre-occupation with ends rather than means has dominated so that the central question becomes one of deciding when to terminate the search for alternatives rather than how the search might be carried out.⁴⁸

⁴⁶ Simon *ibid*, his emphasis.

⁴⁷ *Ibid*

"The main motivation in economics for developing theories of uncertainty and mutual expectations has not been to replace substantive criteria of rationality with procedural criteria but rather to find substantive criteria broad enough to extend the concept of rationality beyond the boundaries of static optimization under certainty"

⁴⁸ As such it is in principle amenable to either optimizing (by equating marginal costs with expected marginal improvements) or satisficing (to terminate when an aspiration level has been reached).

This is very similar to Rawls's idea of deliberative rationality

"It is perfectly rational to follow a satisfactory plan when the prospective returns from further calculation and knowledge outweigh the trouble"

J. Rawls, A Theory of Justice Oxford Clarendon Press 1971 p.418.

Simon's conclusion is that economics will have to devote major energy to building a theory of procedural rationality to complement existing theories of substantive rationality. Loasby sees the problem as "finding the means to simplify, assume and guess",⁴⁹ while Carley looks upon it as the means by which we define the decision space⁵⁰ and then operate within it. As a general comment he states:

"The criticism that rational behaviour is impossible because complete comprehensiveness is impossible is generally resolved by the concept of limited rationality given that this basic limitation to rationality is made clear."⁵¹

It is Carley who also gives the most explicit working definition of what would be generally accepted as being included within the term 'rationality'⁵² in the present day. He expresses these as

⁴⁹Loasby op cit p.4. "In the face of complexity, selection and simplification are essential. But the methods of selection and simplification are not unambiguously determined."

⁵⁰Carley op cit p.12

"No person can grasp the entire complexity of the system and so one must draw a line around the influences and effects considered relevant".

⁵¹Ibid p.16.

⁵²The 'limits' are left open in this approach since, for example, it includes satisficing because it follows the itemised rational procedures.
Ibid p.15.

five sequential activities undertaken by the idealised "rational man"⁵³

- (1) A problem which requires action is identified and goals, values and objectives related to the problem are classified and organised.
- (2) All important possible ways of solving the problem or achieving goals and objectives are listed - these are alternative strategies, courses of action, or policies.
- (3) The important consequences which would follow from each alternative strategy are predicted and the probability of those consequences occurring is estimated.
- (4) The consequences of each strategy are then compared to the goals and objectives identified above.
- (5) Finally a policy or strategy is selected in which consequences most closely match goals and objectives, or the problem is most nearly solved or most benefit is got from equal cost or equal benefit at least cost."

This appears an extremely detailed and well specified definition of the current usage of the term rationality and Carley

⁵³M. Carley 1980 op cit p.11. Carley also refers the reader to

Levine, Musheno and Palumbo "The Limits of Rational Choice in Evaluating Criminal Justice Policy" in S. Nagel (ed) Policy Studies and the Social Sciences Lex, Mass De. Heath & Co. 1975 and B. Smith, Policy Making in British Government London, Martin Robertson 1976.

seems justified in claiming "we can safely assume that when authors talk about rationality they are talking about some variation of these activities."⁵⁴ Because of his own focus on policy analysis it is also a definition which is usefully oriented towards this study's particular concern with public sector investment analysis. This listing of sequential activities provides a benchmark or point of comparison against which to test the reality of investment decisions against the theoretical promises held out by the rational model.

The five activities divide conveniently into the two aspects of decisionmaking identified earlier - project formulation and project evaluation/selection, formulation being covered by steps 1 and 2 and evaluation by steps 3, 4 and 5.⁵⁵

It is with the problem of project formulation that this chapter is concerned. Combining together the earlier discussion of the limited choice which is in practice available to the decisionmaker prior to formal evaluation of investment options and the "enlightened" retreat from the previous 'hard line' rationality of economics to a concept of limited or bounded

⁵⁴Carley ibid p.11. It should be stressed that this model of rationality is not advanced as 'correct' or 'appropriate' for policy decisions. It is merely to form a consensus viewpoint on what 'rationality' entails.

⁵⁵Again it must be stressed that this is an analytic simplification rather than a real dichotomy, as in practice it would be more appropriate to consider formulation and evaluation as interactive. For support of this view see UNIDO op cit p.16-17.

rationality, the problem of project formulation may be summarised as follows:

It appears to be in the nature of economic choice that the alternatives from which selection is made will not be comprehensive. But if this lack of comprehensiveness is accepted as inevitable, the question then at issue is, by what process are alternatives filtered until no more than three or four remain to be evaluated by appraisal techniques? It is after all a large step from acknowledging that the human mind has difficulty in coping with a large number of alternatives to offering it less than five to work on.

I wish to suggest that such limits are placed on the range of choice or, in Carley's terminology, 'the decision space is excessively limited', for two main reasons.

The first concerns the 'problem' definition, since the objectives that have been specified will have tremendous impact on the area of search considered likely to generate alternatives. The second concerns the nature of the technology which may be incorporated into any given alternative, in particular the assumption that the technical nature of a proposal falls into the rational/analytic area rather than the normative one.

It was suggested earlier, that investment proposals by governments which appeared to be unique like the Channel Tunnel or the Sydney Opera House, only possessed this quality of uniqueness to the extent that the initial objectives were so narrowly specified, that the proposed solution to the problem was or rapidly became, the only way of fulfilling the restrictive

conditions. A simple example will reinforce this claim:

The potential purchaser of a car has in mind certain characteristics that he would like it to have. His objective may be to find a car with a certain engine capacity, number of seats, luggage space etc. While his aims are broadly of this nature, any of the car manufacturers would be capable of producing one (or more) models from which he could make his selection. The more specifically he states his requirements however - a rotary engined estate car with electronic monitoring devices - the smaller will be the range of possibilities until eventually his objectives can only be satisfied by a custom built vehicle.

So with public investment projects if the objectives are excessively detailed at the outset then someone or some department has made an a priori choice, since narrow aims will not generate a broad range of options and the step by step logic of the formal analysis is undermined at the outset.⁵⁶ At its least intractable this problem may have arisen through lack of awareness. The decisionmaker may not realise that the way the objectives of an

⁵⁶ Tomlinson makes a similar point in relation to the structure of an organization where the decision takers must rely on information supplied by subordinates:

"In the end they take their decision on the basis of other people's information and no doubt choose the best from what they are offered. What, however, if they are not offered the right proposals? It could be that in the early stages of preparation the wrong alternatives were selected for examination - by ignorance, mistake or, as sometimes happens, selfish motives? If this happens the right decision cannot be taken because it has been made wrong"

Rolfe C. Tomlinson, OR, Organizational Design and Adaptivity, Omega, Vol. 4 No. 5 1976. 527-537.

investment have been specified have failed to capture the essence of the real problem or aim. As with many other aspects of investment appraisal the studies on the Third London Airport provide material in this respect. From the first planning enquiry at Stansted, through the major report provided by Roskill at the beginning of the 1970's to the resuscitation of the Stansted proposal in the Public Enquiry which opened in September 1981, the problem of congestion at London's Heathrow and Gatwick airports, and their anticipated inability to accommodate forecast increases in numbers of airpassengers arriving in and departing from the London area in the future, has always been linked to the objective of finding a site for a third London airport. However, even cursory examination indicates that this is not in itself, or should not be, an objective. Given that the problem has been correctly identified as existing congestion and future growth in demand, then a less restrictive formulation of the objective becomes: find a means of accommodating an increased volume of air traffic into and out of the U.K., a proportion of which may wish to pass through London. From this perspective it becomes immediately apparent that a third London airport is only one of several alternatives which are worth considering. Analysis of current passenger movement may suggest that London is a transit point rather than a final destination for much British holiday traffic and that the upgrading of regional airports for this class of travel may be appropriate. A significant amount of business travel may also fit into this regional pattern. Again, although most overseas visitors spend some time in London it may be found that most also visit Stratford-on-Avon and would be just as happy

to fly into Elmdon as into Heathrow. It is unnecessary to labour the point unduly. Where there is no strong political or bureaucratic pressure underlying the specification of objectives then in principle it only requires an appreciation of the danger of too rigid a specification of objectives, and the possibility of interaction between decisionmaker and analyst.⁵⁷

A more intractable problem is raised when an investment proposal is hedged in or forced into a particular mould for political reasons. It would be naive in the extreme to assume that decision makers come to the arena of public sector investment appraisal in the spirit of free enquiry. Rather more often they are likely to come struggling under the weight of assorted items of ideological baggage and in some cases uninformed personal prejudice. This is inevitable. However despite some complications arising out of the principal/agent divergence,⁵⁸ public sector decisions are in the last analysis presented as decisions taken by government "in the national interest". But as we have seen, this is an extremely elusive concept to give substance to if we extend it beyond the simplistic concept of maximizing GNP, and concepts of national interest and party political interest may become well nigh impossible to disentangle

⁵⁷ the Channel Tunnel Advisory group report referred to earlier provides an excellent model in this respect.

⁵⁸ Briefly, if a lot of power to decide on investment proposals is vested in the administration of the nationalized industries then there is a potential (and often actual) divergence between these agents' objectives and the objectives of their principals (the government of the day).

from each other.⁵⁹

It is not my purpose in this Chapter to pursue the problems of conflict and consensus in society or to consider how closely the majority view approximates to the national interest. At this point it is sufficient to identify as a problem the political bias which may be present in the initial specification of the objectives of public sector investment and which, if present, will have reduced the range of options and thus made the decision process more rigid, before any explicit evaluation and ranking of alternatives is carried out.

I wish to consider in the next chapter whether there are ways in which this pre-selection process may be made more open to debate or explicit consideration and whether these considerations could in turn be reflected in appraisal methodologies. For the moment it is suggested that a valuable, though limited response is for project analysts to point out the restriction that a narrow formulation of the initial problem places on decisions, and to indicate that a less restrictive framework would prevent the foreclosure of certain options at too early a stage in the decision process.

I have so far only considered flexibility in terms of keeping options open - not allowing certain choices to be ruled out too early, either through ignorance or deliberate design.

⁵⁹This highlights the most intractable problem of all concerning flexibility. Governments may have little in a political sense to gain from the pursuit of flexibility if they can see a particular factional pay-off from a more rigid or irreversible undertaking. They may see little virtue in providing a subsequent administration of a different political persuasion with a project which is easy to reverse or amend.

This in many ways is flexibility's most negative aspect. Ultimate flexibility in this sense is never taking a decision at all.

Flexibility or the ability to respond to change can be treated in a much more positive way as I hope to show in Chapter V below, where I shall consider some of the ways it has been suggested that responsiveness can be deliberately encouraged. However this in turn has important feedbacks to the pre-selection procedure - decisionmakers can only decide to use what is known to exist. In this sense the characteristics of flexibility which I examine below have equal if not greater importance in the pre-appraisal stage, since for better or worse a narrowing down process does occur. Before considering short term flexibility however, I should like to look further at this filtering process and what appears to be at the heart of the problem - the values which guide the choice of objectives against which proposals are evaluated.

In Chapter II I approached the problem of poor public sector decision making by considering the development of investment appraisal techniques over the post war period, the hopes of improved decisionmaking with which they were invested in the 1950's and 1960's and their apparent failure to fulfil these expectations. This failure has occurred despite ongoing attempts to incorporate a greater degree of real world complexity into the models, for example, by the inclusion of multiple objectives, provision for risk and uncertainty and so on.

My general conclusion from this review was that certain of the assumptions of neo-classical theory upon which such appraisal techniques are based diverge so considerably from the real world decisionmaking environment that it is inappropriate to consider them merely as simplifying assumptions - temporary scaffolding which will later be removed. In particular the assumptions of the single decisionmaker considering a wide range of options all of which might be itemised in terms of their expected lifetime costs and benefits, no matter how far into the future these stretch, and valued according to the agreed national interest, seem unlikely even to be approximated in practice.

I also supported the view that attempts to accommodate uncertainty are misguided since we are condemned to take decisions in at least partial ignorance, and that rather than try to "best guess" the future it would be more appropriate to build an approach to decisionmaking around the idea of flexibility or adaptability to changed circumstances. It was argued that the ability to respond to unforeseen change should be incorporated as an objective in investment decisions, so that projects which were able to respond to events other than those foreseen and planned for would be valued, rather than the project which at the outset appeared to provide the optimum solution, given our best guesses about what the future holds.

The implications of this idea of flexibility will be examined in greater detail in the following chapter but first it is necessary to consider further the other assumptions on which rational appraisal techniques are based, since valuing flexibility at an operational level will not in itself remove the other problems associated with rational planning. In particular, as we saw in the last chapter, a significant problem of inflexibility arises from the divergence of practical investment appraisal from the idealised evaluation of all possible options assumed by the rational comprehensive model.

It is interesting to note that during the time of greatest development of cost-benefit and associated techniques, a related debate was being conducted in other social science areas, most

specifically in public administration studies¹ as to the overall

¹The major stages of the debate can be found in the annals of the Public Administrative Review:

Charles E. Lindblom, The Science of Muddling Through, Public Administration Review Vol. 19(1959) 79-88

"Government Decisionmaking - a Symposium" in Public Administration Review Vol. 24(1964)

Y. Dror, "Muddling Through - Science or Inertia" 153-157

C. E. Lindblom, "Contexts for Change and Strategy, a Reply" 157-158

Roger W. Jones, "The Model as a Decision Maker's Dilemma" 158-160

Mickey McCleery, "On Remarks Taken Out of Context" 160-162

Wolf Heyberbrand, "Administration of Social Change" 163-165

Amitai Etzioni, "Mixed Scanning: A Third Approach to Decisionmaking", Public Administration Review Vol. 27(1967) 385-392

Further Symposium, Public Administration Review Vol. 39(1979)

C. E. Lindblom, "Still Muddling, Not Yet Through" 517-526

Camilla Cates, "Beyond Muddling: Creativity"

The major participants have expanded their views in longer works, viz

David Braybrooke and Charles E. Lindblom, A Strategy of Decision, London, Collier-Macmillan, 1963.

C. E. Lindblom, The Intelligence of Democracy, NY Free Press, 1965.

C. E. Lindblom, Politics and Markets, NY Basic Books, 1977.

C. E. Lindblom, The Policymaking Process, Englewood Cliffs, Prentice Hall (2nd ed) 1980.

Y. Dror, Public Policymaking Re-examined, Chandler 1965

A. Etzioni, "The Active Society" New York, Free Press 1968

More recent contributions to the debate have included

Paul R. Schulman, 'Nonincremental Policy Making: Notes Towards an Alternative Paradigm', American Political Science Review Vol. 69 No. 4 1975 p.1354-1370.

J. Gershuny, "Policy Making Rationality, a reformulation" Policy Sciences Vol. 9, 1978, 295-316

G. Smith and D. May "The Artificial Debate between Rationalist and Incrementalist Models of Decisionmaking" Policy and Politics Vol. 8(1980) 147-161

D. G. Collingridge, Critical Decisionmaking - A New Theory of Social Choice, London, Frances Pinter, 1982

David Collingridge and Jenny Douglas, "Three Models of Policy Making - Expert Advice in the Context of Environmental Lead", forthcoming 1983

validity of the rational planning model as an approach to public sector choice. This marked the advent of incrementalism as an alternative approach. Since the debate dwelled at some length on both the structure and strategy of decisionmaking, the points raised have important implications for the application of such investment appraisal techniques as we considered earlier.

The concept of rational economic man has a much longer history than the debate we are concerned with here. In its purest (or most extreme!) form - economic man as "an omniscient, lightning quick calculator who chooses among well defined alternatives (possibly billions of them) in such a manner that he maximizes utility"² it would not, by the post war period have found many supporters to maintain its realism. However when translated into the idea of the decisionmaker, carefully weighing the merits of alternative means to achieve an objective, it did and still does play a central role in many areas of social science, and most particularly, investment appraisal techniques of the cost benefit kind are grounded in it.

In fact it would not be an exaggeration to say that, should the rational planning model be sufficiently undermined by the criticism to which it has been subjected, this would in turn cast serious doubts on the validity of the rational analytical techniques which have been developed as an aid to public sector

²Martin Shubik, "Studies and Theories of Decisionmaking"
Administration Science Quarterly Vol 3 December 1958 289-306.

decisionmaking. The details of rational planning models vary but their central characteristics have been identified by Peter Self³ as stressing the need for

- (1) A consistent and coherent set of objectives (goals/matrix) and/or a consistent criteria of evaluation.
- (2) Examination of the maximum feasible number of alternative policies (subject to time and information costs) and projection and evaluation of their consequences.
- (3) Scrutiny of policy constraints.
- (4) Backing with adequate research which is as 'objective' as possible.

As Self points out, this paradigm of rationality is a counsel of perfection, unobtainable in full. As we saw in Chapter III above, some of the most significant attempts to develop and modify it may be attributed to Herbert Simon. Simon came early to the view that description of choice should recognize that alternatives are not given but sought, and at some cost; that information is not only incomplete but a minute fraction of the theoretical whole; and that the task of determining consequences is so arduous as to require curtailment of aspiration to the 'good enough' solution rather than the

³Peter Self, in P. R. Baehr and B. Whittrock(ed) Policy Analysis and Policy Innovation, London and Beverley Hills, Sage 1981.

