

NON-FINANCIAL ASPECTS OF PROJECT APPRAISAL

by

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ABSTRACT

For many companies, project appraisal has concentrated on the assessment of the financial aspects of the project. These are very important but the analyses of a project and its effect on the company would be too narrow if only finance were to be taken into account. The reason for the underemphasis of other components of a project is not their lack of importance but the lack of an analytical framework that would highlight their importance and that would provide guidelines on how to incorporate them into the appraisal. This thesis presents such a framework.

The framework identifies and analyses the non-financial aspects of projects, how they can be assessed, their relative importance to the success of the project, and how they can be incorporated in the appraisal procedure. These non-financial aspects include, in particular, the managerial rôle, strategic and synergistic effects with the rest of the organisation, social, political, environmental and technical links, and organisational aspects.

The framework is then applied to the main types of major projects found in:

- social services programmes;
- R&D;
- aerospace and defence;
- energy;
- oil and gas, mining and construction;

(according to the specific characteristics of each sector, the key areas of analysis and specific risks were identified, and suggestions on how to minimise these risks given). An industrial major project is analysed in detail in the light of the framework, and illustrates the relevance and rôle of the non-financial aspects in a real situation.

The emphasis throughout the research was on the practical ways of dealing with the different aspects and their relevance in the 'real world'. Interviews with a selection of companies undertaking project appraisal were carried out for that effect.

To my parents

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PART I

BACKGROUND

CHAPTER 1

INTRODUCTION

1.1 PURPOSE, CONTRIBUTION, SCOPE AND REASONS BEHIND THE RESEARCH

The basis purpose of this research was to develop an analytical framework for the appraisal of projects that would present information across the spectrum of all non-financial areas of analysis. The framework would encompass all likely risks for the successful accomplishment of projects, and the ways that, through the appraisal, these risks can be minimised and taken into account.

The emphasis of the research was on major projects in particular as, by their nature (size, complexity, novelty, demand), these are the projects that present greater risks for the companies, a wider variety of aspects to analyse (because of their impact outside the company as well) and where those aspects can be determinant for the success of the project (see, for example, 'Preconditions of success and failure in major projects', Morris & Hough [57]). It is also when novelty of any kind is involved (technical, political, cultural, etc.) that companies were reported to feel unsatisfied with their own methodologies of appraisal (see, for example, the survey done by Hastie [23]). Hence, the need for and opportunity of this research.

This need was confirmed during the course of the research. Several companies were found to be in the process, or have recently been in the process, of revising their appraisal methodologies and the trend was to include a more systematic appraisal of non-financial factors. For example, Logica sees its system as still very much dependent on personal experience and is trying to create an 'expert system' to store 'expert knowledge' that can advise on different types of projects, the methodologies to be used and the factors to which to be attended (this is an on-going project at the moment).

ICL have also, in the past six years, revised their system for a new one that gives more thought to the non-financial aspects of projects, and research is still going on into the ways of improving the selection and appraisal of R&D projects (the effort is seen as 'the cost of transforming an ART into a SCIENCE' [93]).

Similar efforts were made by British Rail (a new evaluation procedure was begun since September 1985 in an attempt to avoid projects being developed at a very early stage without a thorough analysis being done; the new procedures put the

emphasis on 'an enforced pause for thought' during those early stages), and in the public sector (where it has also been attempted to make appraisals give more consideration to the non-economic aspects of projects). This work aims to contribute to these improvements.

A review of the work published in this area (Chapter 2) showed that there is little research into the rôle played by the non-financial aspects of projects in the appraisal. Nor is there a comprehensive study of all those aspects, covering all the main types of major projects. The contribution of this thesis is to provide such a comprehensive study and, through a framework approach, to ensure that all relevant factors are considered in a systematic and explicit manner during the appraisal and to act as a basis for decision-making.

By non-financial appraisal is meant the analysis of all dimensions of the project apart from its economics, financing and commercial aspects (which have been covered more fully both in theory and in practice). Those dimensions were grouped under the following categories: strategic analysis, technical analysis, political analysis, social analysis, environmental analysis, and organisational and managerial analysis. The framework covers these areas and also provides information on the basic principles of appraisal (methodological considerations) and on the gathering of all aspects for decision-making purposes.

The discussion of all factors and guidelines provided is rooted in the rich experience of senior members of companies undertaking non-financial appraisal of projects, and the emphasis throughout the research is on the practical ways of dealing with the different aspects. This approach is intended to ensure that: (i) the factors covered are the ones that, in the experience of companies, needed research, and (ii) there is a close link between theory and reality.

Finally, and needless to say, this study has its limitations. These are, mainly, the ones imposed by time (given the breadth of the research to be covered), and the extent to which information was made available by companies (interviews were limited by both). Therefore, the work is not seen as the final word in the knowledge of non-financial aspects of projects, but rather as a contribution towards a greater understanding of those elements.

1.2 OUTLINE OF THE THESIS

This thesis is divided into four parts.

Part I sets the background of the research. It includes three chapters:

- Chapter 1 is a short introduction to the aims, purpose, contribution and motivations behind the research;
- Chapter 2 reviews past work in the field and fits this thesis into that work;
- Chapter 3 presents the working basis of the research and its aims, and discusses the methodology followed.

Parts II and III cover the bulk of the work, and present and discuss the major findings.

Part II develops a framework to assess the non-financial aspects of projects. This framework should be seen as the widest guide of aspects for appraisal, irrespective of the type of industry to which the project belongs. These aspects are grouped in three different categories, each corresponding to a chapter:

- Chapter 4 is about the general methodological aspects that should be present in any system of appraisal (basic principles and overall strategies, evaluation stages, and an outline of a feasibility study contents);
- Chapter 5 is about the non-financial areas of analysis: strategic, technical, political, social, environmental, and organisational and managerial (for each area, the key issues and risks are identified; ways through which to minimise the risks are suggested; and how, when and by whom the assessment should be done is discussed); and
- Chapter 6 is about assessment, weighting, decision-making and trade-offs between the different components of the project (it provides guidelines on how to gather all the components for assessment and decision-making purposes; the rôle of the non-financial areas in the appraisal, the relative importance of each area, and the trade-offs involved are discussed).
- Chapter 7 provides a summary of all aspects of the framework, its main conclusions, and a comparison of its findings with the literature.

Part III applies the framework to the main types of major projects. It includes Chapter 8, which analyses the relevance of the framework in the different types of major projects (for each type, the key factors of the business are described, the relevant areas of analysis examined, the key issues and risks in each identified, and the best practices to deal with those risks are suggested).

Finally, Part IV closes this thesis by providing an overview of the work done and making suggestions for future research in the field.

Two appendices are included:

- Appendix A, which presents the analysis, in the light of the research aims, of a particular major project (illustrating the relevance of the different aspects of the framework in a real case - the Cerro Colorado project);
- Appendix B, which lists the names of the companies and the people interviewed during the course of the research, and presents the questionnaire used in the interviews.