'best'.⁴

The alternative model which Simon puts forward differs in three respects from the classical optimizing model:

- (1) Unlike most optimizing techniques it directly addresses the problem of designing and discovering alternatives. These are then assessed to see which is expected to provide the greatest net satisfaction, an alternative to accepting an initial stipulation of 'ends' which unduly forecloses the alternatives considered.
- (2) It incorporates the concept of an adequate or satisfactory solution in preference to an unobtainable optimum.
- (3) It does not guarantee the quality of the solution which will be found or even in some cases that any solution will be found.

With these modifications Simon departs a long way from the naive rational comprehensive ideal, but there is no doubt that he remains firmly in the rational decisionmaking camp. He sees the rational planning model as an 'ideal' and hence a way of

⁴H. A. Simon, "Theories of Decisionmaking in Economics and Behavioural Sciences", American Economic Review Vol XLIX No.3 June 1959.

H. A. Simon, Administrative Behaviour (2nd ed), NY, Free Press 1957

also

H. A. Simon, "Administrative Decisionmaking" Public Administration Review Vol XXV 1 March 1965.

structuring the approach to a problem despite the fact that its execution might fall short of the ideal through limitations on the collection and processing of information. In his most recently published work⁵ he still maintains:

"Even when the real world situation is too complex or too imperfectly known to allow real optimization it may be possible to find an approximate formulation of the actual situation in which optimization can be carried out optimizing in a simplified world is an important means for satisficing in the real world."⁶

In direct contrast to the rational model and in response to its claim that it serves as a simplified model against which actual conduct can be measured, is the incrementalist decision model. This approach also has a much longer history than that with which it is sometimes credited. Etzioni⁷ traces its roots to Dewey, Myrdal and Hume, and identifies its philosophical roots in Popper's argument for piecemeal social engineering rather

⁵ H. A. Simon, Models of Bounded Rationality, 2 Vols MIT Press Cambridge, Mass 1982.

⁶ Ibid. Introduction to Vol 1.

⁷ Amitai Etzioni, (1968) op cit. p.268

than radical transformation.⁸

Nevertheless the opening salvo in the post war debate is credited to Charles Lindblom in his 1959 article "The Science of 'Muddling Through'"⁹ Developed and modified throughout the intervening period,¹⁰ Lindblom's latest restatement of his position¹¹ is remarkably unchanged in major characteristics. The six primary requirements of the incrementalist model may be summarised as:¹²

1. Rather than attempting a comprehensive survey and evaluation of all alternatives, the decisionmaker focuses only on those policies which differ incrementally from existing policies.
2. Only a relatively small number of policy alternatives are considered.

⁸ K. R. Popper, The Open Society and its Enemies Vol.1 Princeton NJ, Princeton University Press 1963 157-158.

⁹ Charles E. Lindblom, (1959) op cit.

¹⁰ David Braybrooke and Charles E. Lindblom, (1963) op cit.
Charles E. Lindblom, (1965) op cit.
Charles E. Lindblom (Sept. 1964) op cit.

¹¹ Charles E. Lindblom, (1979) op cit.

¹² Braybrooke and Lindblom op cit.

3. For each policy alternative only a restricted number of important consequences are evaluated.
4. The problem confronting the decisionmaker is continually re-defined: Incrementalism allows for countless ends-means and means-ends adjustments which, in effect, make the problems more manageable.
5. Thus, there is no one decision or "right" solution but a "never-ending series of attacks" on the issues at hand through serial analyses and evaluation.
6. As such, incremental decisionmaking is described as remedial, geared more to the alleviation of present, concrete social imperfections than to the promotion of future social goals.

Some critics have made much of the fact that Lindblom seemed to advance incrementalism not only as a description of decisionmaking as currently practiced but also as a normative theory - how decisionmaking should be practiced.¹³ The distinction need not concern us here since we are contrasting it as a model with other normative models and hence may take it as

¹³ e.g. Morton Kaplan "It is not clear through the book, *Strategy of Decision*, if the authors are more concerned with whether disjointed incrementalism is a description of how people do choose or a prescription as to how reasonably to choose" The Annals of the American Academy of Political and Social Science Vol 352 (1964) p.189.

Victor A. Thompson: "Whether the strategy is a description of a 'social process' or an alternative ideal of rationality is not clear." American Journal of Sociology Vol 70 (1964) p.132.

a prescription for how 'good' decisions are made.¹⁴ Lindblom makes a further distinction about the structure of organization within which decisions are made and this is something I shall pursue in greater detail later. However at the level of strategy the incrementalist approach is advanced primarily because of the much more modest information demands it places on decisionmakers. Comprehensiveness is no longer required so the cost of obtaining information and the inability to process more than a limited quantity are no longer the problems that Simon grappled with in his modification of the rational model. They are removed at a stroke. Further, because the alternatives which are investigated are those which differ only to a limited degree from existing policies or projects the problem of

¹⁴ That Lindblom saw and continues to see the theory as covering both these aspects is made clear in "Still Muddling, Not Yet Through" op cit. p.517. The main thrust of his argument is that while everyone agrees that the ultimate aim is better decisionmaking, those who wish to separate the descriptive from the normative aspects of incrementalism believe that to do better means turning away to a different method of decisionmaking. Lindblom on the other hand believes it means practising incrementalism more skilfully.

forecasting the future is to some extent reduced.¹⁵ The strategy also appears as a powerful tool in the search for operational flexibility. Small steps are taken in the 'right' direction or, when it is evident the direction is 'wrong', the course is altered. The incremental approach is deliberately exploratory - one route is tried and the unforeseen consequences are left to be discovered and treated subsequently.¹⁶ Incrementalist decisionmaking has been attacked most severely because of this deliberately limited stepwise change it embraces. Dror while accepting it as an advance on rational comprehensive models - "more closely tied to reality, more sophisticated in theory and more adjusted to human nature"¹⁷ - argues that the approach is only appropriate if three conditions are met:¹⁸

¹⁵ Reduced but not eliminated. Forecasting is grounded in relevant experience, runs the argument and hence the closer new projects stick to existing ones about which operating experience exists, the better will be the forecasts they utilize. But the problem of change is precisely that the future is not like the past hence the need for adaptability as a project or policy characteristic argued in chapter II above. For a discussion of forecasting in the context of the rationalist/incrementalist debate see: J. Gershuny, "What should forecasters do? A Pessimistic View" in P. R. Boehr and B. Wittrock (ed) Policy Analysis and Policy Innovation. London and Beverley Hills, Sage Publications 1981. 193-207.

¹⁶ A. Etzioni, the Active Society op cit p.271.

¹⁷ T. Dror "Muddling Through, Science or Inertia?" Public Administration Review Vol 24 No.3 (1964) 153-157.

¹⁸ Ibid.

- (1) results of present policies must be in the main satisfactory.
- (2) there must be a high degree of continuity in the nature of the problem.
- (3) there must be a high degree of continuity in the available means.

Thus the more rapidly changing is the environment, the less will the approach have to offer since the less can it be assumed that past experience will be relevant to the future.

This is an important criticism in relation to flexibility in two respects. Firstly it suggests that as a normative theory incrementalism might advocate slowing down the rate of change where possible in order to 'improve' the decisionmaking environment.¹⁹ There is also a deliberate presumption that radical change is neither likely nor desirable. Secondly the actual policy or project implemented must not of itself be capable of significantly changing the environment because should a move have proved ill-advised, it must be capable of being reversed. In other words the attribute of reversibility is inextricably bound up with incremental change. But reversibility is also an important concept in relation to flexibility. Can the two be equated therefore? I think not. But as Gershuny points out²⁰, small changes are not necessarily

¹⁹The worst construction which is put on this approach is that it is cautious, conservative, supportive of the status quo - but it might equally provide justification for moratoria - nuclear power in Sweden; American scientists' moratorium on work in recombinant genetics 1974.

²⁰Gershuny 1981), op cit "How do we obliterate a motorway however small? And even if we did could the damaged community revert to its previous status?"

reversible, although the incrementalist model assumes that they are. Nor by the same token are non-incremental changes necessarily irreversible. It will always be risky to adopt a course of action where its subsequent effects cannot be reversed, and difficult to justify doing so without attempting a substantial a priori analysis of its consequences, thus re-entering in part the rational-comprehensive framework. So, I would argue, the idea of flexibility requires more than incrementalism necessarily has to offer, although incrementalism may be one tool in the toolbox.

Dror, Etzioni and Gershuny have all perceived the need for constructing a model that could draw on the best aspects of the "muddling through" and "rational-comprehensive" models and hence prove superior to either. The most fully worked out alternative in this respect is the mixed scanning model of Amitai Etzioni.²¹ Etzioni starts from the position that incremental analysis cannot handle fundamental decisions (which Lindblom accepts) and that the number and role of fundamental decisions are significantly greater than incrementalists allow. When fundamental decisions are missing, or not allowed for within the decisionmaking framework, incremental decisionmaking amounts to drifting - action without direction. Fundamental decisions are needed to set the context for incremental ones.

²¹ Amitai Etzioni, 1967) op cit also

Amitai Etzioni, 1968) op cit especially Ch 12.

To overcome the unrealistic aspects of rationalism by limiting the amount of detail required in fundamental decisions and at the same time to overcome the inherent conservatism of incrementalism, Etzioni developed his "third" approach, mixed scanning.

The essence of the mixed scanning approach is that it reduces the need for the 'project information' of the rational model, while guarding against the myopic viewpoint of incrementalism. Etzioni uses as analogy the setting up of a world wide weather observation system using weather satellites. The rationalist approach would seek an exhaustive survey of weather conditions by using cameras capable of detailed observations and by scheduling reviews of the entire sky as often as possible. This would yield an avalanche of details costly to analyze and overwhelming any capacity to take action. Incrementalism would focus on areas in which patterns similar to recent past developments were occurring and on a few nearby regions. It would ignore formations which might reserve attention if they arose in unexpected areas.²² A mixed-scanning approach would employ a broad-angled camera that would cover all the sky, but not in great detail and a second one to zero in on those areas revealed by the first camera to require a more in-depth examination.

This mixed scanning provides a means of differentiating fundamental or contextuating decisions from incremental ones

²² Etzioni (1967) op cit p.389.

although both have a place in decisionmaking. Incremental decisions limit the information needed to manageable proportions whilst contextuating rationalism helps overcome the conservative slant of incrementalism by its broader and longer term perspective.²³

This distinction matches closely the one I wish to make concerning flexibility. As I have argued in Chapter III an important source of inflexibility in the area of public investment decisionmaking arises before any formal evaluation takes place. Often the objective (for example: find the best site for the Third London Airport) is framed before the problem has been properly explored. (How can the airport system accommodate assumed increases in demand for air transport over the next twenty years?) Thus many options are foreclosed before the formal appraisal process gets underway and the options which are shortlisted are highly circumscribed.²⁴ If we dissect the

²³ Etzioni emphasizes that scanning may be divided into several levels with various degrees of detail and coverage. It seems most effective however to indicate the two ends of the spectrum by an all encompassing overview at the end and a highly detailed exploration of two or three options at the other. Ibid p.389.

²⁴ Detailed formulation of options is an extremely costly business therefore given the way the objective was framed it was inevitable that the shortlisted options would consist of new sites within a given distance of London rather than, for example, the upgrading of existing regional airports. It is interesting to note that broad scanning procedures were used to select sites for detailed examination but by this time the problem was locked into a very narrow format.

problem further in the light of the earlier discussion on uncertainty, the fundamental question is really how the airport system can accommodate uncertain changes in demand over the next twenty years.

An initial approach to such a problem may be, indeed can only be worked out at a very broad level. This should not copy the rationalist approach which, at the extreme, demands that all consequences be surveyed prior to decision. (As we shall see, critics argue that Etzioni has not escaped this problem.) Indeed if the characterization of the future as containing a large area of irreducible uncertainty or ignorance is broadly correct then the possibility of such an approach is ruled out. Rather, fundamental decisions are to be made by exploring possible solution areas in relation to the problem in hand but at as high a level of generality as possible. It is a precursor to detailed evaluation and a means of avoiding focusing too early on a particular response. Once this has been completed then more detailed appraisal may take place within a narrower area. Contextuating decisions set basic directions, while item or bit decisions are then taken within the defined direction (possibly on an incremental basis). The fundamental decisionmaking which is wide ranging compensates for the conservatism of incremental decisions while incrementalism copes best with the specific detailed options and uncertainty.²⁵

It has been argued however that the fundamental

²⁵ A point made also in W. Solesbury, Policy and Politics Vol 9 No.4 Oct. 1981, 419-438.

decisionmaking level as conceived by Etzioni, is little more than rational comprehensiveness or the synoptic model by the back door.²⁶ Three criticisms are levelled:

- (1) Broad scanning for features which might necessitate change in an organization cannot be conducted efficiently by that organization since its perception of the environment will be distorted or biased.
- (2) Etzioni assumes that fundamental decisions cannot and should not be incremental, but fails to provide a criterion for identifying such decisions.
- (3) Whilst appearing in principle to limit the information demanded by synoptic rationality, the approach is to proceed by elimination of options. Yet in practice a great deal needs to be known if an option is to be eliminated, more, it is argued, than is reasonable.

Smith and May have similarly argued that the central weakness of Etzioni's mixed scanning model lies in the importance attached to the distinction drawn between the two different kinds of decision. (A damaging attack indeed if sustained since this is its main attribute!) They point out that since there is no way of objectively differentiating between fundamental and incremental decisions, decisionmakers

²⁶ David Collingridge and Jenny Douglas, *op cit.*

might adopt whichever approach is expedient - pursuing detailed analysis or omitting it at will. Thus "the doubt remains that mixed scanning is just as utopian as rational planning and just as lethargic as 'muddling through'",²⁷

All these points have some validity in the context of Etzioni's model. Etzioni himself very definitely identifies broad scanning with fundamental, contextuating decisions, but is less than clear on the nature of the broad scan procedure which enables the transition to be made to the second stage analysis. Indeed the implication must be drawn that fundamental decisions are generated in the rational mode - albeit abbreviated, back of the envelope, rational analysis. Then, in the second stage, detailed specifications of options are grounded in this underlying decision but are incremental in character.²⁸

I believe that a much stronger argument can be constructed for a two stage appraisal approach than this.

As I hope to show, my interpretation of the value of mixed scanning centres primarily on the procedure it implies in the search for a response to a problem rather than on the type of solution which may eventually be adopted. It would perhaps be more accurate to term it dual scanning. That is, there is no a priori assumption about which type of solution - incremental or radical will be shortlisted for the detailed evaluation. The procedure seeks to ensure that neither approach is neglected.

²⁷Smith and May 1980 op cit p.153.

²⁸Etzioni (1968) op cit p.288.

I would argue that Etzioni has fallen into the same error of which he accuses the incrementalists, namely of assuming that there must be choice between two kinds of decisionmaking despite his protestations to the contrary. The reason for this, appears to lie in his failure to take full account of the structure within which a decisionmaking model will be required to operate. That is, in the interactions of the participants in the decision process. This is the substance of Collingridge and Douglas's point 1 above and also, by extension, an argument which may be directed more generally against the rational model and its variants. It is the other aspect of the rational model about which I expressed disquiet at the beginning of this chapter - in terms of the public sector it is the assumption of the single decisionmaker or executive group acting in the national interest. As we shall see, Lindblom's work makes an important contribution in this area also.

So far we have only directed our attention to the information demands of the synoptic model - in Simon's case where there is an attempt to maintain the rational model but to make it more plausible and in Lindblom's case to substitute a non-comprehensive alternative, the strategy of decisionmaking. But Lindblom's development of incrementalism has a second aspect - it is concerned with the structure of the organization within which decisions are taken. Lindblom not only questions the rationalist approach in its demands for all possible options to be evaluated and displayed prior to decision, but also the existence of a single individual or group with a homogeneous

and stable value set with which to appraise these myriads of alternatives. Lindblom points out that it is a feature of pluralist societies that policymaking is fragmented amongst various agencies each with a partisan approach to any particular problem. The structure of decisionmaking therefore involves the co-operation or adjustment of groups involved in any decision - specialized agencies, the cabinet, parliamentary factions, extra-parliamentary pressure groups, the general public. Policies are the outcome of a 'give-and-take' among numerous societal partisans.²⁹ This dual strategy/structure model is more properly known as disjointed incrementalism. But this is not just a description of what happens. It is argued, more strongly that the various interests which ought to be considered will be better served through such a mechanism than through the presence of some supposedly unbiased decisionmaker with the ability to take a synoptic view of the problem at hand.

This formulation sheds light on what I see as the fundamental attribute of the broad scan - how the general area from which options for detailed appraisal are selected, is chosen. The broad contextuating decisions are essentially concerned with values. As such they are not primarily affected by information or lack of it, but by the strength of the consensus on the values they embody.

²⁹ Etzioni (1968) op cit p.288. Although the terminology is due to Lindblom.

For a more detailed review of partisan mutual adjustment see Collingridge (1982) op cit pp.176-180.

Critics of Etzioni are right to point out that if broad scanning is nothing more than back of the envelope rational analysis it cannot but fail, and this would occur for exactly the same reasons that more comprehensive appraisal of this kind would fail even if the information problem were overcome. The preconditions for the application of such a model - an agreed collection and ordering of values against which to measure project outcomes, cannot be met.