CHAPTER 2

REVIEW OF THE LITERATURE

2.1 TRADITIONAL APPROACH TO PROJECT APPRAISAL AND THE NEED FOR A BROADER ANALYSIS

Traditionally, project appraisal has concentrated, both in theory and in practice, on the financial side of the project only, and assessing each project in isolation from the rest of the company. Much of the literature on project appraisal and general capital budgeting systems have been dedicated to the improvement of the techniques for the measurement of the financial benefits of the project (this has been noted by King, in "Is the emphasis of capital budgeting theory misplaced?" [41]). Projects are considered to be evaluated, ranked and selected according to this single dimension. Obviously, this is a very important aspect, but, for many other reasons, a firm may wish to develop a project without it necessarily having the highest quantifiable return (for e.g., safety considerations, political matters, environmental concerns, etc.). Quoting Hellings [30] "there is a variety of reasons why a firm may wish to undertake a project which does not show the highest return available. The various non-quantitative reasons for investment will have to be taken into consideration and we must reject the concept of an absolute ranking without reference to qualitative factors".

Several surveys have been done during the past 20 years aiming to find out about the real practices in capital budgeting and their relation to what is recommended in the literature (Fremgem [25], Petty & Scott [68], Pike [71], Shall & Sundem [76], Stanley & Block [79]). According to these surveys, the financial return was the only criteria of selection to be incorporated formally - and often using the more traditional methods: PP (Payback period), ARR (average rate of return). A trend was shown towards an increase in the use of the more sophisticated capital budgeting techniques such as the IRR (Internal Rate of Return) and the NPV (Net Present Value), although always in conjunction with the more traditional methods (Petty & Scott [68], Pike [71], Shall [76]). Nevertheless, in spite of more sophisticated techniques being used, there was still a reluctance from managers to abandon the more traditional ones. The surveys also showed that there is a spread in the use of operational research techniques - in particular, for risk analysis purposes [21], the employment of full-time capital budgeting staff in many companies [44], and the more common use of investment manuals [68]. These trends indicate that firms have moved to a more consistent and formal analysis. The manuals, more or less detailed, would in general relate to costs and benefits of the project, capital requirements, other financial data,

reasons for implementing the project, and other key issues [83]. 'Key issues' served to include any qualitative aspect that seemed important. These aspects were not incorporated or assessed in any regular way, though. However, more than 80% of firms, according to Pike [71], were said to have considered them as important or very important factors in their investment decisions, and in Fremgem [25], 97% said they could approve non-economic projects on other grounds, such as social concern, pollution control, safety of employees, need to maintain existing programmes, contract commitments, immeasurable long-term potential, etc. Petty & Scott [67] also found that these kind of factors would influence investment decisions and the most important ones were legal factors followed by image and environmental responsibility. For the majority of projects, 77% of firms said that the quantitative influences dominate the qualitative ones in the decisions. A 'negative' element, in qualitative terms, would be an indicator to introduce a stricter discount rate on the project (this was revealed in most firms as the common way of introducing risk, which in many cases is set by managerial judgement [76]). The rôle played by managerial judgement on investment decisions seems to be an important element (to what extent this judgement covered, and in what way, non-financial risk elements was one of the questions aimed to be answered by the research carried out).

All the above company practices had a bearing on the size of project and the type of industry, as analysed by Pike [71]. In larger companies, formalised and up-dated capital budgeting techniques would be more common than in smaller ones. The same fact was reported by Stanley & Block [79].

The evaluation practices seemed to satisfy most of the firms surveyed. Hastie [30] reported more than 90% as being satisfied with their present systems. However, for projects in non-existing lines, where novelty would demand a closer analysis on all surrounding aspects of the project, apart from its return, this figure was lowered considerably: 79% were satisfied in internal investments and 60% in foreign investments (where other elements would add to the risk: foreign partners, cultural problems, political sensitivities, etc.). In the same paper, managers were said to have stressed the fact that a false illusion of precision might be given by the sophisticated evaluation techniques, when in fact it has not been proved that they would lead to better performance (this is confirmed in Klammer [43]). The fact that managers are not entirely satisfied with the existing systems, in particular to high-risk projects (new fields), the great rôle played by managerial experience to judge on non-financial aspects, and the feeling that increased sophistication with capital budgeting techniques would not itself increase performance, led us to conclude that there was room for improvement in this field, in particular the incorporation in the appraisal of less researched aspects of the qualitative and non-financial sides of projects. Managerial

experience and judgement would always be necessary in the analysis, but it can be improved in terms of efficiency if applied in a structured way.

2.2 A NEW APPROACH TO PROJECT APPRAISAL

Recent literature has been criticising the emphasis placed on the financial and quantitative side of projects, defining it as myopic and misplaced (see, for example, King in "Is the emphasis of Capital Budgeting theory misplaced?" [41], and Pinches in "Myopia, Capital Budgeting, and decision-making" [72]). A broader view of project appraisal, it has been said, should take into account that:

1. All projects are organisationally interdependent [13, 72] and that appraisal is only one stage of the whole process of Capital Budgeting [41, 72]. This means that projects have to be placed in relation to all other projects of the company, and evaluated in the light of the organisational goals and strategies [6, 10, 20, 85]. Focusing the capital budgeting system on only one phase of the process - ranking and selection - is therefore a shortsighted view [41, 72].
2. Prior to appraisal, it should be ensured that there is a proper capital budgeting system and an adequate organisational structure to support it (Camillus [13], King [41], Pike [71], Pinches [72]).
3. The analysis of a project should be broadened so as to include other dimensions, such as the organisational and managerial aspects of the project, political aspects, social acceptability, environmental problems, etc., according to the type of project (see for e.g. Baum & Tolbert [8] and the World Bank publications [87]).

The increasing number of audits on past projects and case studies on the success and failure patterns of a project, as reported in the literature, support the need to increase research in the field, as many risky factors were found to be related to it (see, for example, Baum & Tolbert [8], Hayfield [28], Hall [29], Honandle [34], Morris [57], and Paul [63]).

2.2.1 Capital Budgeting Systems, Organisational Influences and Project Organisational Interdependence

• Capital Budgeting systems

A large amount of work has been done in the study of capital budgeting models. Dobbins & Pike [20] point out that the start of any capital budgeting system should be the establishment of organisational objectives or goals, so that the same overall objectives are to be applied as the criteria to choose a project among the different alternatives. In

this way, capital budgeting and organisational planning should be closely related. The capital budgeting model they recommend includes the following stages: recognition of opportunities of where to invest, screening, definition of project and alternatives, evaluation, and control. The same/similar model is proposed by other authors, such as King [41] and Pinches [72]. King states the organisational influences in the process at each of these stages: the budgeting and planning procedures at the triggering phase; the strategy, structural and situational factors at the screening and definition stages; and the company criteria and procedures for the evaluation, transmission and decision stages.

- **Organisational Influences**

Camillus, in "Designing a capital budgeting system that works" [13], looks at the kind of design for capital budgeting systems that should be used by the different types of organisation - entrepreneurial, functional, division and conglomerate organisations - in order to account for a capital budgeting model similar to the ones mentioned (his own proposal includes communication, triggering, screening, definition, evaluation, transmission, decision and monitoring). Among the techniques that he recommends to each type of organisation, for each stage that needs formalisation, we can find:

1. **For communication:**

- active involvement of both corporate and divisional managers in the setting of the strategic plans;
- use of plenary meetings of managers from all levels of organisation;
- an analysis of the strengths and weaknesses of the divisions in the light of the corporate perspective.

2. **For triggering:**

- provide channels other than the usual hierarchy for submitting ideas, e.g. 'IDEA' systems as used in Texas Instruments, where funding from the formal planning system is given;
- analysis of strengths, opportunities, faults and threats - 'soft' analysis - especially for large organisations;
- 'shocking objectives', i.e. triggering forced by the highly demanding objectives set by corporate managers;
- portfolio planning models, e.g. BCG growth/share matrix, suggesting areas where investments are highly favourable, or areas where divestment should be done.

3. For screening:

- involve higher level managers in the idea-generating stage of the process, for commitment and for communicating top managers' criteria to lower level managers, so that ideas from previous stages are supported.

4. For definition, evaluation, transmission, decision and monitoring,

- the use of conventional capital budgeting systems that already formalise, in most cases, these stages; it includes classification of the project into categories, delegation of authority for decision, and formal post-audits for monitoring.

Other structural means to increment the capital budgeting decision process include the parameters used to evaluate and reward performance. They should reflect this type of capital budgeting system - not based on short-term profits but on long-term and strategic goals (in a survey made by Quinn, as mentioned by Pinches [72], out of 179 firms, 79% reward executives for short-term performance and only 42% offered long-term incentive plans).

- **Project organisational interdependence**

An equally important amount of work has been spent on looking at the interdependence of the project with the company, and how to assess its importance for the organisation as a whole [51, 64]. This has been seen in two main ways:

- The synergy of the project, i.e. if that project is in the same line of business as the firm's present activities, if it would benefit from previous experience gained in other projects, or if it can share plants, services, etc.
- The strategy aspects of the project, i.e. if that project is in accordance with the company objectives; for example, if it is in a dimension that the company wants expand or not.

Both these aspects - synergy and strategy - should be as important for the selection of a proposal as the financial one. Both constitute 'key factors in capital budgeting', as "investments have impact on other units (not only on their unit performance, which generally is the only one measured - operating key factors) and on the achievement of long-run company objectives - planning key factors" (in Petit [65]).

A way of assessing the value of these criteria is given by Wissema in "How to assess the strategic value of a capital investment" [85]. Wissema proposes the constitution of an index, based on weights given to each item of a questionnaire concerning the synergistic and strategic aspects of a project. The strategic questions relate to three main areas:

- corporate objectives
- product-market combination
(objectives expressed in terms of certain market shares, and competitive power)
- functional departments
(such as sales department and marketing department)

The weighted average of the answers will give a certain mark for each proposal, possibility then its ranking. The weights need to be uniform to all projects. It is recommended that "users of the method should not be afraid of giving relatively large weights to one or two questions. Failure to do so tends to result in moderate answers for all projects and therefore does not discriminate between projects".

Another method for both strategic and financial evaluation was proposed by Derkinderen [19] - the Potential And Resilience Evaluation (PARE) - which consists of an assessment of:

- Potential of the firm to generate and utilise attractive return possibilities.
This potential depends as much on the financial capacity as on other aspects, such as manpower, expertise, organisation and flexibility. (The capacity to utilise this potential is the action range of the firm.)
- Resilience.
This is the ability of the firm to cope with the adversities associated with its projects (risk) and to handle any contingency (endurance).

Through this analysis of the potential and resilience aspects of a firm, a project can be positioned in terms of its relation to the organisation as a whole.

2.2.2 Overall View of Projects and Project Management

2.2.2.1 Project life-cycle

As it has been pointed out by the more recent literature, project appraisal, is only one stage of the life of the project. Whatever the type of project, they all pass through a succession of phases throughout their lives, each with its own characteristics and requiring different types of management. There is no complete agreement among authors as to the identification of these phases. The number may range from three to six, but most tend to identify the following ones (as Morris [56]):

1. **A conceptual phase**, when projects are identified and feasibility is established - financial, technical and non-financial. This is the time when all high-risk levels should be examined before the detailed work is defined (the next phase will examine more closely the proposal until confidence in the possibility of success is achieved). As stated by Asbury [3], the establishment of feasibility can only be recognised by the level of confidence achieved in the project team, as only this feasibility can actually be proven for the technical part.

This stage includes the analysis of alternatives, development of basic budgets, set-up of preliminary organisation, definition of size and location, and also arrangement of some preliminary financial and marketing contacts.

2. **A planning or design phase**, when all work from the first phase is detailed and the remaining risks are identified. All major contracts are defined, and prototypes may be built.
3. **Execution phase** (construction + manufacturing + installation), which is the time to develop into reality the plans previously defined. This will involve a much greater number of people than before, requiring a redefinition of the organisational structure. Estimation is greatly replaced by monitoring performance and keep it within target.

During this stage, all construction works and major installation activities are completed.

4. **Turn-over and start-up phase**, when installation is completed, final testing done, and resources are released to the start of normal operations.

In practice, there might always be a certain amount of overlap between phases, and often, for smaller projects, these phases tend to blur [56].

At the end of each stage, the project can be dropped forward to the next one or recycled back for reshaping and redefinition - as more information will always come along. This is an iterative cycle. One of the keys to good management is the proper definition of the amount of work to be done in each phase before moving to the next one [56]. Too much overlapping or concurrency is one of the major factors for cost overruns. This is especially true when new technology is involved, in which case it is advisable to make use of an incremental development policy if possible, i.e. each phase completed before starting another one that uses the prior results (Cohran [18]).

2.2.2.2 Approaches to project management

Project appraisal is part of the project management work. Modern project management has its point of reference on a systems model coupled with a contingency approach. Morris provides a useful systemisation of the systems' perspective [56] which will be summarised in the following lines.

According to Morris, systems thinking "is behind the need of project management itself (given the emphasis on viewing a system as a whole), the need for clearly defined objectives, the recognition that projects are organisations in constant change and the need to define and manage the major subsystems and their interfaces".

Morris considers the project's main subsystems and suggests some key factors for its management. The main subsystems derive from three sources:

- (A) From the project life-cycle (each project stage).
- (B) From the project management levels:
 - Level I - institutional level:
Involves senior management and deals with project/outside world;
 - Level II - strategic level:
Involves middle management and coordinates the manufacturing;
 - Level III - technical level:
Involves technical management and manufactures the project (technical content of the project).