The problem of values in relation to economic policy making (and by extension to the techniques designed to assist policy choice) has received much attention in methodology debates during the twentieth century. Often referred to as the 'economist as technocrat' argument it may be summarised as,

"Let governments decide their 'objective function' defined in terms of the multiple ends or goals of economic activity; it is the task of economists to delineate the 'possibility function' the costs and benefits of alternative allocations of scarce means; provided the means-ends distinction is rigidly maintained, economic advice to governments is, or rather can be, value free"³⁰

For example to use cost benefit analysis to encompass national decisions it is necessary that the national preference function or social welfare function be known and used to evaluate options. Two objections are levelled at this approach.

³⁰ See M. Blaug (1980) op cit p.149) who quotes, Oscar Lange, 'The Scope and Method' of Economics' Review of Economic Studies 1945, in this respect.

The first, due to Arrow, is that under certain generally accepted conditions, no social welfare function exists which is an aggregate of individual preferences - the 'Impossibility' theorem.³¹ Arrow shows that under these conditions there is no way of ranking alternative outcomes which preserves the role of individual preferences demanded by neo-classical economics. Whilst there continues to be some debate both about the overall methodology employed by Arrow and the specific conditions he adopts as being 'reasonable' or generally accepted,³² it continues to remain a problem in the context of the neo-classical framework which attempts to restrict value judgements to the basic assumption that the individual is the best judge of his own welfare. The use of a rational decisionmaking model is also affected by it:

"Cost benefit analysis has been generally interpreted as a method of aggregating individual preferences so as to provide a basis for social choice. The Impossibility theorem claims to show that no such aggregation is possible without introducing ethical

³¹K. J. Arrow, Social Choice and Individual Value, 2 ed New York 1963.

³²For critiques and development of Arrow's work see:
A. K. Sen, Collective Choice and Social Welfare San Francisco, Holden-Day Inc. 1970.
A. K. Sen 'Social Choice Theory: A Re-examination' Econometrica Vol 45 Jan 1977, 53-89.
P. C. Fishburn, Theory of Social Choice, Princeton, Princeton University Press, 1973.
C. R. Plott, 'Axiomatic Social Choice Theory: An Overview and Interpretation' American Journal of Political Science Vol 20, August 1976, 511-596.
Dennis C. Muller, Public Choice, Cambridge, Cambridge University Press, 1979.

judgements of a more specialized kind than requiring simply that individual preferences should count. The explicit introduction of ethical judgements into CBA thus appears inevitable"³³ or as Gershuny maintains:

"Simon asserts that a social welfare or collective preference function is necessary for rational public policy making; Arrow proves that such a function is impossible - so the rationale for rationality disappears"³⁴

A decisionmaking model must therefore contain provision for the working out of a value set rather than assume the pre-existence of one.

It would not be unreasonable to state that disjointed incrementalism more than any other approach to decisionmaking has sought to tackle this problem. The model seeks to define the social and political context within which decisions are taken - the structure of decisionmaking as well as its strategy. It is this aspect which has led to the criticism of disjointed incrementalism as mixing description with prescription, but such criticism is not well founded. Lindblom makes it absolutely clear in his restatement of the disjointed incrementalist position in 1979, that not only is partisan mutual adjustment a

³³ Dasgupta and Pearce (1972) op cit p.90.

³⁴ J. Gershuny (1979) op cit p.297.

description of how competing interest groups manoeuvre and make accommodation in present western democratic society but that such adjustment is a necessary condition of a continuing democratic social structure. Similarly most decisions are made incrementally and should continue to be so.³⁵

The converse of this is that in centralized economies with a strong underlying ideology one would expect to see decisionmaking along the lines of the rational model. In this context it is interesting to note that Zbigniew Brzezinski, later a leading policy adviser in the Carter administration, in a discussion on ad hoc incrementalism poses the question of whether such muddling through may be a universal characteristic of complex structures or whether it is more proper to attribute it to the prevailing political culture. In comparing the U.S. and U.S.S.R. patterns of decisionmaking, Brzezinski inclines to the latter explanation.³⁶ In my view the partisan mutual adjustment aspect of Lindblom's work is of even greater significance than incrementalism which has received greater attention. Lindblom avoids what I identified in my introduction as a major failing of decisionmaking approaches

³⁵ The main thrust of his argument is that while everyone agrees that the aim is to achieve better decisionmaking, those who wish to separate the descriptive from the normative aspects of disjointed incrementalism believe that to do better means turning away from it to rational analysis. Lindblom on the other hand believes that it means practising incrementalism more skilfully.

³⁶ Z. Brzezinski and S. P. Huntington, *Political Power: U.S.A./U.S.S.R.* New York Viking Press 1964. quoted in Etzioni (1968) op cit p.271f

derived from neo-classical economic theory - that of ignoring the environment in which the analytical tools will be used in favour of rigorous internal consistency. The partisan mutual adjustment aspect of disjointed incrementalism is very firmly rooted in the way value conflict is handled within a mixed market democratic society. Yet it appears to me Lindblom has avoided the lack of realism inherent in comprehensive rationality only to fall prey to the other faults of which Etzioni accuses him - myopia and undue conservatism. By linking the democratic interplay of value determination so inextricably with incremental change, Lindblom's approach cannot encompass the quite radical shifts in value which may and do take place within societies. If a decision theory is unable to encompass this type of decision, it is a worrying inadequacy.

For example the following ten most important trends in U.S. society identified in *Business Tomorrow* by John Naisbitt³⁷ might all be interpreted as suggesting quite sharp changes in social values over the last decade:

	FROM	TO
1	industrial	information society
2	centralization	decentralization
3	party politics	issue politics
4	machines	human technology

³⁷ John Naisbitt, 'U.S. Trends for the 80's' Business Tomorrow Vol.3 No.1 Feb. 1980.

5	racism/sexism	ageism
6	top-down management	bottom-up management
7	equal health/education	equal access to capital
8	bigness	appropriate scale
9	"company" board of directors	independent board of directors
10	representative democracy	participatory democracy

It also becomes clearer that some projects and policy changes will, as Etzioni saw, anticipate fundamental or contextuating changes, since they will be the early indicators of a shift in social values. I am therefore convinced of the value of a two stage or mixed scanning approach to public sector decisionmaking but I have some to extent turned Etzioni's model on its head! It appears to me that two quite distinct processes are involved - the accommodation of a variety of different values and perspectives within the decision process if such a decision is to 'stick' or be accepted and secondly the specific characteristics or details of the solution finally selected. In the context of this present study the former relates to the problem of pre-selection or narrowing down of options which are evaluated in any detail. This I have already identified as a source of inflexibility (Chapter III above) since so many potential solutions to a given problem are never explicitly considered. The problem therefore gets locked into a restricted framework very early in the decisionmaking procedure.

It is obvious at a practical level that this must necessarily occur. The costs of preparing detailed plans for

even a modest investment proposal are significant. However the problems that this may generate are hidden by the assumption of comprehensive rationality on which traditional investment appraisal rests. If this assumption is inappropriate the important question is how the narrowing down process is accomplished. There is a need for an explicit means of accommodating the move from the almost infinite range of potential projects to the selective short list. What Lindblom has termed "a strategy for skilfull incompleteness"; a means of avoiding the impossible aspiration to synopsis.

I believe that a dual scanning model makes explicit the importance of agreement on values and objectives in a pluralist society. The initial scan may be interpreted as the stage at which large conflicts between groups are considered and moves to consensus made. Solution areas on which there appears to be little or no chance of consensus are ruled out at this stage. The fact that in a society such as ours one person may technically make a decision - for example a government minister does not negate this process. Nor does the procedure itself assume any "correctness" or otherwise of the area delimited in this way. If the values embodied are substantially different from a working consensus - if for example they are imposed by one group - then any project decision which results will be continually challenged and if implemented will be perceived as a disaster by parts of society. Equally if in important respects agreement is forthcoming then the chances of eventual success are greater.

quotes Lord Bridges the former head of the British Civil Service: "However complicated the facts may be, however much your junior may try to persuade you that there are seventeen arguments in favour of one course and fifteen in favour of the exact opposite, believe me, in four cases out of five there is one point and one only which is cardinal to the whole situation."³⁹

Self sees this as an expression of the pressures which guide administrative thinking and the need to identify and respond to what seems most urgent at any given time. It is however also a further expression of the view that certain components of a decision are pivotal. Once a choice has been made in these areas then many subsequent actions follow automatically. Conversely, agonizing over many details prior to such critical choices is often time wasted. What I would argue further is that such choices are critical because they are the focus of competing aims and values of participating groups. Thus it is precisely these areas where there is the greatest demand for partisan mutual adjustment.

Broad scanning enables these areas to be identified and moves to consensus made. At this stage individual

³⁸ P. Self, Administrative Theories and Politics, London, Allen and Unwin, 1977 (2nd edition).

³⁹ Lord Bridges in A. Dunshire (ed) The Making of an Administrator Manchester, Manchester University Press, 1956 p.12.

participants may advance appraisals of proposed schemes as part of their evidence, one more item in the bargaining process, but such appraisals will not have any pretensions to be synoptic. Indeed it is at this fundamental or broad level that mutual adjustment is most needed and rational appraisal techniques most inappropriate. If the analysis that I have developed here is substantially correct then it has serious implications for the application of investment appraisal techniques in the public sector, implications which are not widely recognised. In particular it calls into doubt the direction of post war development which has been to encompass greater and greater degrees of complexity within a single decision algorithm. Much of this work must now be regarded as superfluous. Analyses produced under such conditions will inevitably be biased in the values they incorporate (or omit). Loasby⁴⁰ recognizes this:

"The operation of the American Defence Department under McNamara was apparently based on the assumption, eagerly taken up in Britain, that many national issues could be removed from partisan debate and reserved by the clinical application of managerial techniques. The great vogue for cost-benefit analysis was a product of this assumption. But any belief that major issues of national security (or of airport location) can be handled by a pure rational process, which will produce results

⁴⁰B. J. Loasby op cit p.97.

acceptable to all reasonable men, is a chimera: differences of objective, our limited ability to process information, and the inevitable absence of some information - about the future, and about future discoveries - all ensure this result."

Recognition of this problem releases rational appraisal techniques from the impossible burden placed upon them and returns them to their proper function of ranking comparable options in the detailed scan.

The most significant points to emerge from this re-formulation of mixed scanning are;

(i) It is at the broad scanning level that the need for an adjustment process to reconcile conflict is at its most acute.

(ii) At this level rational analytical techniques have no part to play since any trade-offs between objectives which are included will be partisan and only of significance to the particular group whose values they represent.

(iii) If a satisfactory resolution to this stage of the decision process can be achieved then a second stage detailed planning process may be initiated. There is no a priori reason why the area detailed for closer examination should be either limited and incremental compared to the existing environment or radically different. The emphasis lies on satisfactory solution and the strength of the consensus achieved.

(iv) At this second level appraisal techniques have a part to play since although even here values are inevitably

subsumed within them, more obvious conflicts will have been taken into account at an earlier stage. Also since the area of search for solutions has been defined by broad scanning there will, by this process also, be less need to incorporate specific weights which are themselves attempts to incorporate particular values.

One further advocate of mixed scanning that I would like to consider in this context is Jonathan Gershuny.⁴¹ Gershuny identifies the need for broad scanning in terms of the demand for vindication of public policies. He recognizes that conflicts of interest will occur but argues that in order for losers to be able to reconcile themselves to a decision it needs to be demonstrated that "all the feasible alternatives have been considered together with all their effects and that on the basis of that consideration some decision has been taken".⁴² On adoption of a particular policy option those who oppose it have a choice. Either they will, while using any legitimate means to oppose it, consent to its implementation or else they will not consent and will adopt non-legitimate (i.e. revolutionary) tactics. Within the boundaries of any consensus which is formed opponents of policies will require that policies be vindicated. "Vindication requires in practical terms the comprehensive consideration of feasible policy alternatives."⁴³

⁴¹J. Gershuny (1978) op cit.

⁴²Ibid p.199.

⁴³Ibid p.200-201.

But how could this ever be achieved? Once again we are back into the problem of rational comprehensiveness. In order to consider policy alternatives in this way they have to be evaluated and compared. Let us assume for the moment that this is done on the basis of some variant of cost benefit analysis. As we have seen an a priori condition of such an appraisal is that certain values have to be known before the analysis can commence.⁴⁴ Thus any comparison will only be done with respect to one configuration of values.

Under these circumstances the 'losers' will have very little interest in whether every conceivable alternative has been considered. What they will wish to be reassured of is that the prevailing set of values is a reasonable representation of a consensus that would attract majority support and that the possibility of change remains open should they be able to make sufficient converts to their own position.

Again we are brought to the view that such a framework implies

- (a) That the broad scan is essentially a test of competing values and partisan mutual adjustment to achieve a workable consensus.
- (b) That flexibility is a highly important attribute of decisionmaking under such conditions.

⁴⁴ For example what weight is to be given to inter-temporal (even inter-generational) distribution, or how are social or environmental impacts to be valued.

- (c) That a detailed second stage appraisal is equally necessary since some unanticipated aspects of a proposal may be revealed which may modify some of the values implied by (a).

I do not wish to appear to underestimate the problems of making such a mixed scanning system operational. A major problem lies in how values are to be both articulated and synthesised. The most obvious direction in which to look first is the election of a government in a democracy. But as we have seen, the assumption that the value judgements of government may be regarded as some sort of proxy for the community at large, leads very quickly to the model of the single decisionmaker acting in the national interest. A simple majority voting system cannot support such a burden, as the problem of intransitivity shows. Nor is the problem of 'strategic' voting allowed for. Perhaps a more important role in working out consensus might be awarded to all party Select Committees in the U.K. or the various committees of the House of Representatives and the Senate in the U.S.⁴⁵ In an extra-parliamentary sense the importance of Etzioni's perception that incremental decisions may anticipate

⁴⁵The American budgetary process as described by Aaron Wildavsky in the Politics of the Budgetary Process, Boston 1964 is often cited in this respect. Hence Self's comment

". . . the actual budget is stitched up according to last minute bargains reached within and between the two chambers of Congress and the Scope for Congressional revision also causes far stronger and more overt bargaining within the executive branch than would otherwise occur."

Self op cit p.42.

fundamental decisions is highlighted, since if this occurs it is an implicit way of taking account of a shifting consensus. But most importantly at the present time is the growing demands which may be perceived, for moves to participatory rather than representative democracy⁴⁶, especially in the growing use by interest groups of the Public Enquiry system in Britain.

After the broad scan has been carried out the operational techniques of the detailed planning are less problematic. The way becomes clear for the use of rational techniques such as cost benefit analysis at this level. This is possible because both the value determination and information overload problems have been reduced. It is desirable because this mixed scanning approach centres primarily on the procedure it implies in the search for an appropriate project or policy rather than on the type of solution (incremental or radical) which might eventually be adopted.⁴⁷

When the second stage is reached the alternatives will of necessity be incrementally different from each other, irrespective of their relationship to what has gone before. The narrowing down process of the first level scan ensures this. Systematic comparison and evaluation of alternatives can

⁴⁶ Also identified by Naisbitt, op cit.

⁴⁷ To illustrate: My understanding of the Third London Airport problem is that an incremental approach was always a fruitful line of investigation. On the other hand, taking the case of the Sydney Opera House, which Peter Hall also classifies as a planning disaster (Hall 1981 op cit), if the overall aim of the N.S.W. government was to create something which would gain international recognition then an incremental approach is inconceivable.

take place using standard appraisal techniques precisely because similar projects are being compared. At this second stage the need to give operational significance to flexibility within the evaluation is of great importance. The fact that comprehensiveness is no longer attempted does not alleviate the forecasting problems which underlie even a constrained optimization approach. In addition, the climate of uncertainty within which decisions have to be taken extends also to the embodied values which are also part of any decision. There is no more reason to assume that these are fixed and immutable than that technical and economic estimates of future conditions can be assumed to embody perfect foresight. It is to this topic I wish to return in the next chapter.

Possibilities of Change

In Chapter III I examined the ways in which a potentially infinite number of possible investment projects were reduced to the very limited number subjected to formal appraisal. Although this 'filtering' or 'sifting' process appeared on the surface to arise for different reasons, at root it could be traced to a narrow specification of objectives which in turn enabled the candidates for selection to be reduced to a manageable number. Whilst it seemed eminently reasonable that some such filtering process should be carried out, it called into question both the rational decision model which in its purest form does not provide for an inability to attain comprehensiveness, and also the criteria by which pre-selection takes place. I suggested that the narrow specification of objectives which enabled this pre-selection process to occur could be traced back further to the value-conflicts are present in policy making. In the following Chapter, I looked at the wider context of decisionmaking and at models which had been proposed as alternatives to the rational one. My own conclusion was that a mixed scanning model provided a way out both from the dilemma of excessive information demands of the comprehensive model and as a means of incorporating the activities by which accepted values are determined in a pluralist state namely negotiation, bargaining, power play and other forms of mutual adjustment. However, in direct contrast to the mixed

scanning models of Etzioni¹ and Gershuny², I suggested that the broad scanning level should be interpreted as the value determination level and that if areas of choice are to be ruled out prior to detailed evaluation it should be on the basis of their lack of conformity with a prevailing consensus. In this way we can give some form to the idea that public sector projects should be appraised according to the 'national interest'. This approach in turn appears to strengthen the role of the rational appraisal techniques at the detailed scanning level since it neutralizes to a large degree that body of argument which has attacked the idea that cost benefit analysis and related methods are or ever could be regarded as value free policy making tools. Now we are no longer relying on the purist Robbins³ view of a rigid distinction between the means and ends of public policy to handle problems of value but on making explicit the very delicate balance of views that makes for consensus at any given time in a democratic society. It is this consensus which determines the feasible set of options from which a particular project or policy will be selected. Where consensus is strong the feasible area is likely to be clearly delineated and few obstacles will exist to the comparison of two or three alternative designs.⁴ Conversely

¹Etzioni (1967) op cit.