The involvement of each of these levels is different during each phase of the project life-cycle. Managerial skills are also different at each level - at the feasibility stage, levels I and II are the ones more involved. According to the author there is little work in the literature that deals with the level I issues such as the relations

with the media, local and federal government, regulatory agencies, lobbyists and community groups.

(C) From project operation:

- Project/outside level:
(financial and commercial arrangements, manpower, relations with outside groups, etc.);
- Infra-project level:
(provision of infrastructures, organisation, realisation of project definition).

These subsystems present a fundamentally different characteristic - they are either dynamic or static. Dynamic subsystems relate to the way the project develops - life-cycle subsystems are all dynamic. Static subsystems represent on-going operations. According to their type they will need different managerial attention. According to the type of subsystem, there are dynamic interfaces (between and within dynamic subsystems) or static interfaces. The systems perspective of project management lies in the management of these project interfaces (change points). Each interface presents a different size that may be measured by the degree of differentiation between subsystems. Typical measures of differentiation are:

- Organisational structure
- Interpersonal orientation
- Time horizons
- Goals and objectives

According to the degree of differentiation, more or less integration may be necessary. For subsystems which are in continuous interaction the ways to achieve it are through liaison devices:

- liaison positions
- task forces
- special teams
- coordinators
- full project management
- matrix organisation

(in increasing order of integration potential).

Integration becomes particularly important when the degree of organisational interdependence is significant such when:

- the goals of an enterprise bring the need of different groups to work closely together
- the environment is complex or changing rapidly
- the technology is uncertain or complex
- the enterprise is changing quickly
- the enterprise is organisationally complex

Morris then suggests some key points to manage project interfaces, such as:

1. Keep static interfaces clearly defined:
 - very clearly define lines of responsibility and authority;
 - delegate work according to these lines;
 - do organisational checks and balances.
2. Do early and firm control of technical definition (seen as essential to success).
3. Vary managerial skill requirements according to the management level and stage of the project:
 - typically, large projects require a decentralised organisation during production, with centralisation before and after;
 - project organisation must change according to the needs of project size and complexity;
 - once decentralised, with informal controls and communication proliferating, projects require a substantial management superstructure to effect the necessary coordination (in informal organisations, where formal reports are fewer, there is a danger of assuming that things are happening when they may not be).
4. Each major project change point requires its own distinctive total management (feasibility to design is economically the most important step, which points to the need to do a thorough feasibility study).
5. Ensure full working out of the static subsystems at each stage of the project life.
6. Planning must be incremental.
7. Control: varies with stages of projects and level of control.
8. Personnel issues also vary with stages of project and level of control:
 - Research into the most important drivers of project success found that, for the early stages, the most important are:
 - personnel ambition and motivation

- senior management support
- team motivation
- clear objectives
- technological advantage

As inhibitors (also at early stages):

- unmotivated teams
- poor leadership
- technical limitations
- financial limitations

The management of all subsystems and interfaces relies greatly on the rôle of the project manager and his capability of viewing the project as a whole and integrating all subsystems.

Paul provides another overview of project management in his book "Managing Development Programs - The Lessons of Success" [63]. The book looks at the role of management interventions in development programs - what are the management and institutional interventions associated with successful development programs and what lessons can be learnt from their experiences. He identifies the key variables influencing a project and suggests some possible interventions according to the type of project (type of environment and complexity of project objectives).

The basic variables identified are:

- **Environment.**

This should be taken in terms of its properties (scope, diversity and uncertainty), instead of the more conventional segmentation in economic, political, social and technological aspects of that environment (which are all aspects that belong to diversity in his model).

The manner in which project tasks are grouped and its service defined must reflect the degree of diversity present. In cases of greater uncertainty, there should be greater flexibility in the strategy planned to facilitate adaptation to the unforeseen contingencies.

- **Strategy.**

It is related to the long-term decisions specifying the operating goals, policies and courses of action of a program. The degree of freedom a project manager has in formalising a strategy varies but, even when targets are given by the Government, goal-mean relationships and the trade-offs involved are seldom specified. Under competing goals, the

project manager tends to limit the operating goals and searches for a dominant one.

The strategy components are:

- the service-beneficiary - sequence strategy (i.e. define goals, what service, for whom, when?, etc.); and
- the demand-supply - resources strategy (i.e. define tasks, how?).

- **Structure.**

This is related to the structural forms, the degree of decentralisation and the organisational autonomy options.

The appropriateness of a structure can only be judged in relation to the project strategy and environment - local adaptation is necessary when certain diversity exists.

- **Process.**

This variable deals with the influence in human behaviour leading to decisions and action. The focus is on how the outcomes are reached.

It includes four critical areas of decision-making and action:

(1) **Participation process**

("a process that encourages the participation of people at all levels and gives employees the internal authority to plan their tasks may yield not only better plans by generating ideas which the top management on its own cannot do, but also impart greater motivation and commitment to the participants for action");

(2) **Monitoring process**

- see who is concerned about the information, what and how, etc.;
- it can be a tool for raising commitment and motivation of people;

(3) **Human resources development process**

- recruitment, selection, training, etc.;

(4) **Motivation process**

- economic and non-economic motivation factors.

All these four variables interact and from the interaction effects a certain level of performance will be reached.

Among the ways to increase performance in which to intervene in each of the variables (in the three last ones, as environment is taken as the context to which to attend in all the others) Paul suggests:

- **Strategic Interventions:**
 - choice of goals:

best choice is a single goal, in particular for projects with scarce techno-managerial resources. If various goals are necessary, it should be best done sequentially.

(This approach is also suggested by Baum & Tolbert in [8] for large projects: Complex objectives - identify which activities are central to the project's primary purpose and concentrate resources on them; when the primary function is well established, then do the secondary objectives.);
 - integration of inputs to produce and deliver the service;
 - learning from pilot projects:
 - past experience can play the rôle of pilot test;
 - same people should be involved in the pilot project and in the project so that lessons can be learned;
 - demand mobilisation:
 - in economic projects, market linkages and economic incentives play a key rôle, whereas in social projects community participation is the key;
 - greater attention should be paid when the complexity of the environment is high and multiple social goals are the objective;
 - phasing the project:

means by which large projects can successfully build on experience and can adapt to uncertainty, diversity and scope of the environment and scarcity of managerial or technical resources.
- **Structural Interventions:**
 - careful design and dynamic adjustments of structure over time are essential:

successful leaders create or adapt their organisational structure to reinforce their strategies. For complex environmental projects, the use of a matrix form is advisable;
 - considerable reliance on interorganisational cooperation through network structures rather than on hierarchical control through vertical project structures (in particular, for greater complexity of projects and environment; use of multiple sources of lateral influence; political support; joint planning, etc.);

- degree of decentralisation that matches the project strategy and the complexity of the environment - it should increase with complexity;
 - organisation autonomy should rise with the complexity of a project and its environment.
- **Process interventions:**
- beneficiary participation, attention to selection and training, formal monitoring, motivation through non-economic incentives, etc. All should increase with project complexity and environment;
 - project performance is facilitated by project manager flexibility in staff selection and a strong emphasis on training and commitment creation.