²Gershuny (1978) op cit.

³The famous definition of economics as the study of the allocation of scarce resources among competing but given ends.
L. Robbins, An Essay on the Nature and Significance of Economic Science, London, Macmillan 2nd ed 1935.

⁴Dam or reservoir construction projects are often of this kind.

where serious conflicts of values exist initially then some form of bargaining and accommodation is a necessary pre-condition to the detailing of options. Otherwise their selection is excessively partisan and such projects stand a large risk of lacking acceptance at the end of the process. If however existing conflict is brought into a consensus by the various means at the disposal of pluralist states then competing options are being measured against a common yardstick of values - precisely the assumption which it is important to be able to make before using a technique like cost benefit analysis. In this more restricted context allocative efficiency gains in importance. Thus a two level mixed scanning approach restores the place of rational analytical techniques in appraising different but comparable alternatives - a position they were originally designed to fulfill before the greater burden of resolving what were essentially value conflicts was placed upon them.⁵

In this way also the options subjected to detailed appraisal will almost certainly be only incrementally different from each other. But this is itself different in concept from the incrementalism of Lindblom since we have not foreclosed the possibility that the area of choice from which a new project or

⁵ It is, I believe, this confusion of the value-conflict level of decisions with the more factual inputs which causes much of the frustration apparent for example in public enquiries. For example in the current Sizewell enquiry the question of whether nuclear power is inherently undesirable should be viewed at a quite different level to debates on the relative merits of the PWR as against the Candu reactor, but under the present system the two get muddled together.

policy is to be selected might be radically different from the prevailing status quo. However with that proviso, when the area of choice has been defined, the shortlisted projects cannot help but be variations on a theme. Because the demands placed on them are more limited, rational techniques used at this level are more capable of fulfilling them successfully. They enable a systematic display of the available information and a framework within which assumed casual linkages are made explicit. The alternative is likely to be "a loose unstructured collection of information that mixes up conceptual levels, hides bias in its presentation, lacks any readily graspable perspective on the problem and so confuses decision makers if they do not ignore the information altogether."⁶

Nevertheless although a two level approach to the selection of projects has attempted to come to terms with the place of value judgements, the problem of seeking an optimum solution still remains, and it is to this question I now wish to turn.

The concept of maximization is rooted deep in economic theory. it is at the heart of neo-classical theory, forming in Lakatos's terminology part of the hard core of that particular scientific research programme⁷, inextricably linked with the assumption of rationality to which I referred earlier. As Hollis and Nell colourfully describe:⁸

⁶ Michael Carley (1980) op cit p.32.

⁷ See especially Latsis' development of I. Lakatos' work in Latsis (1972) and (1976) op cit.

⁸ Hollis and Nell (1975) op cit p.54.

"rational economic man . . . lurks in the assumptions leading to an enlightened existence between input and output, stimulus and response We do not know what he wants. But we do know that whatever it is, he will maximize ruthlessly to get it He is always at what he takes to be the optimum, believing (however falsely) that any marginal change would be for the worse."

Maximization is, they conclude, the primum mobile of neo-classical economics.⁹ Translated into investment appraisal techniques the assumption is that by following the procedure for displaying and analysing information, the optimal project will be selected. To assume that anyone who has to make a choice about anything will try to make the 'best' choice, is little more than a truism. The strength of the neo-classical idea of maximization or optimization, as it is expressed in appraisal techniques, lies in the static nature of the analysis. At a particular point, the planning stage, it is assumed that there is sufficient information to select the best project and that this project will continue to be superior to all other alternatives during its construction, implementation and lifetime. As I hope I demonstrated in Chapter II above, this requires such unrealistic assumptions about both the extent and the quality of information available to the analyst that except in the most restrictive conditions they are unlikely

⁹ Ibid. They acknowledge antecedent use of this phrase in Sherman Roy Krupp 'Equilibrium Theory in Economics and in Function Analysis on Types of Explanation' in D. Martindale (ed) Functionalism in the Social Sciences' American Academy of Political and Social Sciences 1965.

to be fulfilled. It was suggested that an alternative approach to project selection in these circumstances was to place a positive value on a project's flexibility - on its capability of performing well under a variety of circumstances rather than under the one configuration of events specified prior to selection. I have chosen to designate this concept short term flexibility - it indicates the degree of manoeuvre permitted to operators once they are committed to a specific choice, and is in contrast to the idea of the long run range of choice of Chapter III.¹⁰

As we saw in Chapter III neo-classical theory assumes perfect substitutability of factors to exist both prior to an investment decision and also in the production process chosen after the investment decision is implemented. Although even in choice of technique theory this might be regarded as an unrealistic characterization of the ex-ante position¹¹, our pre-investment problem was identified primarily in terms of deciding the appropriate area from which to select possible investment projects for more detailed examination. In other words the ex-ante situation was seen to present problems of inflexibility not

¹⁰ The short run is defined as that period of time in which some inputs in a production process are fixed. Since capital items (plant and equipment) are among the most difficult inputs to change quickly the short run is generally understood to mean time during which these items must be regarded as fixed.

¹¹ For example Rosenberg has pointed out that the amount of R & D work necessary to uncover a part of the production function which is distant from current practice may be no easier or cheaper than the effort required to shift the production function i.e. to produce a technological advance.
Nathan Rosenberg, Perspectives on Technology Cambridge, Cambridge University Press 1976, p.62-64.

in terms of too few options being theoretically available for selection but in a precipitous rush to the second stage - the evaluation of the three or four options from which final selection would be made. In this respect at least the ex-ante neo-classical production function acts as a focus of the difficulties of handling comprehensiveness. However in the ex-post situation this changes drastically. Once again complete substitutability between factors is assumed in the neo-classical model; flexibility of production possibilities at any point in time is therefore unrestrained by any previous choice of technique decision. With this modelling of the ex-ante and ex-post structure of technology, it becomes more apparent why an active search to incorporate flexibility into this type of economic decision has received scant attention in economic theory - orthodox theory assumes it to be there already. To the extent that the assumption of ex-post factor substitutability has received attention it has been mainly in the context of theoretical growth models. These have shifted away from the pure neo-classical model by assuming capital to be rigidly non-malleable ex-post.¹²

¹²See for example,

L. Johansen 'Substitution versus Fixed Proportion Coefficients in the Theory of Economic Growth: A Synthesis' Econometrica 27 (1959) 157-176.

M. C. Kemp and P. C. Hahn 'On a Class of Growth Models' Econometrica 34 (1966) 257-282.

E. S. Phelps 'Substitution, Fixed Proportions, Growth and Distribution' International Economic Review 4 (1963) 265-288.

Further work by Fuss¹³ and Fuss and McFadden¹⁴ have concentrated on empirical testing of this hypotheses in different contexts.¹⁵ They have therefore attempted to determine the pattern of flexibility which actually exists in a given area of production.¹⁶

The idea of flexibility in contrast to the neo-classical concept of optimality, was sketched out by George Stigler as early as 1939.¹⁷ He developed the ideas of adaptability, flexibility and alterability in the context of the theory of production and cost.

Stigler started from the position that neo-classical assumption of variable coefficients of production was not applicable to short run production problems. In the short run some inputs, most particularly capital equipment, must of necessity be fixed, but fixed not only in terms of value or total

¹³M. A. Fuss 'The Structure of Technology Over Time: A Model for Testing the "Putty-Clay Hypothesis' Econometrica 45 (1977a) 1797-1821.

M. A. Fuss 'The Demand for Energy in Canadian Manufacturing: An Example of the Estimation of Production Structures with Many Inputs Journal of Econometrics 5 (1977b) 89-116.

¹⁴M. A. Fuss and D. McFadden 'Flexibility versus Efficiency in Ex-Ante Plant Design' in Production Economics: A Dual Approach to Theory and Applications, Fuss and McFadden (ed) Amsterdam, North Holland 1979.

¹⁵See especially Fuss 1977a op cit.

¹⁶Ibid. p.1817. In testing the putty-clay model against data from fossil fuel electricity generation plants, Fuss concludes that the hypothesis is a useful approximation to the structure of technology for electricity generation. However further amendment to the clay-clay model is not warranted in his view.

¹⁷G. Stigler, 'Production and Distribution in the Short Run' Journal of Political Economy Vol. 47 No. 3 1939 p.305-327.

quantity, neo-classical theory would not quarrel with such an assumption, but also to a greater or lesser degree fixed in form.¹⁸ The extent of this rigidity might in the first instance be regarded as an accident of technology and would be characterized by a strongly 'U' shaped cost curve indicating that deviation from a very narrow output range would incur severe cost penalties. At the other extreme, a technology where the fixed factors of production could easily adapt to differing levels of the variable factor would be represented by shallow average cost curve, permitting a much wider choice of output levels at near minimum cost. Adaptability as defined by Stigler is, if present, an inherent characteristic of a production process. If the entrepreneur is dealing with an adaptable process then he has little need of the tactics detailed below since he can alter his output without incurring much increase in unit costs. However if he is faced with an unadaptable production process in the short run he may react in two ways.

(1) He may opt at the outset for flexibility by deliberately investing in plant which is tolerably efficient over a range of output but does not minimise the cost of producing the optimum. Such a process would be represented by a flat or shallow average cost curve over a reasonable range of output. This might be achieved by the divisibility of the fixed plant which would

¹⁸ Stigler characterized the neo-classical position as:

If 10 men are digging a ditch and an 11th man is employed, then for perfect adaptability the 10 existing shovels need to be metamorphosed into 11 smaller or less durable ones. Thus the total amount of the fixed input is unchanged but the form is not.

reduce the variable cost of sub-optimum output or by transforming some fixed costs into variable ones e.g. in the earlier example the shovels are no longer bought at the outset but hired as the need arises.

(2) He may choose a plant which, although designed for a restricted range of output, has the characteristic of alterability. At the time he makes the investment he selects the plant which approximates closest to the existing optimum but which can be changed in response to a decision by the entrepreneur. Later during the lifetime of the plant he may choose to alter it to a different level of output by incurring further expense. He is then paying to shift to a different cost curve. It seems reasonable to assume that the original cost curve of such a process would be steeper than the flexible plant but with a lower minimum cost point.

It therefore seems that according to Stigler flexible plant involves investment at the outset in order to alter output levels reasonably easily at a later stage whereas alterable plant enables additional investment decisions to be made in response to changed circumstances.

From our point of view this distinction between flexibility and alterability need not be absolute since both involve the ability of the entrepreneur to change the production process according to circumstances which are not fully known at the time the initial investment is made. However the tension between the costs and benefits of flexibility are highlighted. Stigler's flexible plant undoubtedly responds most quickly and cheaply

to change but at high cost since all the expense of obtaining such flexibility is sunk in the process at the outset. The alterable plant incurs only a portion of the extra cost initially but would incur time costs and further investment costs should change prove necessary.

Nevertheless both approaches incur costs above the theoretical minimum which perhaps goes a long way to explaining why current production theory still ignores the idea of such a trade off.^{19, 20}

Forty two years after Stigler, Bergman and Maler follow approximately the same reasoning in an article in the Scandinavian Journal of Economics.²¹ They start with the notion of a trade-off between static efficiency and ex-post flexibility of input proportions. The problem is posed in relation to Swedish energy policy which is aimed at reducing Sweden's consumption of oil by the introduction of oil-efficient

¹⁹To deliberately incur costs above the theoretical minimum is incompatible with the neo-classical assumption that producers maximize profits and in turn undermines general equilibrium theory which depends on such maximizing behaviour.

²⁰Empirical work on cost curves indicates that average and marginal costs appear to be near horizontal in many processes in the short run.

(A. A. Walters 'Production and Cost Functions' Econometrica 1963) which might suggest that commercial producers at least do opt for production processes which are not centred on a narrow output range. It is interesting to speculate whether in this respect public sector decisionmakers are less able to step outside the theoretically approved model.

²¹L. Bergman and Karl-Goran Maler, 'The Efficiency-Flexibility Trade-Off and the Cost of Unexpected Oil Price Increases' Scandinavian Journal of Economics Vol. 83 No. 2 1981 253-268.

technologies. However the authors suggest that while plants specially designed for a single input price constellation are more efficient if oil prices attain their expected value, they might also be quite rigid in terms of oil input co-efficients. If oil prices reach unexpectedly high values, a technology with relatively high ex-post flexibility would make it possible to reduce the use of oil and thus mitigate the real income loss due to the higher oil prices.²² Bergman and Maler attempt to obtain an estimate of the significance of such an embodied flexibility using a simulation model of the general equilibrium type and postulating an unexpected oil price increase. A major failing of this part of the study is its inability to make more than arbitrary estimates of the potential savings implied by the relatively flexible technologies. For example when the oil price was increased to a level 80% higher than the expected level, the use of flexible technologies was estimated to reduce real income loss by about 8%. However without some estimate of the additional costs incurred this takes us no further than Stigler's earlier theorizing. Making a somewhat heroic assumption that a technology exhibiting a Cobb Douglas type production function²³ would be 1% less efficient in its use of capital, labour fuels and electricity and hence would imply a real income level 1.5% lower at the static optimum, the simulation results then indicate that if oil prices are highly unlikely to deviate from expected levels by more than

²² Although Bergman and Maler do not make it explicit a corresponding argument would hold true for low oil prices.

²³ i.e. with an elasticity of substitution between factors of unity.

80%, it will not pay to choose the more flexible option. If however deviations of 160% or more are likely, the reverse is true. We cannot therefore get beyond the rather two handed conclusion that increased flexibility may yield substantial benefits or it may not depending on the circumstances!

Once again it is to the literature of water resource development and in particular to the work of Hashimoto, Fiering, Loucks, Stedinger and Matalas,²⁴ that we must turn for further development of this concept. Water resource projects are characterized by being large and expensive with long lead times between planning and implementation. Once investment is in place it is required to perform for anything up to fifty years, yet the level of service which such facilities will need to provide so far into the future is very uncertain.

Using concepts of resilience and brittleness, Fiering points out that the need for system resilience has been recognized in the

²⁴For example:

- T. Hashimoto, 'Robustness criterion for planning water supply/demand systems. Angew Systemanal 1(3) 1980.
 - T. Hashimoto, D. P. Loucks and J. R. Stedinger, 'Robustness of Water Resources Systems, Water Resources Research Vol. 18 No. 1 February 1982 21-26.
 - M. B. Fiering(a), 'A Screening Model to Quantify Resilience Water Resources Research, Vol. 18 No. 1 February 1982 27-32.
 - M. B. Fiering (b), 'Alternative Indices of Resilience Water Resources Research, Vol. 18 No. 1 February 1982 33-39.
- N.C. Matalas and M. B. Fiering 'Water Reserve Systems Planning', in Climate, Climate Change and Water Supply, National Academy of Sciences, Washington D.C. 1977.

civil engineering literature for some time although not expressed in this terminology.²⁵ and concurrent advances in statistics and biology have introduced similar concepts. Fiering re-states the, by now, familiar problem:

"Classical optimization procedures which, (if successful) would identify the cheapest scheme to meet some performance criterion and constraints might overlook a valuable characteristic of system performance and select a brittle solution which could not well tolerate system perturbations. The desirable characteristics which we propose to introduce into system design is called resilience."²⁶

Fiering pursues the problem further in its technical perspective, suggesting that redundancy and buffering capacity enables large²⁷ systems to adapt to changing conditions without seriously compromising their performance characteristics. Alternatively the resilience of a single design may be measured against changes in target operation. Fiering speaks approvingly of engineers who "have historically done reasonably well without sophisticated systems theory precisely because they have imparted redundancy (and made their systems larger hence more resilient) to their designs."²⁸ But this seems a procedure akin to another observed tendency of engineers to make very conservative estimates

²⁵ Fiering 1982a p.27.

²⁶ Ibid. p.28.

²⁷ Large in terms of number of design options.

²⁸ Ibid p.31.

of development costs to offset a perceived lack of understanding of technical projects on the part of financial and marketing personnel.²⁹ Whilst it may say much for engineers' appreciation of real world uncertainty it gives no guidance for formal decisions - at what point does the deliberate provision of buffering capacity become too expensive in terms of extra cost involved. While Fiering suggests tentatively that there is no direct relationship between cost and resilience his work in this area seems extremely sketchy. Fiering also develops alternative indices of resilience, for example in terms of performance failure and the time needed to bring the system back under control.³⁰

However what is characteristic of all his approaches is that he is exploring the nature of flexibility and its manifestations rather than the trade-off between flexibility and cost. Thus he states:

". . . knowing something about the distribution of first passage times to failure from any state allows the decisionmaker explicitly to incorporate his level of risk aversion into the choice among available policies or actions, because he can elect to invest money and move to another state."³¹ and later,

²⁹ H. Thomas 'Some Evidence On the Accuracy of Forecasts in R & D Projects. R & D Management Vol. 2 No. 2 February 1971 55-69.

³⁰ cf. David Collingridge's work on flexibility and corrigibility in

D. Collingridge, The Fallibilist Theory of Values and Its Application to Decision Making, PhD Thesis University of Aston, 1979.

also Collingridge (1980) op cit p.37-40.

³¹ Fiering 1982(b) op cit p.37.

"The point of this analysis is to develop some insights into the (resilient) behaviour of the system in the vicinity of its global or local cost optima. Can some systems be said a priori to possess a wide distribution of potential decisions at or close to the optimum? Or is the optimum such that no (or only a few) substitutions in the solution will keep response close to its optimum? Answers to these important questions define the merit of systematically worrying about how to develop a plan."³²

It is obviously important in any project formulation that knowledge of the technical feasibility of building-in adequate performance capability under a range of possible operating conditions is available. Nevertheless we are still no nearer finding a method of coming to terms with the cost benefit trade-off.

Hashimoto et al revert to the term robustness for their explanation of the problem but point out its correspondance to Stigler's concept of economic flexibility.³³ They also recognize that Fiering's work concentrating as it does on the design system (what I have referred to as the exploration of technical flexibility) does not encompass the full extent of the problem. Their robustness measure is intended to describe the overall economic performance of projects and thus to complement more tradition benefit-cost analysis.³⁴ It is recognized that for example in a water resource project, if future demand forecasts

³² Fiering 1982(c) op cit p.41.

³³ Hashimoto et al op cit p.21.

³⁴ Ibid.

are incorrect and another set of demand conditions actually occurs the project design chosen might be inferior to another design which was available. The difference between the actual project costs and the theoretical minimum cost is the opportunity cost of not having perfect information. (In other words it is the cost of ignorance). However some projects might have the ability to adjust their operating policies to actual conditions as they occur in the future. In this case the difference between minimum and actual cost is the price of flexibility. But will these modifications be cost effective? Once again we have the familiar statement of the tension between flexibility and cost. But this time the problem is pursued a little further. For any demand (q) waste water flow, municipal water demand or whatever, the opportunity cost of selecting design D is the difference between the actual cost $C(q/D)$ and the minimum cost $L(q)$ of satisfying q. When evaluating a particular proposal D one might then ask, for what values of q is the opportunity cost no greater than a fraction β of the minimum cost. If this set of q values includes all conceivable ones then the cost of D will always be within 100β % of the minimum cost design no matter what level of actual demand occurs. This in turn enables an expression for flexibility or robustness relating this chosen level of protection to minimum cost to be derived

$$C(q/D) \leq (1+\beta)L(q)$$

or

$$\frac{C(q/D)-L(q)}{L(q)} \equiv R(q/D) \leq \beta$$

where $R(q/D)$ measures the relative magnitude of the opportunity

cost of design D. However the authors acknowledge that as is the likelihood of finding a design to satisfy all q is reduced. However they eschew the conventional approach of attempting to assign probabilities to future values of q and then calculating the expected opportunity cost, on the grounds that it provides little insight into how confident one can be that a particular design D will be reasonably close to the least cost design. Instead they define design robustness R as the likelihood or probability that the above equations will be satisfied

$$R_{\beta} = \text{Prob} [C(q/D) (1+\beta)L(q)]^{35}$$

In essence this approach is very similar to Stigler's, but it adds a little flesh to the bare bones of Stigler's outline. It shows how the additional costs incurred by more flexible projects may be systematically incorporated into a relative assessment of which options perform tolerably well over a range of operating conditions.

The approach still involves a deliberate choice of the magnitude of β . Percentage estimates are suggested - for example $\beta = 20\%$ and this also gives a hint as to how the choice might be made since it is suggested that a design within $\beta = 20\%$ of the cost effective alternative might be accepted. This might be regarded as justifiable because, for example, cost estimates have that level of imprecision, or because the public and other interested parties will be relatively unconcerned with such modest inefficiencies. Whilst doubting that the latter would be true if they were presented as inefficiencies - as we shall see in the following case study public sector institutions are extremely reluctant to admit fallibility - nevertheless there is a strong case for presenting it as a means of preserving flexibility and of selecting what will be the better project in the longer term.

CHOICE OF ELECTRICITY GENERATING PLANT - A CASE STUDY

One of the severest shocks to economic systems in recent years has arisen from the drastic shift in relative fuel prices stemming from the 1973 oil embargo and continuing OPEC activity in the ensuing period. Whilst the reverberations from these events have been felt in all sectors of the economy, nowhere has the jolt been more severe than in the electricity generating industry. As I noted earlier the inherent inflexibility of a decision to invest in a particular type of power station technology is extremely high. There is a long gestation period between the investment decision and the commissioning of plant, and, once built, plant is expected to have a lifetime of around forty years or more.

The Electricity Generating Industry has been in the public sector of the economy since its nationalization in 1947. Electricity generation in England and Wales is the responsibility of the Central Electricity Generating Board (CEGB) and within it the design and construction of power stations is the responsibility of the Generation, Development and Construction Division.¹ However whilst the Board in common with other nationalised industries has considerable autonomy in day to day operations, it must obtain the approval of the Secretary of State for Energy for its capital

¹Lynn F. Pearson, The Organization of the Energy Industry, London Macmillan 1981 p.85.

investment programme for each year and his specific approval before placing an order for a new power station.² The decision to invest in new generating capacity is therefore clearly identified as an important public sector investment decision and it is interesting to ask how the CEGB approaches the appraisal of this type of project and to assess the outcome of its procedure in a particular case. In relation to its capital investment policy the CEGB has always emphasized the conditions of operation which were laid down at the time the industry was nationalized - namely that the Board has a duty to operate the electricity generation system in a secure and efficient manner, so that demand is met at minimum cost,³ although certain additional responsibilities have been suggested over the post war period.⁴ Further, there has never been any suggestion until very recently that its decisions are founded on anything other than a standard optimization exercise. In other words the responsibility of taking a decision in 'the national interest' has been regarded as being adequately met by a procedure which attempts to select the minimum cost option available at a particular time. Minimum cost is itself deduced from a single calculation of discounted

²The Monopolies and Mergers Commission (MMC) Report 1981 op cit p.12.

³The statutory duties of the CEGB are laid down in the Electricity Acts of 1947 and 1957.

⁴The CEGB appears to be shifting its ground in this respect in its evidence of the Sizewell 'B' Public Enquiry. See for example J. W. Baker CEGB Policy, Proof of Evidence No. 1 London 1982 p.14.

The Board is instructed to have regard to the desirability of preserving natural beauty, conserving flora, fauna and geological or physiographical features of special interest, and of protecting buildings and other objects of architectural or historic interest. Electricity Act 1957, Section 37.

cost⁵ - referred to by the Board as net effective cost (NEC). As we saw in Chapter II above the main provision for uncertainty in the variables included in such an exercise, is to test the overall result for sensitivity to changes in the basic variables. More specifically the less the final calculation is affected by changes in these variables the more 'robust' the solution is said to be. The degree to which such calculations are helpful appears to be invariably related to the degree of complexity of the assessment. Whilst the advent of computing facilities has made it feasible to incorporate within an analysis variations on the central estimates of many variables, the degree to which additional information of this kind may illuminate the basic uncertainty surrounding the investment decision is dubious.⁶ More significantly, sensitivity analysis does not transform a static into a dynamic analysis. It measures the ability of a particular project to withstand the effects of what may prove to be incorrect estimates rather than

⁵The individual cash flows considered relevant for this exercise are:

- (i) Capital cost and associated expenditure
- (ii) Decommissioning, dismantling and disposal costs
- (iii) Fuel costs
- (iv) Operating costs other than fuel costs
- (v) Impact on system costs

M.M.C. Report 1981 op cit p.67-69.

⁶When one project is more sensitive to changes in a key variable than another project there may be grounds for choosing the more robust in preference to the minimum cost although the degree to which it is desirable to make such a trade off remains to be determined. However when sensitivity to several key variables is calculated the matter becomes more complex since, to calculate combined sensitivities it must either be assumed that all variations are weighted equally or weights must be allocated.

its ability to adapt positively to new circumstances which are not envisaged at the time of decision.⁷ In this sense measuring robustness is quite different from measuring flexibility. A further point needs to be made with reference to the CEEB's use of this technique. Normally robustness is measured against a central estimate for a variable so that although the option preferred would be insensitive to variation at least any variation which did occur would be as likely to give a more favourable outcome as a less favourable one. This is the case for the Board's estimates of economic activity, demand future fuel prices etc. However for what are termed technical parameters or plant related variables this procedure does not apply. For variables such as capital costs or construction times the basic estimate is also the 'best' estimate rather than the mean, which in turn will introduce a favourable bias into the 'basic' NEC's.⁸

This then is the general procedure operated by the CEEB in the appraisal of its investment projects. It is, however, a procedure which has led to the present situation in which the CEEB has five large modern oil-fired power stations⁹ - a total of 10 GW

⁷ Evans makes a similar point in his conceptual analysis when he notes that robustness essentially bears the connotation of endurance rather than responsiveness. J. S. Evans (1982) op cit. However the usage is somewhat ambivalent in the general literature. For example Hashimoto et al (1981) op cit use the term almost interchangeably with flexibility.

⁸ The Board justified this procedure to the M.M.C. on the basis that it would be unwise to appear not to be planning for success! M.M.C. op cit p.92.

⁹ Fawley, Pembroke Ince 'B', Grain and Littlebrook 'D', Sizewell 'B' Power Station Public Enquiry, CEEB Proof of Evidence 4. F. P. Jenkin, London 1982 p.33.

capacity - in service or under construction. These stations were all designed for base load operation - i.e. on a three shift system very high in the merit order.¹⁰ The consequent rise in oil prices since their inception has meant that they have not fulfilled this base load function - hence the cost of electricity generated in these stations has been high for two reasons - the high fuel cost and the high capital cost per KW entailed by operating at levels much lower than the original design rating.

In retrospect the decisions to build these stations were poor ones (some would term them disasters). In the light of the discussion earlier in this chapter could such an outcome have been avoided or at least mitigated?

The investment analysis carried out on these stations was grounded in the prevailing economic conditions of the 1960's and early 1970's. It is interesting to note that in the 1967 White Paper on Fuel Policy the major worry expressed was the too rapid transition from coal to oil as a major energy source and a concern with the consequent difficulties of the coal industry.¹¹

Evaluation of non nuclear options at this time¹² under the

¹⁰ Operating regimes are divided into four groups: base load - three shift (nuclear and large coal); 2 shift (medium coal/large oil); 1 shift (small coal and other oil); peak lopping (gas turbines).

¹¹ Fuel Policy 1967 (Cmd 3438) Concern to provide a breathing space for a contracting coal industry was one justification for the tax imposed on oil.

¹² This matter is complicated since on contemporary assessments the AGR was not competitive with oil stations at 1970 prices whereas the LWR was considered by general world opinion to be so. There was however total commitment to the British AGR by the government at this time.

See Duncan Burn, Nuclear Power and The Energy Crisis, London, Macmillan 1978, p.282-283.

This point is also made in Roger Williams, The Nuclear Decisions, London, Croom Helm 1981.

assumption that the lifetime cash flows were a reliable basis for decision, indicated oil as the obvious fuel for electricity generation.

Two things may be said about this approach:

- (1) There is little evidence that even within the limits of conventional optimization exercises, serious attempts to assess the impact of differing relative fuel prices on discounted cash flows were made.¹³
- (2) Failing specific sensitivity estimates there appears little evidence of more general awareness of the effects of changing economic conditions on the decisions, or consideration of ways of mediating the inherent inflexibility of the decision to invest in a large oil fired power station.

Whilst it would be unfair to use the wisdom of hindsight as a stick with which to beat the CEGB it may prove illuminating in the context of this present study to ask what alternative courses of action were available to the CEGB at the time the large oil stations were initiated. For simplicity we may identify 3 main categories of options that might have been adopted in the light of the contemporary uncertainty which must necessarily have surrounded any generating decision:

¹³In the M.M.C. report it is noted that even as late as 1976 the CEGB Development Review showed the estimated basic NEC's of oil fired stations to be less than those of new coal-fired plant. The sensitivity analysis in that Review (and earlier reviews) made no provision for a change in the relative prices of marginal coal and oil and the robustness of the supposed advantage of oil fired stations was not explored.
M.M.C. Report (1981) p.75.

- (1) Build multi-fuel stations to enable a relatively rapid response to significant changes in fuel costs.
- (2) Adopt a strategy to proceed at the slowest possible pace commensurate with the basic objective of providing a secure supply i.e. build small plant of the preferred generating technique.
- (3) Build plant as suggested by a static optimization procedure and bear any costs of adjustment if and when they occur.

The first two options would appear to require a broader interpretation of the Board's responsibility to provide electricity at minimum cost. In other words the increased flexibility of operation would be interpreted as a method of minimizing lifetime costs in an uncertain environment. But to set against this there would undoubtedly be additional initial costs to purchase this flexibility. To examine these alternatives in more detail:

- (1) Multiple Fuel Use Plant

The decision to build a station which is able to burn more than one fuel is for all practical purposes reduced to dual-firing of plant, and in the case of the CEGB, to oil/coal fired plant.¹⁴ The CEGB did in fact invest in one 2,000 MW dual fired station at Kingsnorth, commenced 1962 and commissioned at the end of the decade.

¹⁴ Commercially, gas/oil was the preferred combination when gas was offered to industry at favourable rates but under a 90 day interruptable tariff agreement.

The station¹⁵ was designed for dual firing because although at the time of planning and project initiation coal was generally considered to be the preferred fuel, the station site on the Thames Estuary meant that there was a cost penalty incurred in the transport of coal (as compared to an East Midlands station) and conversely the possibility of favourably priced oil supplies from a refinery only about four miles away. In the event, the station ran wholly on oil for the first five years of its life (up to 1974/75) and then on a constantly declining proportion of oil up to the present (90% in 1975/76 to 14% in 1982/83). There will always be a small proportion of oil used for technical purposes such as lighting up and flame stabilisation.

There is little information available on what, if any economic analyses were carried out for Kingsnorth at that time or what proportion of the cost of the station resulted from the decision to provide dual firing. It is suggested however that Kingsnorth might have cost some 5-10% more than a typical coal-fired station built around the same time.¹⁶

Given the pattern of fuel use, it has obviously proved valuable to have dual firing at Kingsnorth although no post investment study has been carried out¹⁷ to determine the extent to

¹⁵ Personal communication from Mr. E. M. Eunson, System Development Engineer, CEGB London, June 1973.

¹⁶ Ibid. Mr. Eunson is careful to point out that each site is unique and that he cannot in this general estimate make any provision for cost differences which might be due to the Kingsnorth site itself.

¹⁷ Ibid.

which the savings in fuel costs have offset the initial additional capital cost. Without access to details of the operating pattern of the Kingsnorth station since its commissioning, it would not be helpful to try to determine the actual savings which have been achieved through dual firing.

However since exact information has proved impossible to obtain the following may give some idea of the orders of magnitude involved.

In the early to mid-sixties the capital cost of the most efficient coal fired station was £43 per Kw.¹⁸ Translated for a 2000 MW station which is the Kingsnorth capacity this works out at a cost of £85 million in 1965 figures. Thus on the evidence that Kingsnorth incurred a cost penalty of 5%-10% in the provision of a dual firing capability this would have been in the region of £4m-£8.5m. In order to ascertain whether this had in retrospect proved a worthwhile investment it would be necessary to assemble sufficient information to construct alternative cash flows for single fuel stations and for the dual fired station and to see if the discounted difference in operating costs have already offset the additional capital cost or would be likely to do so over the project's life. It proved impossible to obtain sufficient information to carry out such a detailed study. However interpreting Openshaw Taylor and Boal's¹⁹ work in relation

¹⁸Capital cost of Cottam power station given in CEGB. Appraisal of Dungeness 'B' Power Station, 1965, op cit.

¹⁹E. Openshaw Taylor and G. A. Boal, Power Station Economics, London, Edward Arnold 1969, p.51-73.

to stations of Kingsnorth's vintage, annual fuel use for a 2,000 MW station is 5 million tonnes of coal in the case of a coal fired station or 2 million tonnes of oil in the case of an oil fired one.

Using this information in conjunction with Department of Energy Statistics on average prices of fuels used by the electricity generating industry yields the following pattern:

Extent and pattern of fuel price advantage for a hypothetical 2000 MW Station 1971-1981

Year	Oil Advantage £m	Coal Advantage £m
1971	5.1	
1972	8.5	
1973	11.00	
1974		9.6
1975		1.7
1976	1.5	
1977		4.7
1978	10.5	
1979	12.9	
1980		12.3
1981		27.7

Whilst it would be inappropriate to place too much reliance

on the specific figures of such a calculation, it is nevertheless interesting to note that the discounted savings due to fuel flexibility in any single year would go a large way towards offsetting the £4-£8 million additional capital cost estimated above.²⁰

(2) Multiple Plant

In the immediate post war expansion of generating capacity a decision was taken to standardise on two types of plant 30 MW and 60 MW. These standards lasted hardly any time at all. For a decade and a half the size of sets increased first to 120 MW (the main unit size introduced 1955-60) and then to 275 MW sets which first entered service in 1962. By the mid-sixties 500 MW and 600 MW sets were being introduced and there have been developments since to produce sets of around twice this size.