Paul's argument is that, by taking the adequate interventions in all basic variables of the project and according to the specific type of project and environment, project performance can be positively influenced. His emphasis is on a contingency approach to do that: "A blue print approach is not workable".

2.2.2.3 Other aspects

• Planning

"Many organisations have found planning to be the key to project success in meeting growing and changing conditions" Kelley [38].

Planning should be done all the way through the life of a project. According to Kelley "the larger and complex a project, the greater need for planning early", although "the dilemma is, it is then when the information on which to base the plan is less certain". It should be done incrementally: "successful planning should be a continuous iterative process ... as new information is being acquired as the project moves ahead ..." and "Planning must provide feedback points for new information and the flexibility to assimilate and act on it".

Morris reinforces the idea of an incremental planning process: "Planning must be phased to the stage of the project life-cycle..., it cannot be done comprehensively at the start; ... Initial planning must concentrate on building viable planning bases for each principal subsystem: detail being added later in phase with the project schedule" [56].

- **Risks management**

Risks should be identified **at the start** to adopt the measures against them, and then following them to keep them under reasonable control. People tend to rush over this or just identify some and do a thorough analysis on those only (Hayfield [28]). Hayfield says that the risk management function itself is not always evident on projects. "This function should start by an indoctrination of the project people of the risks involved going to a simple control system whereby any situation creating a risk or leading to a recognised risk is immediately signalled and a reaction generated".

2.3 Feasibility Study and Areas of Analysis

The early phases of a project are decisive to its success or failure and many authors advise that time should be taken to establish feasibility without "rushing to do the real work" (e.g. [28]). "It is in the initial stages of the project", says Hayfield, "that we can make or break a project. It is during these phases that the more important decisions are made ... When a project has started badly, it demands much greater effort than usual in order to try to bring the project back to where it should be".

2.3.1 World Bank methodology

The feasibility studies must cover all areas of a project, right from the first studies. A comprehensive approach is suggested by Baum & Tolbert [8]. The areas of analysis should cover the following aspects:

- technical
- financial
- commercial
- economic
- sociological
- institutional

These aspects are to be analysed, both separately and interdependently, as they all are interrelated and affect each other. The design process must always involve trade-offs between the five factors. It is the whole package that must be optimised.

Financial, commercial and economic aspects are outside the scope of this thesis, so no reference will be made to them here.

The technical area is concerned with questions of:

- physical scale, layout and location of facilities;
- technology to be used;
- appropriateness to local conditions of the technical standards adopted;

- approach to be followed for the provision of services;
- the realism of the implementation schedule;
- the likelihood of achieving the expected levels of output;
- review of cost estimates and the engineering or other data on which they were based in order to determine their accuracy and see if the margin allowances are adequate;
- procurement arrangements;
- procedures to obtain engineering or other professional services.

(The two latter aspects are included by Baum & Tolbert [8] in a separate analysis, although they often appear in other World Bank publications under this heading.)

The institutional aspects relate to organisational/managerial aspects. In the World Bank's methodology, they include five major groups of topics:

1. Decisions behind the choice of project management arrangements and institutional development objectives (prior experience in the sector; partnership analysis; distribution of power, benefits, etc.).
2. The project's structural, organisational, managerial, administrative and control arrangements and methods.
3. The institutional development objectives.
4. Schedule for implementing institutional changes.
5. The definition of criteria to be used in monitoring and evaluating the performance of the implementing agency throughout the duration of the project.

(This view of institutional analysis has in mind a large amount of projects implemented in developing countries in which the World Bank has been involved.)

The sociological aspects are taken in the World Bank classification in a broad sense to include social, environmental and political aspects. The sociological analyses should include the following four areas:

(1) Socio-cultural and demographic characteristics

Comments:

- design of the project should take them into account;
- very important when the project affects specific target groups, such as ethnic minorities (women, etc.).

Characteristics to be considered:

- patterns and distribution of human settlements;
- size, social structure and organisation of communities (population density, class composition, etc.) (the homogeneity of the population is frequently wrongly assumed; all groups should be identified).

If any resettlement is needed, it should be ensured that the population would be better off or at least not worse off (it may be necessary to scale down or stop the project because of these costs).

(2) Social organisation (the way in which the project population carries out productive activities)

- Land tenure, structure of household, how it affects availability of labour, seasonal wages, etc.

(3) Cultural acceptability

- Project design must be compatible with local customs and needs **as perceived** by beneficiaries. ("Project design is sometimes more influenced by the planners' own culture than by the people directly affected by it".)

It is the World Bank's own experience that the project results forecast has been often optimistic because planners overestimated the appreciation of the project by the beneficiaries.

- Local groups must understand the project, agree to it, and be capable of operating and maintaining it.

(4) Social strategy (to elicit commitment)

- Involve locals; consult them before defining the project objectives and/or major changes; discuss and agree with them the terms of participation to make sure that they are acceptable. ("A project can get into serious difficulties if it fails to motivate a work force or build a viable community for its workers and their families".)
- Project design must build on local experience.

The four areas above, like any other dimensions, should be started at the identification stage and continue throughout each stage of the project cycle.

If appraisal determines the project as a high risk socially, it is advisable that a pilot project is set up or that it is postponed. Where possible, technical aspects should be modified or eliminated if they make the project socially risky. It is also advised that an information and motivation component be included in the project to accelerate the necessary social changes. There should be enough built-in flexibility to allow design changes in response to socio-cultural information. It is also essential to listen to what the people say, and to try as far as possible to fit their ideas into the scheme.

The purpose of this analysis is to consider a suitable design for projects, so that they fit into the community and/or improve it - a project ignoring cultural traditions, local values, etc., has little chance of success, as referred to by Tolbert & Baum [8].

2.3.2 Contributions from other authors

The importance of organisational, social, political, environmental and technical aspects has been emphasised by several authors.

2.3.2.1 Technical aspects

The appraisal looks into the technical alternatives, the solutions proposed, and the expected results. It should be ensured that the options followed are appropriate to the circumstances of the project objectives, the enterprise, and the country (the impact on intended beneficiaries and local conditions).

In relation to the choice of technology, it is emphasised, in particular, that "developing countries should not be the proving ground for advanced technologies being developed elsewhere and with the needs of other countries in mind".

Technical reasons are behind many project failures. Several case studies lead to this conclusion, for example [14, 18, 28, 40, 59, 57]; the main reasons pointed out by these studies are:

- change [14, 28];
- bad definition of the project [28, 59];
- concurrency [18, 59];
- enter into novelty too fast [18];
- design not proven before final commitment to project is made [57].

One of the major lessons in Kharbanda's & Stallworthy's "How to learn from project disasters" [40] is that change is expensive ("The later the change occurs, the more

expensive it will be" Kharbanda says and, therefore, "It is best to prolong the design stage if necessary").

'Losing control of design changes can sink a project', is one of Hayfield's conclusions in [28]. "Depending upon the circumstances, modifications cannot be avoided but they can be minimised and their impact can also be minimised", he adds. The need to control design changes was one of the lessons of the Tunnel Rail Link in Morris & Hough [57].

Poor project definition is associated with cost growth and poor performance, according to RANDS studies on pioneer projects (where the data is from) [18].

The effects of concurrency was the particular object of Cohran's study in "Concurrency and disruption in new product innovation" [18]. By concurrency it is meant the "concurrent performance of the product development and production functions". There are two main factors behind it:

- the uncertainty inherent in the product development process, which causes delays and changes to the design;
- the urgency of delivering operable units.

Entering into novelty too fast was one of the causes of the failure of the SRAM project (Short Range Attack Missile). This project was, according to the author, "a too ambitious step" to advance the state of the art in solid propellant rocket [18]. He advises gradualism in technological innovation.

Design not well proven was behind another case studied by the same author - the BART project (Bay Area Rapid Transit). In the BART project, sophisticated technology was not well proven before implementation, and changes that had to be done afterwards led to increased costs and delays [18]. In Hayfield's opinion [28], to stick to a proven design on a plant with technical reliability may be conservative, or even negative, with regards to progress, but it is a sure formula for success. "To innovate is perfectly in order", he adds, "but all parties should be aware of the risks at the start".

Morris & Hough found among the preconditions of success in major projects [57] the following factors:

- good design/technology management, especially where there is technical uncertainty or complexity;
- avoidance of concurrency as far as possible;
- comprehensively and clearly communicate project definition.

Finally, Arditi et al [1], in the study of the reasons for delays in public projects in Turkey, pointed out:

- delays in design work;
- large quantities of extra work;
- frequent changes in orders.

2.3.2.2 Organisational and Managerial Aspects

"As the project gets larger and more complex, we get away from overquantified approaches to look more at organisational factors - people become more important", Kelley [38].

These factors, which will be reviewed, include the choice of organisational structure and partnerships, selection of the project manager and project personnel, leadership styles and managerial aspects related to it: participation, team spirit, information, communications and decision-making.

• Organisational structures and choice

The current thinking on this matter is illustrated by Honandle [34]: "organisational choice and managerial practices offer explanation for differences in success ... There is no optimal way of organising - there are trade-offs and the local situation determines the relative advantage of each option".

There are three basic types of organisational structure:

- Functional structures
- Project structures
- Matrix structures

(this represents all kinds of intermediate situations between the two previous ones)

Functional structure is the prevalent form among organisations: it corresponds to the basic hierarchical structure (standard pyramid). In it, organisation is divided according to each discipline and people report to functional managers. Its main advantages lie in the centralisation of similar resources; it enables people to stay in touch with new development in the fields - mutual support is provided by physical proximity. Weaknesses are that, if an organisation has multiple projects, conflicts over priorities for different projects arise [37, 88].

Project structure groups all resources necessary on the basis of a specific project, separating them from the rest of the organisation (internally, project organisation is still functional). It promotes better interdiscipline, but it is more

difficult to keep pace with new developments. It is more of a short-term view. Its advantages are: unity of command, singleness of purpose, and allowance for effective informal communications. It is an horizontal structure [37, 88].

A matrix structure is a combination of the vertical hierarchical structure with the horizontal one. People report both to a project manager and a functional manager. The main disadvantage may lie here: men in the middle work for two bosses and it is easier to be caught in a conflict between them (if rôles and authority are not clearly defined) [88].

Katz & Allen [37], Morris [56, 58], Adams & Bardnt [68] and Youker [88], wrote some of the papers dedicated to the choice of an organisational structure.

Katz & Allen studied the relationships between performance and the relative dominance of project manager and functional manager in three areas of decision-making within the project teams (technical decisions regarding project activities, salaries and promotion decisions, and staffing and organisational assignments to particular activities), and for influence in the overall organisation. According to the research results (higher performance when balance of authority over salaries and promotion decisions is perceived; and highest performance when organisational influence is centred on the project manager and influence over technical details of work is centred on the functional manager), he advises that matrix organisations should be defined along project manager and functional manager rôle differentiation, for higher performance (among dimensions of influence and not joint responsibility), the project manager should be more outward looking (external relations and activities, and output side of the project), should be concerned with gaining resources and recognition for the project and linking it with the other parts of the business, and should have necessary back-up from higher management to obtain critical resource to coordinate project's efforts with marketing and manufacturing. The functional manager is more inward-looking, and should be concerned with technical excellence, seeing that the project's input includes state-of-the-art technology. The rôles should not be completely separate, however; for example, relations with marketing and manufacturing have critical implications for technical content and *vice versa*. The balance between the project manager and the functional manager would be the key.

Morris favours a contingency theory of organisations. Whatever the merits, he says:

1. The full project manager rôle - with a project manager in overall command of the project - does offer stronger leadership and better unity of command (better for achieving the big challenge).
2. Matrix organisation is more economical on resources. For this reason alone, it is often almost unavoidably used for large and complex projects (he refers to this type as the most complex one, needing a division of

responsibilities between the person to decide the 'what' and 'by whom' (functional manager) and the one to decide the 'when' and 'for how much' (project manager)).

3. It is quite common to find a project manager on top of a matrix structure - the two forms are not incompatible - providing the ultimate decision-making authority and leadership.

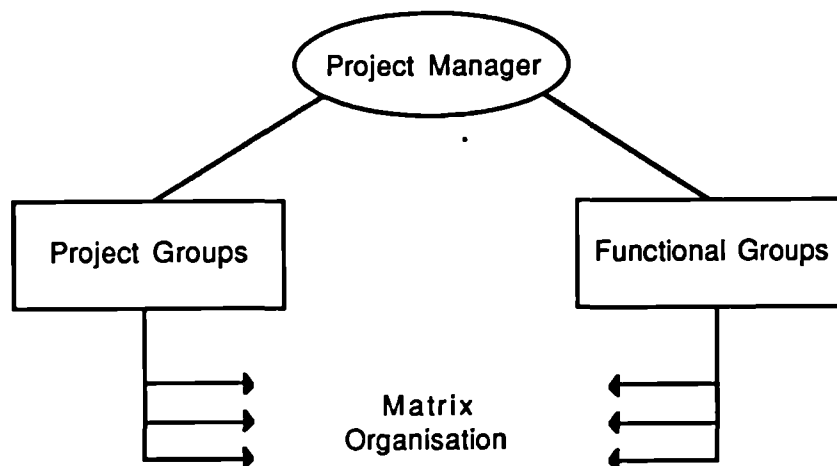


Fig 2.1 - Typical use of the project management and matrix organizations simultaneously (figure as in reference [56]).