The main economic argument in favour of this development is that there are substantial economies of scale to be achieved, so that unit costs of production are brought down.²¹ I shall consider below whether empirical evidence supports this view. However even if it could be shown unambivalently that direct unit costs decline as set size increases, strong arguments have been advanced by Collingridge²² to show that inflexibilities are

²⁰ For example the discounted values of potential savings in years 1971, 1974, 1978 and 1981 are: £2.9m; £3.7m; £2.75m and £6.02m respectively. (Discounted to 1965)

²¹ Strong support of this idea was advanced by Sir Francis Tombs in a 1978 lecture "Economies of Scale in Electricity Generation and Transmission since 1945" Proceedings of the Institute of Mechanical Engineers 192,39 1978.

²² D. Collingridge (1980) op cit 116-122.

increased by this development.

Of particular importance is the slow and sparse feedback of information from a few large stations. In order for change to be instituted the need for change must be recognized. Learning from operating experience is in general significantly less when a few large units are built both because the opportunities to learn are fewer and also the length of time needed to construct a station may mean parallel rather than sequential construction takes place. Learning of two types is important in identifying the need for change:

- (i) Learning about the project itself - technical aspects such as the achievement of planned load factors, or availabilities, accuracy of cost estimates, construction times and so on.
- (ii) Learning about the environment within which the project is designed to operate - divergencies in capacity need from earlier forecasts, changes in input prices or availability in the first case large units provide proportionately less information per time period than small units and in the second they are less able to respond quickly to new external information.

If we relate this to the large oil-fired stations commenced before the 1973 rise in oil prices we can see that the CEGB would have been able to respond more easily to the unforeseen change in fuel prices had it been constructing smaller units. Firstly it would have been able to reconsider its choice of fuel at an earlier stage and secondly it would have been able to consider a

reduction in its total planned capacity in the light of the downturn in economic activity engendered by the rise in oil prices.

At worst this option might be seen as illustrating the tension between on the one hand minimizing unit costs for specific size and type of output and on the other purchasing flexibility at some initial cost. There is, however, growing evidence that this trade off is less stark than the CEGB would have us believe.

In a recently completed study²³ Nuttall, using CEGB data, shows that there is a steady decline in total power station specific costs from 1945 until the early 1960s but these then started to rise again and jumped significantly once set size moved beyond 500 MW. Abdulkarim and Lucas²⁴ indicate an even lower size of fossil fuel plant to be optimum, at between 200 MW-300 MW. They use simulated systems of between 100 MW and 400 MW unit size and varying lead times. Kelly²⁵, evaluating operating results from 500 power stations around the world concludes that unit size should remain in the 300-350 MW range even for the largest utilities. Evidence is also advanced by Fisher²⁶ and Van Helden

²³ E. T. Nuttall, Cost Trends in U.K. Power Station Construction CNAA dissertation, Wolverhampton Polytechnic 1983.

²⁴ A. Abdulkarim and N. Lucas, "Economies of Scale in Electricity Generation in the U.K." Energy Research 1 223-31.

²⁵ A. G. Kelly, "Correct Unit Sizes Yield Planned Flexibility" Institute of Mechanical Engineers Conference, Harrogate 1979.

²⁶ Dr. John C. Fisher, 'Economies of Scale in Electric Power Generation' Paper presented to IIASA October 10 1978.

and Muysken²⁷ that set size has been developed way beyond the point at which scale economies cease. Most of these authors point out that a related finding of their work is that flexibility will be increased if smaller units are favoured.

The overall conclusion to be drawn from this research appears to be that while there may be a trade off involved in the flexibility offered by many small units, against the operating efficiency of fewer large units, a proportion at least of the cost penalty may be more apparent than real. The current practice is not necessarily the 'best practice' even in the very narrow economic sense.²⁸

(3) Static optimization

As argued earlier, the standard investment appraisal procedure of the CEGB relies on static optimization techniques. The use of sensitivity analysis in this context suggests that there is a theoretical possibility of trading off robustness against minimum cost, but little practical evidence that this has ever been a significant consideration in the CEGB's deliberations. The decisions to build the large oil-fired stations were a product of this type of decisionmaking.

The argument in favour of this process is that potentially unnecessary costs are avoided until in fact they are actually

²⁷G. J. Van Helden and J. Muysken, 'Economies of Scale and Technological Change in Electricity Generation in the Netherlands' De Economist 129, 4 1981, 476-503.

²⁸The CEGB shows little awareness of this literature. They state quite categorically:

The CEGB has examined the option of building conventional coal fired stations using 350 MW, 120 MW or 60 MW units rather than the 6600 MW units normally used in modern stations and, in particular, the possibility of re-using existing sites for this purpose. However, as unit size decreases, capital cost goes up and thermal efficiency goes down. These disadvantages are greater than possible advantages from shorter unit construction time, higher availability or those which might arise from the re-use of existing sites.

F. P. Jenkin, 1982 op cit p.26.

In particular Van Helden and Muysken using data from the Netherlands conclude that "there is no significant difference in full efficiency for turbines between 200 and 650 MW."
Van Helden and Muysken 1981 op cit p.493.

perceived as necessary.²⁹

The corollary of this is that if circumstances do change significantly some response is called for. At worst the investment may be so specific that no change can be accommodated and it must be scrapped. At best modifications may be possible to permit continued operation with little loss of operating efficiency - what Stigler characterized as natural or inherent adaptability.

We need not labour the point again that such adaptability is not a natural characteristic of investment projects like power plant. Post investment change is both costly and technically complex in these cases. Yet when flexibility has not entered into the planning process at the pre-investment stage then costly change or almost total loss is the stark choice facing decisionmakers. This is the choice now facing CEGB managers who are currently considering the desirability of converting the large oil stations to burn coal. Such a conversion requires the modification of the boiler and its auxiliary equipment and the provision of new equipment or facilities for coal transportation, storage, handling, processing and the removal and disposal of ash. The lowest cost conversion would be achieved by using the existing boiler but the converted plant would then have a lower output. In

²⁹To invest in flexibility is somewhat akin to purchasing insurance. In insurance calculations where risks are small a sensible procedure may be to bear the cost of an unfavourable outcome. However this is only relevant to situations where actuarial calculations may be made. For example it may be inappropriate in a flood control scheme to purchase protection against anything bigger than a 75 year flood. Investment in a power station with its attendant non-actuarial uncertainty could not be handled in this way.

order to provide full rating a new (larger) boiler would have to be constructed adjacent to the existing boiler.³⁰ The CEGB's present position is that only 1 GW (slightly less than 10%) of large oil fired plant shows clear economic benefit (future savings in system operating cost which more than offset the capital cost of conversion) from conversion. On this assessment therefore, 90% of the CEGB's investment in large base load oil stations has proved an expensive mistake: furthermore a mistake not susceptible to remedial action even when it has become apparent. This experience hardly gives credibility to the view that the provision of flexibility in projects is an unnecessary expense or that modifications can be grafted on as and when required.

In this section it has not been possible to do more than indicate some of the most important points to be considered if flexibility is accepted as a desirable characteristic in investment projects. I have attempted to give some form to this discussion by looking at a particular public sector body, the CEGB, and a particular past investment decision - the choice of oil as the preferred fuel for base load power generation in the late 1960's early 70's. from this starting position it has been

³⁰F. P. Jenkin, 1982 op cit p.32-33.

possible to sketch out alternative options which would have given the Board a greater ability to respond to the very significant changes in operating conditions triggered by the 1973 oil crisis and ensuing events in the Middle East since that time. However it has not been possible to cost these alternatives to judge whether any additional costs incurred would have been vindicated by experience.³¹ Fortunately the argument for flexibility does not rely on extrapolation from past to future except in the very general lesson to be learned that the future has never turned out to be precisely as we have calculated it. Thus any additional costs of flexibility can never in this sense be justified prior to the investment. Only the more general argument may be advanced that it is more sensible to assume that the future environment is uncertain rather than that it is fully known. Above all it requires an acceptance of this general principle on the part of the decisionmaker. As we have already seen in this chapter and will continue to see in the next, there appears to be a strong resistance in the public sector to acknowledging fallibility or the possibility of being wrong.³² Once over this hurdle it still remains a problem how this consideration can be given expression

³¹ From my communications with the CEGB I am forced to the conclusion that it is either remarkably casual in collecting and analysing data on its operating experience or is unprepared to release such information

³² This is in the initial planning stages. For example the CEGB's comment to the Monopolies and Mergers Commission that it was reluctant to extend its estimates of construction cost and time even though experience suggested it should, because it was reluctant to be seen "not to be planning for success."

This ex-ante position is in direct contrast to Henderson's experience referred to in Chapter II above where he comments that, post-investment, having been right or wrong hardly seems to matter at all.

within the normal appraisal process and here it seems unlikely that we could progress beyond an ad hoc cost boundary such as that suggested in the engineering literature.

In this final chapter I wish to look at the particular experience of the British Public Sector over the post war period particularly at the changing approaches to public investment decisions revealed in Government documents - White Papers, Treasury guidelines, Select Committee reports and advice to specific industries.

I commented at the beginning of this study that there was and continues to be an uneasy and ill-defined relationship between the development of economic theory and its translation into policy implications and techniques for economic management.

Government when issuing directives or guidelines for investment procedures in the public sector cannot avoid this issue. In this role as intermediary it occupies an uncomfortable position at the interface between theory and practice. It does not have freedom to determine the assumptions under which its model will apply. Instead it must take the external environment as it exists, or as it is within its powers to change, and attempt to fashion economic approaches which can be applied to what is a sizeable part of the total economy. But government is not a semi-passive intermediary digesting, simplifying and transmitting information. Whilst it might have conceivably been able to fulfill this function under an assumption of a single objective - efficient resource allocation, and a single means to this end - the correction of any distortions in the market, no government has, in practice, ever regarded its role in such a light. Also, I have argued at some length earlier that a simple concentration on efficient resource allocation is no longer regarded as a desirable characterisation of the demand placed on public sector activity. Nor does the conceptually neat

model of public investment appraisal with a single decisionmaker valuing alternatives according to the national interest, measure up to reality. I have argued that national interest in a pluralist society is not synonymous with the political programme of the party which gains office but needs a much wider acceptance of the need for partisan mutual adjustment until a working consensus is achieved on what values actually make up the national interest. Furthermore, techniques based on static optimisation procedures which assume that our knowledge of present and future events, if not perfect, nevertheless approximates to that state by the use of probability estimates, do little to assist decision making in a world of rapid unforeseen and unforeseeable change.

If these problems remain unsolved then whatever guidelines for investment appraisal are issued or methods of selection implemented, the final results will be less than satisfactory. I would not wish to imply that the answers are self-evident or easily to be found. Yet I do believe that an important first step is to acknowledge and accurately define these issues. It would therefore be a growing awareness of such problems and the first attempts at resolution that it would be reassuring to see emerging in the government investment appraisal literature.

Inevitably most of the formal advice of government is directed towards the nationalised industries. The public sector as it appears today was largely fashioned during the two post war Labour governments between 1945-51 when it grew enormously in size and composition. The major thrust to public ownership was contained in a programme of nationalisation initiated at this time which covered virtually the whole industrial infrastructure. This drive to shift the balance of ownership in the economy in favour of the public sector was, in large part, a reflection of the belief embodied in the

Labour Party constitution that the achievement of a more equitable distribution of income depended on common ownership. This central argument was also supported by views held across a wider political spectrum that natural monopolies required considerable central control to ensure acceptable levels of service, prices, and safety, and evidence from various investigatory committees that increased government ownership and control could be beneficial in a number of ways. It could be used to: a) promote efficiency, or b) ensure due concern for employees and local communities in any necessary rationalisation, or c) achieve the survival and development of strategically important industries where private risk capital was not forthcoming¹.

However, the form that public ownership took, that is the vesting of assets in a public corporation which is not an agency of the Crown, and to which various statutory powers are attached, owes much to Herbert Morrison. This approach to Nationalisation is not the only means of taking enterprises into public ownership. Earlier in the twentieth century different forms of organisation for public enterprise had been canvassed. For example, prior to the First World War it had been assumed that industries would become government departments and there were also competing claims from syndicalism and guild socialism. Morrison popularised the general concept of the public corporation in the 1930s² and is widely credited with being architect of the post war programme³.

1 National Economic Development Office, A Study of UK Nationalised Industries, London, HMSO, 1976, Appendix C, p.76.

2 H.Morrison, Socialisation and Transport, Constable, 1933.

3 NEDO (1976), op.cit., Appendix C, pp.80-81.

Continuing the metaphor, his design might be said to follow a contemporary architectural precept of 'form follows function' since one of his central concerns was to keep an 'arms length' relationship between enterprise and government so that government intervention could be kept to a minimum. Yet there was a very firmly held view by the post war Labour government that public enterprises should not have profit maximisation as a prime goal. They would not, for example, follow the path of Joseph Chamberlain who used municipal enterprise for revenue raising purposes to reduce the rates⁴.

Thus the composite requirement that emerged was that a public corporation should be left free from frequent government intervention yet should itself operate on criteria other than normal commercial profit seeking ones. In Morrison's words: "the Board and its officers must regard themselves as the high custodian of the public interest"⁵. Ministerial powers would not be used to influence day to day management but would ensure that a corporation's activities were commensurate with national policy. The concept of an arms length relationship appears to rely ultimately on the existence of a situation in which the difference between commercial and social obligations can be precisely defined and where rules of behaviour in the pursuit of objectives in both spheres may be unambiguously laid down. As we shall see, this has not eventuated.

4 L.Tivey, Nationalization in British Industry, Revised Edition, London, Jonathan Cape, 1973, p.164.

5 Quoted in NEDO (1976), op.cit., p.83.

The assumption that there was a partnership of interests between government and public corporation and that the corporation would therefore operate in the national interest as a matter of course, was embodied in the vaguely worded statutes of nationalisation. The duties of each public corporation were set out in separate statutes but were broadly similar in style for most corporations⁶. They invariably prescribed a general duty towards the national interest without advancing any detail. For example the National Coal Board was exhorted to make "supplies of coal available of such qualities and sizes, in such quantities and at such prices as may seem to them best calculated to further the public interest in all respects ..."⁷. A requirement to break even one year with another was common to all corporations⁸, and there was usually a clause against showing undue preference to any person or group of persons, again without further interpretation being provided.

Thus at the time of nationalisation the requirements placed on the public corporations made allowance for the pursuit of objectives other than the purely commercial without giving specific guidance on what these might be. At the same time attempts were made to acknowledge the commercial dimension by imposing a financial constraint. (Although the requirement that public corporations should break even taking one year with another was, as many have pointed out, strictly meaningless until further definition was made of the period within which this must occur⁹.) The intention

6 Ibid.

7. Coal Industry Nationalisation Act, 1946, Section 1(C).

8 NEDO (1976), op.cit., p.79.

9 C.D.Foster, Politics, Finance and The Role of Economics, London, George Allen and Unwin, 1971, p.27.

when the corporations were set up appears to have been to enable the various Boards to operate in an unconstrained fashion where commercial and public interest did not conflict, whilst reserving certain rights of intervention to Ministers should they wish to override commercial decisions in the national interest. In practice, Parliamentary reluctance to allow a Minister a carte blanche in the name of the national interest meant that the term was interpreted very narrowly¹⁰. On the other hand the autonomy that the arms length policy conferred on the nationalised industries soon gave rise to some concern and led to the creation of a Select Committee in an attempt to tackle this problem of accountability and control.

The Select Committee on Nationalised Industries was established in 1952 in response to this apprehension that the post war expansion and operation of the public sector through the creation of the public corporations, was not subject to the normal process of public scrutiny through the Parliamentary system. A series of SCNI inquiries criticised the lack of economic discipline within some of the major industries¹¹. It was revealed that sponsor departments did not make any detailed attempt to satisfy themselves on the financial or economic validity of public corporation programmes, being more concerned with the total sums involved¹². Particular industries were criticised by independent inquiries like the

10 Ibid, p.25.

11 See Lynn F.Pearson, The Organisation of the Energy Industry, London, Macmillan, 1981, p.69.

12 NEDO (1976), op.cit., p.88.

Herbert report on the Electricity Supply Industry¹³, and a general point noted by the standing committee was that techniques of financial management had not been developed to a level comparable with private industry.

It is interesting to note that the main focus of attention at this time was the failure of the public corporations to be sufficiently commercially minded rather than the reverse. As we have seen, when the enterprises were nationalised it was a concern of Morrison's that they should not merely be state firms. It was intended that their remit should be broader than a profit maximisation objective, although little guidance was given in the statutes as to what this might entail. By the late 1950s and with a Conservative government firmly established in power, the emphasis shifted to a demand for more commercially efficient behaviour¹⁴. The Herbert report referred to above, embodied the idea common to that period that economic and commercial considerations were synonymous. It recommended without qualification that the Boards should see their duty as running the corporations as economic concerns and making them pay¹⁵. All non-economic (i.e. non-commercial) considerations which might affect general policy

13 Cmnd 9672, Report of the Committee of Enquiry into the Electricity Supply Industry (the Herbert Report), London, HMSO, 1956.

14 This reflects the more general concern about public expenditure control at the end of the 1950s which led to the publication of three White Papers: Cmnd 1203 Public Expenditure in Great Britain, London, HMSO, 1960; Cmnd 1338, Government Expenditure Below the Line, London, HMSO, 1960; Cmnd 1432, The Control of Public Expenditure (the Plowden Report), London, HMSO, 1961.

15 Herbert Report, op.cit., p.97.

should be left to the specific decision and directive of the government. For example the Central Electricity Authority was castigated for purchasing heavy plant from British manufacturers without seeking tenders from abroad, for cross-subsidising new rural connections and for not being as vigorous and commercially progressive as possible in the retail area. Whilst a case might be made that all these activities contributed to the national interest, the Committee was in no doubt that they should only be undertaken on precise instructions. Nor did the Committee take any pains to conceal that in its view such intervention should be kept to an absolute minimum¹⁶.

These demands for a more clearly delineated role and code of operation for public enterprises culminated in 1961 in the production of a White Paper on the nationalised industries, the first of three¹⁷, which were to appear over the next two decades and which provide the most accessible evidence of the development of government attitudes and approaches to investment activities within the public sector. The 1961 White Paper presented in more formal terms the ways in which the commercial viewpoint espoused by the Herbert Committee could be given substance. Despite its title "The Economic and Financial Obligations of the Nationalised Industries", it concentrated almost exclusively on a review of the financial aspects of the industries. A new framework was laid down. More specific definition was given to the break even requirement -

16 Ibid. Summary of Main Conclusions and Recommendations. Tivey concurs in this view of the Committee's position, Tivey (1973), op.cit., p.170.

17 Cmnd 1337, The Financial and Economic Obligations of the Nationalised Industries, London, HMSO, 1961; Cmnd 3437, Nationalised Industries: A Review of Economic and Financial Objectives, London, HMSO, 1967; Cmnd 7131, The Nationalised Industries, London, HMSO, 1978.

it was to be assessed over a five year period and not only should revenue cover direct costs over this period but should also contain provision for both replacement and new investment. Any investment plans which were expected to yield a low return would be subjected to special scrutiny. Most particularly, whilst there was not an absolute retreat from the idea that non-commercial considerations would have a place in the behaviour of public corporations this was made more difficult to accommodate under the new financial regime. There was no provision made for direct subsidies to offset any reduced commercial performance. Account of this was only taken in a more general way in the setting of the five year targets.

Like the Herbert Report before it, the White Paper strongly implied that intervention should be kept to a minimum. Thus the low (by commercial criteria) prices which had been encouraged in the previous decade for anti-inflationary or wealth-redistribution purposes would no longer occur. Yet the Paper appears in the last analysis reluctant to close the door on the broader national values which led to nationalisation in the first place. It emphasised in its final paragraph that the nationalised industries had wider concerns than the purely commercial. But at no stage did it give explicit guidance on investment decision rules. Yet to allow a place for wider obligations at all, inevitably undermined the quasi-commercial approach adopted in the main body of the Paper.

This first White Paper, published early in the decade, was essentially a product of the late 1950s concern with accountability and control especially in financial matters. However the 1960s was a decade when a broader view of planning was adopted and the development of planning techniques rose rapidly in importance in Britain. I have already noted in Chapter II the explosive increase in academic investment appraisal literature in this period. The

mid-Sixties also saw the election of a Labour government committed to the general principle of economic planning. By this time also investment had been growing at a rate far greater than had been foreseen in the previous White Paper. It is therefore not surprising that these trends combined to produce the 1967 White Paper giving directives to the nationalised industries which were more detailed than anything which had gone before¹⁸.

The Government saw its major responsibilities in relation to the nationalised industries as being to measure the demands on scarce resources, to assess priorities and "to allocate resources upon an economically and socially rational basis"¹⁹. It was recognised that such a wide brief could not be satisfied merely by maximising the financial returns: "... significant costs and benefits can occur which are outside the financial concern of the industry and it is the special responsibility of the Government to ensure that these 'social' factors are reflected in the industries' planning"²⁰. The financial targets were retained but much more emphasis was placed on two new areas - guidelines on investment appraisal and on pricing.

At the heart of the Paper was the instruction to nationalised industries to appraise investment projects using a discounting technique, the net present value (NPV) method, and a centrally determined test discount rate (TDR). The rationale for this centrally determined rate was that efficient resource allocation could only be secured if investments were made where the return to

18 By comparison, the OECD manual for Third World Countries published a year later was much more sophisticated; OECD, *A Manual of Industrial Project Appraisal*, op.cit.

19 *A Review of Economic and Financial Objectives* (1967), op.cit., p.4.

20 Ibid.

the economy was greatest. Therefore the TDR should represent the minimum rate of return to be expected on a marginal low risk project undertaken for commercial reasons. In other words there should be comparability between private and public investment in order to avoid a sectoral misallocation of resources. Additionally all public enterprises should adopt the same discount rate to maintain consistency within the public sector and thus avoid an intra-sectoral misallocation²¹.

The TDR was therefore interpreted primarily as a measure of the opportunity costs of capital. Yet at the end of the discussion it was allowed that the rate might be raised if the total amount of investment undertaken was regarded as excessive, thus giving it the role of reflecting a time preference consideration also. This conflict appears neither to have been resolved nor indeed recognised in the guidelines²². Nor did the White Paper come to terms with the possible conflict between use of the TDR and any capital rationing which might be imposed. Theoretically capital rationing should not be a tool of policy since any project which displays a positive NPV is justifiable under the discounting methodology adopted. Further difficulties arise when a financial target is also imposed. Then the industry will take output and pricing decisions on the basis of expected actual costs (including

21 Ibid, p.5.

22 Ibid, p.7. I commented in Chapter II above on Feldstein's 1964 article on the impossibility of one discount rate fulfilling two functions. For arguments for discounting at the social time preference rate see: Fleming, "What Discount Rate for Public Expenditure?", in M.V.Posner (1977) ed, op.cit., and D.A.Heald, The Economic and Financial Control of UK Nationalised Industries, University of Glasgow Discussion Paper in Economics No.30 (1978).

depreciation, interest charges and with a view to meeting financial targets) and will use the TDR to find the cost minimising investment to meet these plans. A procedure which is entirely inconsistent with the marginal opportunity cost rationale of the TDR²³. It was also inconsistent with the long run marginal cost pricing guidelines which were based on a Pareto welfare optimisation approach²⁴.

Whatever the intentions of government at the time the 1967 White Paper was drafted, in subsequent years manipulation of the nationalised industries' funding was used to pursue a variety of macroeconomic policy objectives - particularly the control of inflation, and cuts were often imposed across the board²⁵.

Overall then the 1967 White Paper attempted to achieve two entirely different aims. One was to provide an incentive to managerial efficiency by setting a financial target; the other was to achieve allocative efficiency following rules generated by the neo-classical model²⁶. The chance of the means to these two ends being compatible is extremely remote. Yet to be charitable, the White Paper, despite its theoretical shortcomings and simplistic approach, did attempt to tackle some of the more obvious

23 Ray Rees, Public Enterprise Economics, London, Weidenfeld and Nicholson, 1976, pp.18-19.

24 D.A.Heald, "The Economic and Financial Control of UK Nationalised Industries", Economic Journal, 90, June 1980, p.262.

25 Ibid, p.246.

26 Discounting and marginal cost pricing are both reflections of this aim: "Choosing an investment programme by maximisation of net present value of social benefits is, in a first-best economy, exactly equivalent to choosing an investment programme by marginal cost pricing", R.Rees, op.cit., p.49. A second-best world requires further qualification.

shortcomings of public sector investment appraisal. For example, there could be no justification for industries using pay-back period analysis from that time on. Indeed one of the more general criticisms levelled against it has been that it was probably too ambitious in its attempts to specify a general framework, which led to arguments being qualified to the point of equivocation²⁷. The discounting methodology it introduced was one which in principle could have been extended to accommodate at least some of the secondary costs and benefits which would have fallen into the 'social' category. Whilst obviously wishing to guard against the cross-subsidisation of goods and services without good cause, the White Paper appeared to accept that in some cases the practice would fulfill wider economic or social considerations. This consideration could be translated into shadow prices.

This practice would require more specific individual advice from government. The White Paper was quite clear about its view that the nationalised industries were not in a position to make estimates of this nature and that sponsor departments must undertake to do so²⁸.

Ironically the investment appraisal approach embodied in the 1967 White Paper was never tried except in a very half-hearted peripheral way. Most commentators agree that this was in the main attributable to the macroeconomic issues which dominated the end of the 1960s and the early 1970s, especially the price restraint policies induced by the rise in inflation in that period²⁹.

27 C.D.Foster, Politics, Finance and the Role of Economics, London, George Allen and Unwin, 1971, p.43; Heald, op.cit., p.262.

28 Cmnd 3437 (1967), op.cit.

29 Cmnd 7137 (1978), op.cit., p.6; Heald (1980), op.cit., p.260; Tivey, op.cit., p.177.

As early as 1968 the SCNI was beginning to voice doubts as to whether the principles contained in the White Paper were being applied rigorously enough³⁰ and by 1973 in its report on Capital Investment Procedures³¹ had concluded that the government had failed to implement the approach laid down. It accordingly recommended that there should be a detailed study of the role of the nationalised industries and their control.

This study was undertaken by the National Economic Development Office (NEDO) and published in 1976³². It carried out an extremely comprehensive piece of research. In the course of its enquiry it commissioned a variety of background papers and eventually ran to eight volumes.

One of the background papers was a study by Coopers and Lybrand Associates Ltd which reviewed the experience of four nationalised industries in applying the 1967 criteria for pricing investment decisions and financial management³³. The industries examined were the British Gas Corporation, British Railways Board, British Steel Corporation and the Post Office (Telecommunications). The most significant point to emerge from their review of the investment appraisal procedures was that full appraisal involving both costs and benefits, was carried out for only a small proportion of the total investment programmes in three of the four industries (BSC was the exception). Usually

30 SCNI, Report on Ministerial Control, HC 371, Session 1967-68, London, HMSO.

31 SCNI, Capital Investment Procedures, HC 65, Session 1973-74, London, HMSO.

32 National Economic Development Office, A Study of UK Nationalised Industries, with Appendices and Background Papers, London, HMSO, 1976.

33 Ibid, Appendix D, pp.95-117.

investment was characterised as being 'replacement' investment and hence 'unavoidable' and investment appraisal was based only on cost effectiveness studies. The consultants also concluded that none of the industries operated satisfactory 'back-checks' or post investment studies. In general the consultants concluded that the guidelines in the 1967 White Paper had not been a notable success in achieving the overall objectives of government contained therein. They suggested that a new approach was needed in which there would be recognition by both government and nationalised industries that because of the importance of the position of the public corporations in the economy, they must inevitably be expected to pursue a mixture of social and commercial objectives and that the idea that the 'social requirement' could be isolated from the commercial was unduly simplistic.

The overall findings of the NEDO report were quite devastating. It concluded that the relationships between government and nationalised industries were confused, demoralising to all concerned and could have damaging economic consequences for the country as a whole³⁴. In particular it criticised the arms length philosophy which it believed had been and continued to be an unrealistic detachment of Parliament, Government and key interest groups from the activities of the public corporations. Although there might at first sight be a good deal of attraction in the concept of an arms length relationship with precisely defined obligations and responsibilities on each side, the evidence demonstrated convincingly that in the real world things would not work out like that³⁵. The importance of these enterprises "as

34 Ibid, p.44.

35 Ibid, p.9.

employers, suppliers and customers and the economic and social implication of their actions make it right as well as inevitable that government should take a close interest in their strategies"³⁶.

The arms length approach was contrasted with a 'concerted' approach. "A concerted approach presupposes that there are a large number of important decisions in which government, trade unions and other groups have a legitimate interest. The history of the last decade has demonstrated time after time that management cannot be expected and has not been permitted to exercise sole responsibility for these decisions. Government and trade unions increasingly exercise their power to change or negate them. A stable and effective policy framework is more likely to come about through the direct participation of the main parties at the right time, in the right environment and with the proper insight into all the relevant circumstances. Only then can the various groups come to understand the options, constraints and often inconsistent aims of other groups and so reconcile their differences before positions become entrenched."³⁷

Drawing on a background paper prepared by M.R.Gardner³⁸, NEDO advanced the view that experience from France, Sweden and West Germany showed that interest groups which were closely concerned with government strategy needed to be involved in economic decisions at an early stage. All of the countries referred to above had representatives of employees and government on the Boards of their public enterprises and West Germany had users and suppliers of goods on the Board also. In contrast the U.K. was

36 Ibid, p.10.

37 Ibid, p.45; my emphasis.

38 M.R.Gardner, "Relationships of Government and Public Enterprises in France, West Germany and Sweden", NEDO Report, op.cit., Background Paper No.2.

an example of disjunction rather than conjunction. For example, the SCNI had condemned the presence of the Chairman of the Consumers Consultative Councils on area Gas Boards. Everything was structured for confrontation rather than collaboration.

The NEDO report summarised the arguments for and against both the arms length and concerted approaches and talked of adopting a compromise or balanced approach³⁹. It did, however, in its recommendations, lean to the concerted approach.

It recommended the setting up of a Policy Council whilst retaining a Corporation Board as an executive authority. The Policy Council would bring together some members of the Corporation Board, representatives of the main interest groups concerned with the industry - government departments, trade unions, suppliers and consumers - and also members reflecting other independent viewpoints⁴⁰, who would add both a breadth of experience and balance to the Council. This arrangement would enable the overwhelming gap which had opened up between the operational and strategic levels of decisionmaking to be bridged. It would enable social, regional and wider rational objectives to be stated and agreed. Pricing policies and investment appraisal techniques could then be designed to reflect the particular circumstances of the industry and the demands placed upon it⁴¹.

The 1978 White Paper came as something of an anticlimax after the NEDO report. Not only did it reject the radical reform proposed by NEDO on the grounds that it would slow down the process

39 Ibid, p.45.

40 Ibid, pp.47-48.

41 Ibid, p.49.

of decisionmaking and would confuse responsibility and accountability⁴², but also, while agreeing that change was needed, proposed several retrograde measures. Heald⁴³ has argued convincingly that far from re-introducing and re-inforcing "the approach to investment appraisal pricing policy and financial targets which was set out in the 1967 White Paper", the 1978 White Paper returned to the financial traditions of the earlier 1961 White Paper. Of particular importance in the investment appraisal area was the replacement of the TDR by a required rate of return on investment (RRR). The nationalised industries were given a primary responsibility to achieve 5% on their new investment as a whole but could then choose their own operating methods of investment appraisal. Of the problems of inter-sectoral and intra-sectoral misallocation of resources which led to the recommendation of a uniform discount rate, there is no mention. To try to accommodate the ever-present problem of national interest considerations, the White Paper suggested that specific legislation was needed to formalise the right of ministerial intervention rather than relying on informal persuasion⁴⁴. However, this power was not to be unfettered. Any direction given would be in the form of a statutory instrument subject to Parliamentary procedures. The White Paper noted that the Government intended to use these powers sparingly. One cannot escape the view that this again was a retreat to the 1961 pattern of commercial primacy.

42 Cmnd 7131 (1978), p.9.

43 Heald (1980), op.cit.

44 Foster had several years earlier noted the legal incapacity of ministers in this respect, C.D.Foster (1971), op.cit., pp.24-28.

In the event, political changes overtook this last White Paper, produced by a Labour Government, and a Conservative administration was returned to power in May 1979 and again in June 1983. This present government is committed as a political philosophy to privatisation of the existing public sector where feasible.

Perhaps one of the strongest statements of the values which it regards as forming part of the national interest is made by a government's approach to the balance between the public and private sectors in the economy. The present government's position must be interpreted as a belief that the values which comprise the national interest are adequately expressed by free market behaviour⁴⁵. The degree to which other interest groups in society acquiesce in this view is yet to be determined.

45 The use of market forces to allocate resources does not of course preclude intervention in specific circumstances or, for example, the enactment of legislation to define property rights and hence internalise externalities. Nevertheless, it does indicate that intervention is regarded as more unlikely to be needed to correct divergencies of public and private interests.

The two themes which I developed earlier in this thesis may be related to this evidence. The first concerns the ideas of operational flexibility raised in Chapter V. What became increasingly clear in my examination of government guidelines directed towards specific project appraisal techniques was that these were so underdeveloped, even in terms of the standard optimisation procedures which were generally agreed in the theoretical literature by the early seventies, that it soon became apparent that there would be little chance of finding detailed discussion on, for example, the problems raised by gross uncertainty in the forecasts of various industries.

The most recent guidelines for project appraisal in the public sector appear in two revised manuals issued by the Treasury in 1982 and 1983 entitled "Investment Appraisal in The Public Sector"⁴⁶. Whilst written in particular for those responsible for the spending decisions of central government, the document also points out that it is relevant to other parts of the public sector, such as nationalised industries or local authorities.

Whilst it is much more obviously a manual of appraisal than any of the other documents considered so far, and hence more specific in detailing the components of an appraisal, it is firmly rooted in the rational comprehensive framework. Objectives will be defined, all options evaluated and a choice made⁴⁷. In the face of uncertainty, the expected NPV is to

46 HM Treasury, Investment Appraisal in the Public Sector, London 1982, and Investment Appraisal in the Public Sector: A Management Guide for Government Departments, London 1983.