In Chapman's opinion, as stated in Baker & Wilemon [6]:

- A matrix structure works best for:
 - small, in-house projects;
 - where project duration has 2 years or less;
 - where a field installation has a substantial fluctuation in the amount of project activity it is handling.
- A matrix structure begins to lose its flexibility on large, long duration projects, where a more fully projectised structure is appropriate.

Reeser, also quoted in reference [6], found some unique human problems related to project organisation, such as: insecurity about unemployment, career retardation, and less loyalty to their organisations (the first two may be minimised with special remuneration terms).

Adams & Bardnt relate the type of organisation to the life-cycle of a project. In this research, they also looked to other organisational variables, such as size, climate, conflict, and job satisfaction. A mechanistic structure was distinguishable

(more or less corresponding to the functional type) with communications downward, high formalisation, low intergroup cooperation, and infrequent task feedback; and an organic structure (more or less the project type) characterised by high intergroup communication; open communication channels, low formalisation of rules and procedures, and lack of adherence to the chain-of-command. These types vary along the project life-cycle. In the conceptual phase, research indicated that teams are small and a relatively organised type of structure is used. In the planning phase, structure is generally organic but with significant mechanistic characteristics - a consultative system (relatively large work groups organised along semi-organic lines with mechanistic tendencies). In the production phase, the type of organisation is still organic with some stronger mechanistic tendencies. Finally, in the start-up and turnover phase, the size of project decreases again and with it the mechanistic tendencies. Morris, in reference [56], had also stated the need to change project organisations according to the development of the projects. Typically, he says, Major Projects require a decentralised and more formal organisation during production, and a more centralised one before and after. ("The great importance of the initial strategic planning and design phase requires unified direction. This dictates a centralised decision-making process and structure", he argues.)

Youker, in "Organisational alternatives for project managers" [88], presents the different alternatives of organisation, according to environment and nature of task, and the criteria to choose among them. He relates the type of organisation to the type of project manager involved. Organisational choice is again put into perspective through a contingency point of view - he presents a list of key factors to choose the right organisation structure for the given conditions of a specific project and the given organisation and environment. Those conditions relate to uncertainty, technology, complexity, duration, size, time criticality, number of customers and importance of project. For all medium situations, he favours a matrix type of structure. For strong situations, he suggests either a project form (in high complexity, high technology, large size, etc.) or a functional form (in the opposite conditions). It is also both possible to use the three situations on the same project - at different levels - and in the same company - on different projects. For the choice of a structure, three other elements must be considered:

1. Relationships between organisation, design, project manager, and planning and reporting systems.
e.g. In a project form, the project manager has to have the skills of a general manager, and planning and reporting can be fairly simple as teams are in close proximity.

2. See if there are ways of improving coordination and commitment in the functional structure without moving to a project or matrix structure.
e.g. Develop methods of lateral communication across functional departments, through plans, review meetings, direct contact between managers, informal liaison rôles on teams.
3. Note the many variations of the matrix structure one can use and its advantages.

(Two of the ways to differentiate between a strong and a weak matrix are:

- the percentage of personnel that stays in departments (the greater, the more functional the emphasis - usually some functions, like accounting, will always be performed by the functional structure); and
- the degree of power between functional departments and the project staff.)

The matrix type is referred to as the more difficult one to work with. To deal with it, Youker suggests:

- (a) differentiation of rôles: project manager/functional manager;
- (b) project coordination must anticipate conflicts in the matrix;
- (c) take positive steps for developing team work (e.g. social gatherings);
- (d) use project plans and budgets to hold departments to their commitments (should be signed by functional heads);
- (e) best to avoid direct conflict with functional department head (a matrix manager should use his boss when caught in between);
- (f) do not supervise functional department too closely - remember that the project manager is concerned with the 'what' and not the 'how';
- (g) continuing planning to reduce uncertainty - from which most conflicts arise.

Other authors stress the need to be flexible in choosing the organisation and in working with it. Kelley says "We must be fluid in thinking, not letting organisational charts rule the project. We must be able to regroup large numbers of people and quickly define authority and responsibility to meet new situations" [38].

Hayfield [28] says that often organisations are used or kept too rigid, or the definition of some positions are incompatible or inaccurate. Equally, the division of responsibilities can be unclear or ambiguous. These are major causes for failure. On

international projects, he says, the geographical dispersion of the project organisation needs careful attention to minimise overrepresentation and yet have effective presence and avoid confusion.

In several other case studies, organisational factors were found to be a cause of project failure (delays, cost overruns, etc.).

Baker [4] found the cost of overrun to be the use of a functional organisational type when a projectised form was needed (in this study, a project form of organisation is most often associated with perceived success).

Asbury [2] reports that, according to managers, matrix management involving responsibility to both the project manager and the functional manager is not well accepted in the UK (1982). The project manager is not given sufficient authority and many thought his first function would be information handling and not decision-making.

• **Partnerships**

In large projects, it is common, given their size, complexity or risk, for more than one company or government to be involved. Past experiences advise that there should be one person in the overall charge.

Sykes [80] recommended that it should be ensured that participants are compatible. He advises:

- minimum numbers - as every participant adds to the number of interfaces and every interface adds to delay ;
- maximum compatibility - it is worthwhile to have a majority clause to avoid very prolonged decision-making or to allow the buy-out of smaller participants if necessary.

Baker also recommends that it is best to keep to the minimum number of government agencies involved, especially in public projects where public participation is unavoidable. A single source of funding and authority is also more successful [4].

World Bank experience advises that, in the case of more than one agency running the project, the analysis of the likely distribution of power, benefits and influence derived from the project is useful in designing the strategy, management and administration of the project [8].

• **Rôle of project managers**

Within a systems perspective, there is a critical need for "an across-the-board integrating rôle" to be played by the project manager (see, for example, Kelley [38], Morris [56], or Sykes [80]). To be able to do this, a project manager should see the

project as a whole and have the necessary multidisciplinary skills as it is important to compromise between different disciplines (e.g. the best engineering solution may cause too much environmental or social opposition to be implemented). Sykes [80] finds multidisciplinary skills and experience the most essential factors for choosing a project manager. Multidiscipline is very important because senior management is, in most large organisations, dominated by engineers and therefore the engineering aspects of problems tend to receive the most attention in the pre-construction phase of the project to the detriment of other problems, such as political, organisational, etc. Experience is especially important on the really difficult projects. It has to be gained on other major projects but is irrespective of industry as the peculiar features of project management are more a function of size than type of project. Morris, also regards experience as a vital quality for a project manager ("The project manager should have a mature understanding of the way projects develop as all projects, regardless of size, type, etc., follow a broadly similar pattern of development" [56]).