47 Treasury (1982), op.cit., p.2.

be calculated⁴⁸. Where sensitivity analysis "shows that the outcome is very dependent on the value of a particular estimate, that estimate should be examined to see whether it can be made more reliable"⁴⁹. In short the very antithesis of flexibility is enjoined. Again with respect to irreversibility: "The effects of some expenditures are reversible. The effects of others, especially many of those affecting environmental quality, are for practical purposes irreversible. There are no special procedures for handling this ... if a change is irreversible, important effects are more likely to extend into the very long term"⁵⁰.

It is not perhaps surprising that a manual for general use embodies a very orthodox approach⁵¹. What is slightly more difficult to accept is the attitude expressed by the NEDO report, which whilst developing a very radical approach in other areas still incorporated the view that more stability is a precondition of better decision making, "so that management can plan with confidence"⁵². This is the other half of the view that better forecasting is needed. Thus the Leitch Report on Trunk Road Assessment still advocates this approach. Despite being informed by consultants that forecasts obtained for commercial vehicle

48 Ibid, p.15.

49 Ibid.

50 Ibid, p.11.

51 Yet in this context it is interesting to note that a Treasury Study on the use of investment appraisal techniques by departments found that of 103 investment decision where they would have been appropriate only 17 were subjected to a full appraisal. "The Use of Investment Appraisal in Straightforward Spending Decisions by Government Departments", Treasury 28th Report to the Committee on Public Accounts, HC 417, Session 1981-82.

52 NEDO, op.cit., p.9.

traffic were so unreliable "that the final result can be little better than guesses"⁵³, the Committee bases its faith on a move from extrapolatory to causal forecasting models. "...a causal question cannot adequately be answered by an extrapolatory model. We conclude therefore that the current methods are insensitive to policy changes. The causal model will be more sensitive to policy changes"⁵⁴. But this of course begs the question of how policy changes after an initial decision has been taken, can be accommodated.

In conclusion, there is little sign to date that public sector investment appraisals are attempting to come to terms with an uncertain world in the analysis employed, despite the lip service paid to the idea of flexibility in many areas.

In the second area of inflexibility leading to poor decision making, that is, where options are foreclosed early because the values on which objectives are based have either been ignored or have failed to take account of important interest groups, there has been much greater awareness. Thus from the time of their initiation, the nationalised industries have been perceived by governments of both parties (until very recently perhaps) as having a wider role to fulfill than the purely commercial. Yet until the NEDO study there was extreme vagueness as to what the national interest was and how it was to be expressed so that investment decisions could take due note of it. Though it did not

53 Report of the Advisory Committee on Trunk Road Assessment, Chairman Sir George Leitch KCB OBE, London, HMSO, 1977.

54 Ibid.

employ this terminology, the NEDO report was in fact advocating an administrative framework that took account of the need for partisan mutual adjustment. Although the NEDO recommendations were never taken up, it was, I believe, right to recognise that the national interest does not exist written on tablets of stone for all to refer to. It must evolve and therefore a forum must be provided to assist in this evolution. If account is not taken of this then it is difficult to see how any outcome will be judged as a good decision except in the most uncontentious of circumstances.

Conclusion

It has become almost a commonplace in recent years for commentators on widely differing aspects of economic planning and organisation, both in Britain and in the international arena, to refer to the increasing pace of change in the modern world. With what was for most countries the exceedingly painful unforeseen change in national and international environments triggered by the 1973 oil crisis, the need for governments to be flexible, to improve their ability to cope with heightened uncertainty has been further stressed. Kenneth Boulding commented in 1974¹, "Evaluations, decision strategy and the quality of decisions in general depend very much on the degree of uncertainty of the items on the agenda. The greater the uncertainty of the agenda, the higher the value which should be placed on decisions which leave future options open - that is on 'liquidity' and non commitment". And further, "An important source of bad decisions is illusions of certainty which often lead to decisive action which zeros in on disaster. The great danger is that the product of planning frequently produces illusions of certainty simply because it is dressed up so prettily".

1 K.Boulding, "Reflections on Planning: The Value of Uncertainty", Technology Review, Vol.77, No.1, 1974, p.8.

The problems raised by an uncertain environment have therefore been noted and the need for flexibility strongly canvassed. However, a more detailed consideration of what is involved in the pursuit of flexibility, exactly what is being sought and the way governments might systematically encourage it in their own spheres of influence, has received considerably less attention.

A second, and I have argued, intrinsically related theme to emerge in the 1970s has been a dissatisfaction with the outcome of a growing number of public investment projects. These were the fruits of the appraisal techniques developed over the previous two decades. Peter Hall could write in 1964², "We have begun to grope our way towards a practical concept of economic planning which may prove in a few years time to be as revolutionary in its policy implication as was the Keynesian revolution in economics thirty years ago". Cost-benefit analysis would enable us ... "to determine our investment nationally from the point of view of the community as a whole, just as the capitalist can now do from his private point of view." Twenty years later it would be difficult to sustain this enthusiasm in the light of contemporary experience.

These two problems of dissatisfaction with public investment projects and the increased need for flexibility in a rapidly changing environment have formed the core of this thesis. They are presented as two aspects of the same underlying problem. Investment decisions are taken and implemented amid change and at least partial ignorance of the future. Yet decision making techniques have been developed within a much more restricted and static framework, where only a highly circumscribed form

2 P.Hall, 1964, op.cit.

of uncertainty is permitted to enter. The resulting projects, therefore, often fail to satisfy early expectations.

Initially a review was carried out of the development of project appraisal techniques, the changing demands made of them and, more generally, the changing perception of the aims and objectives of public investment. The strongest theme to emerge from this review was the growing awareness indicated in the literature that government objectives should be represented by several goals rather than a single growth objective.

In conjunction with this investigation I sought for evidence from post-investment studies, of the degree of success exhibited by investment appraisal studies in terms of the outcome achieved by the projects undertaken. This evidence was surprisingly sketchy, perhaps taking to extremes the old edict that in economics bygones must be forever bygones. Where it did exist, however, it suggested that even the core elements of project appraisal - the direct costs and benefits - had not been accurately estimated in many of the appraisals. One author, Haveman, who had carried out the most systematic post investment survey of a large number of water resource projects, concluded from his research that more recent developments in the theory of appraisal which attempted to increase the complexity of the analysis by introducing multiple objectives and secondary costs and benefits, were misguided. In effect, Haveman was arguing for a retreat to a simple profit and loss accounting, albeit from a national rather than a commercial viewpoint. His position was founded primarily on the premise that it was preferable to learn to do the central assessments properly before launching into peripheral considerations.

The nub of Haveman's argument was that the responsibility for a poor outcome lay with the practitioners. They needed to try harder and to stop dissipating their energies and all would be well, or at least greatly improved.

I have argued that the problem is less tractable than this viewpoint suggests, that rather than being a failure of effort it stems from a failure of theory. Project appraisal techniques have their roots in neo-classical economic theory which, in order to build internally consistent and determinate models found it necessary to assume perfect foresight. It supposed a world in which uncertainty did not exist. Since this immediately raises very practical difficulties in policy related theory, various attempts have been made to overcome the deficiency without undermining the whole edifice. These depend on handling uncertainty - imperfect foresight - by the use of probability estimates. But the use of these devices whether of actuarial or subjective probabilities does not in any way come to grips with the central problem. Some future events may certainly be guessed at with a reasonable chance of accuracy but others are essentially unknowable. That is, when we take decisions they have consequences stretching into the future of which we are at least partially ignorant and no techniques are available which permit us to act directly on this situation to change it significantly. Economic models which depend like mathematics on basic premises and logical deduction can only reveal what is already implicitly stated. Any bank of knowledge assumed by such a model must be specified by the model builder and known to him. It can in Shackle's terminology have no place for novelty or surprise³.

3 G.L.S.Shackle (1972), op.cit., p.32.

To use a static optimising technique in a changing environment carries with it the likelihood that the project which initially appears most suitable will, over a longer period, prove less appropriate. The difficulties of estimating future events is usually assumed to be in direct proportion to the length of time which will elapse before the events will occur. In this sense public investment appraisal meets more difficulties than private, because infrastructure projects which are characteristic of public investment are by their nature likely to have both long gestation periods and long lifetimes. Thus in time terms alone there is a greater likelihood of estimate and actuality diverging.

An equally important consideration is the pace of change in the external environment. Extrapolation from the past to the future is more likely to give acceptable results in a very slowly changing environment than one where change is endemic. Crude extrapolation as an approach to forecasting is now usually rejected by contemporary analysts who concur in the view that modern society is characterised by increasing turbulence. Yet often their response is either to attempt to foresee change in order to amend what is basically an extrapolation model or alternatively to seek ways of imposing stability or of slowing up the pace of change.

This has something of the manner of Canute about it. Worse, it directs attention away from what, I have suggested, is the more profitable approach, that of seeking ways of adjusting the techniques of analysis to accommodate unforeseen change, rather than denying its significance. It is the search for flexibility. It requires a retreat from the deterministic models which promise a single 'best' answer to a problem since our judgement of what is 'best' at present may very well be modified by

future events. It seeks to replace the static optimisation procedure with a more dynamic, adaptable one.

In pursuing the idea of flexibility in relation to individual projects it became increasingly clear that in general terms the alternatives which were formulated for comparison and from which eventual selection would be made, were themselves at the end of a drastic reduction process for which the standard appraisal framework makes no provision. This appeared to be an important source of inflexibility in decision making since it ruled out many options at a stage prior to the formal evaluation. It locked the decision making process into a particular area at a very early stage and without explicit acknowledgement. If the area pre-selected in this way was inappropriate it would naturally lead to the formulation of unsatisfactory projects. I suggested that this pattern was evident in attempts to select a site for a third London airport.

A study of decision making theory reveals two broadly competing views of public decision making identifiable as the rational comprehensive and the incremental models. The former represents what may be termed the orthodox approach to decision making in assuming that objectives are specified, all conceivable options considered in relation to these objectives and the 'best' option chosen. This formulation may be modified to make it more realistic. In particular I have noted Simon's concept of bounded rationality which modifies comprehensiveness by stopping the evaluation of alternatives once a satisfactory solution to a problem has been reached. The incrementalist approach, on the other hand, denies our ability to accumulate and/or process the amount of information demanded by the rational comprehensive model. As an alternative it suggests that

decisions should not, normally, be radically different from what has gone before since that is where our best information lies. It also permits us to test small changes from the known so that we may retreat most easily if unexpected or undesirable consequences arise.

Whilst this second model is attractive in the way it gives an important place to reversibility, which is one aspect of flexibility, it suffers from bias towards a particular class of solution. It cannot handle proposals which are radically different from the status quo. Indeed the assumption is that this type of solution will not normally be desirable.

A third approach, mixed scanning, developed by Amitai Etzioni was also considered. This at first seemed to promise to elucidate the process by which options are short-listed for detailed examination. It advances a two stage approach which consists of an initial broad scan of alternatives which enables the great majority to be discarded. Attention is then focused upon a small area which is to be examined in greater detail. This appears to be exactly the process at work in project evaluations. However, Etzioni was very unclear about the principles to be used in carrying out the broad scan. Indeed this part of his work has been criticised as backdoor comprehensive rationality since it appears to differ very little in the information demands it places on the decision making process and the range of alternatives it considers. Yet the general idea of a two stage approach still retained its attraction. The sheer cost of carrying out detailed appraisals appears to determine that in any decision making process only a few proposals will be subject to detailed evaluation. Yet it did not appear that a satisfactory explanation of the processes at work in this narrowing down procedure had been advanced in the decision making literature.

It had, however, become apparent as this line of reasoning was being pursued that the descriptions of projects such as 'appropriate', 'best', 'desirable' or 'unsatisfactory' only have meaning in relation to the values that underly appraisals. In public sector appraisals these values are subsumed within the term 'national interest'. Within conventional appraisal methodology it has been usual to accept that the objectives of policy are exogenous to the decision making model, that they are in some sense 'given'. The project analyst is seen as a technocrat, assisting the decision maker to achieve the end results desired but abstaining from involvement in the choice of aims. This division of labour in the decision making process depends crucially on the ability of those responsible for taking decisions on behalf of the nation, i.e. government, to construct a social welfare function which reflects the general or national interest. In other words government is perceived in this scenario as a neutral intermediary, the stress remaining on the importance of individual preferences. Following Arrow's demonstration of the impossibility of aggregating individual preferences into a social welfare function without transgressing at least one of five very innocuous and apparently reasonable conditions, the need for explicit value judgements in public appraisal has been more apparent. A social welfare function has to be constructed rather than emerging from the aggregation of individual welfare. Yet confusion has remained as to whose value judgements should be embodied in this process. Suggestions have ranged from the project analyst, who, it is claimed, has most experience and understanding of the structure within which decisions are implemented, to the value judgements of the political party in power since they are elected by majority voting. Neither of these extremes is acceptable.

The former elevates the values of an arbitrarily selected group within society, while the latter requires a single vote system to carry the burden of a complex of values, unlikely to be mirrored by the views of a single political party. Yet in many areas of public interest consensus (though not unanimity) is achieved. In a wider consideration of public policy and the learning processes of society, Donald Schon⁴ has referred to "ideas in good currency". Although too little is known of the mechanics by which these ideas emerge, there is little doubt that they are for a time very powerful in guiding public policy. Similarly, I referred to Naisbitt's study in the United States, which identified quite dramatic shifts in social values there over the last decade. Such studies are creditable attempts to come to some understanding of what 'national interest' may mean in a pluralist society.

However, the most detailed explanation of these processes is to be found in Lindblom's work in the concept of partisan mutual adjustment. Here Lindblom shows the means by which various competing views and objectives are brought together into a consensus. The end result comes very close to the idea of the social welfare function as an expression of the national interest. I believe that these ideas on the formulation of a social consensus provide the key to understanding the filtering process at work in project selection. The initial broad scan can be interpreted as largely guided by prevailing social values. Possible solution areas which are at wide variance with general social opinion will therefore be quickly ruled out. Yet prevailing values alone cannot

4 Donald A. Schon, Beyond the Stable State: Public and Private Learning in a Changing Society, Harmondsworth, Pelican, 1971.

make the final choice since there will be indeterminacy between some options. Thus a second level detailed evaluation and comparison of these options will be needed and it is here that appraisal techniques come into their own. A contemporary issue may provide a useful example of this process. Sweden and Austria have taken a decision in principle to reject (or more accurately to impose moratoria on) nuclear power for electricity generation whilst France, amongst others, has decided to pursue it. Such decisions may be interpreted as being first level decisions based largely on prevailing social values. They in turn determine the second level detailed appraisal of two or three alternatives - either alternative types of nuclear reactor or alternative types of conventional generating plant. In this respect it appears that the current Public Enquiry in Sizewell 'B' may, at great expense, be muddling two levels of selection together. The decision concerning nuclear power in principle properly precedes a comparison of types of reactor, PWR, Candu or other variants. More positively, the increased use of the Public Enquiry may mark a growing awareness of the need to provide a forum where competing social values might be aired. Nor is this need special to obviously contentious issues. One of the strongest recommendations to emerge from the NEDO study on the UK nationalised industries considered in Chapter VI, was the need to give much stronger definition to the national interest in this context also.

Having attempted to understand and make explicit the process by which the large number of potential investment projects is reduced to a short list of five or six, the way was then clear to examine in more detail the specific characteristics of flexibility which will enable a project to be responsive to circumstances unforeseen at the time of the original

decision. I have termed this short run or operational flexibility. There are many different ways in which a project can be made more flexible or able to adapt to a range of different demands which may be placed on it, and the particular combination chosen will depend on the individual characteristics of a given project. Having considered some approaches in Chapter V, I therefore used a short case study as one particular example. However, in terms of methodology the most significant common thread is the general assumption that flexibility can only be purchased at some cost. It is acknowledged that there is an ever present cost tension between investment decisions which follow standard optimisation procedures and those which attempt to provide for tolerable performance under a wide range of operating conditions. I have suggested that such a cost penalty is not necessarily as great as conventional wisdom would claim. In one instance I have referred to mounting evidence that some of the claimed economies of scale in electricity generating plant may not in fact be present. Small plant exhibits several characteristics of flexibility and the additional cost of choosing several small plants in preference to a single large plant may be less than previously thought. Nevertheless it would be foolish to deny that in general terms flexibility, like other forms of insurance, will involve initial extra cost. Moreover it is a cost which will only prove to have been worthwhile or not at the end of the project's life.

This brings into stark contrast the difference between the approach to public investment decisions suggested here and the reassurance of an optimisation method. Acknowledging as it does the existence of incomplete knowledge and learning through time, it cannot draw on the support of an equilibrium model. Furthermore the suggestion that the national interest

is determined by the consensus achieved between different societal groups holding different values, cannot hope to fit easily into an axiomatic methodology.

Yet this is I believe a necessary step in producing an approach to investment appraisal which takes account of the world within which these decisions are taken, not an ideal world of theory but the messy, turbulent world of competing ideals and uncertain outcomes. I hope to have shown in this thesis that flexibility is valuable in such a world, that to seek it as an attribute of projects is one way of facilitating a satisfactory outcome in a changing environment. But, as important, is the need to recognise that the judgement that a project is good or satisfactory is itself specific to a particular society at a particular time. Outcomes are judged not against immutable aims and objectives but against a body of ideas and values 'in good currency'.

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