Kelley [38] says that:

- the project manager must be an innovative, entrepreneurial leader "... a good project manager quantifies the key variables at the project planning process - these may or may not be the ones the standard system would give. He determines the variables that are different for particularly new and innovative projects ... He must identify the external factors, such as regulation, early on in the planning stage and must be aware of external pressures from government agencies to the public and the financial community, all of which are generally transferred to the project". Because larger projects require many people, he needs to delegate more and manage people better; "He has to manage the project more remotely, through other people and through directions".

Baker & Wilemon [69] also advise that the activities to be kept under direct responsibility and executive control of the project manager should be kept to a minimum - especially in complex projects.

At a project manager forum, reported by Asbury [3], managers characterised a project manager as someone with a good sense of structure, both in designing the interdependency at the planning stage and monitoring progress through the life of the project; someone who must ask the right questions, who takes the risk, who is able to express himself objectively and unambiguously, and who does realistic estimates (with the help of techniques).

kharbanda & Stallworthy [40] say that a project manager's function is one of negotiation all the way. To do it well, he really should know how to listen: "looking for the solution without listening to the problem is working in the dark".

Baker, Murphy & Fisher [5] found that technical skills followed by human skills and administrative skills were the most important for a project manager.

Katz & Allen [37] found that projects with relatively more powerful project managers (greater organisational influence, at least as perceived by their teams) are somewhat higher performing than are other projects - people want to be in the winning team.

Myers & Devey, in a study to relate management and performance - "How management can affect project outcomes" [59] - found that:

- a single project manager with decision-making authority over the project is the best solution (even when a team approach is used); and
- turnover in project managers is related to higher than expected costs and poor plant performance. This would suggest having the same project manager for all the project life.

The above was found to be more important in pioneer projects than in the ones using commercial technologies.

• **Project personnel**

Along with the project manager, all other project personnel - in particular, senior management - should be chosen criteriously (with experience and skills). Sykes [89] refers to the need to have an appropriate senior team for recommending policies to the project board and for implementing policies once agreed. He considers as essential that their loyalty is exclusively to the project and not to a particular company or organisation. To ensure complete integrity (i.e. not to continue a project if not necessary), unique remuneration terms should be agreed. The same prerequisites as those for the project manager apply to their recruitment: experience and multidisciplinary skills. Along with this 'inner project direct group', Sykes defends the idea of a project directorate consisting of recognised experts - for example, recently retired people or those at the end of their careers, and when they do not want to be in a particular project - that would provide the board with the most objective advice: giving suggestions, reviewing stages of the project, reviewing the projects main problems, policy options, and providing terms of reference for the project's senior management. The same idea, as discussed in MPA meetings [47], is to avoid personnel and organisational biases, maximise managerial competence and is a way of holding expertise (as teams break up at the end of each project and experience tends to

become lost) [57]. It is especially important in the early stages of projects before the go-ahead to full implementation.

The good selection of all project personnel is essential and it is many times the cause of unsuccessful projects, as investigated by Hayfield [28]. He says, "the right person for the right job is well known but often insufficient attention is given to the selection of key personnel - sometimes the ones available until someone better turns up". Hayfield also draws attention to the need to have a replacement plan for key positions (in case someone decides to resign unexpectedly).

• **Decision-making**

The project manager should be given sufficient authority to make important decisions and to direct the project team. Morris found that clearly giving to the project manager the fullest authority possible was one of the preconditions of success [57]. Also, in Baker, Fisher & Murphy's study - "Factors affecting project success" [5] - insufficient project authority was significantly related to cost and schedule overruns. This authority should be used for decision-making effectiveness and not as influence modes. Hodgetts, as quoted in Baker & Wilemon [6], researched the ways in which to overcome the lack of authority or authority deficiency of project managers. The more important ones were: competence, personality or persuasive ability, and negotiating skills.

Bad project decisions, in the World Bank's experience [8], are often the result of:

- personal and emotional attachment of some people who consider the project as a means to attain recognition;
- pressure for quick results and apparent progress;
- the project becoming involved with the prevalent political wave.

• **Team spirit**

Commitment, teamwork and a sense of unity are important areas of attention in project management (Baker & Wilemon [6]). Team spirit is particularly important in international joint ventures where people coming from different places get together (cross-cultural problems when working in a different environment may lead to misunderstandings). The project manager has a key rôle in establishing team spirit as well as the top functional managers. The latter, says Hayfield [28], often do not bother. Lack of team spirit and a sense of mission are strongly associated with the perceived failure of projects (Baker [4]).

- **Communications**

Communications are the link, and they must be effective for the project to operate well (see, for example, Stallworthy & Kharbanda [39]). Relationships along 'dotted lines' establish informal channels of communication, and they are as important as the formal ones [38]. Lack of team spirit [28], lack of project team participation in major problem-solving [6], and excessive structuring within a team may all prevent open communications.

- **Information**

Hayfield [28] refers to information as the lifeblood of a project, as it is the interface between everyone concerned with the project. The project manager has to know reasonably accurately:

- where the project is today
- where it should have been today
- its future trend

Hayfield refers to it as 'project management visibility' and, according to his study, it is one of the most vital causes of success or failure. The frequency of the information is also critical - it must be up-to-date. It should highlight the exceptional and critical items and not be a massive volume of information - keep down the volume of paperwork. Too much information is as bad as too little. Contrary to some people's assumption, noted Baum & Tolbert [8], the accuracy and flow of information comes first, and then the means (e.g. microcomputer, etc.) comes after.

- **Lessons from case studies**

Many of the above statements have been supported by several authors' case studies.

In Stallworthy & Kharbanda - "How to learn from project disasters" [39]

- we find that:

1. The Algerian LNG project failed because of lack of managerial support.
2. The 'Glace-Bay' project in Canada shows the importance of good communications, skilled staff, and worker's morale (to improve morale, additional facilities for workers - refectories, etc. - were built in this project).

Arditi et al in "Reasons for delays in public projects in Turkey" [1], found "organisational deficiencies" in both public agencies and contracting companies as among the key causes of failures. "Whereas public agencies claim that site manager's

administrative and financial autonomy is too limited for efficient operation and that contractors organisational structure is not up to the size and type of work they undertake, contractors complain about the slow decision-making mechanism in public organisations and the bureaucratic obstacles they encounter all through the construction process”

In Morris & Hough - “Preconditions of success and failure in major projects” [57] - we were shown that:

1. A precondition of success is that organisational arrangements are carefully considered and the fullest authority is clearly given to the project manager to the greatest extent possible.
2. Effective leadership should be ensured, recognised and demanded; the leader should play the external rôle of champion and the internal rôle of motivating and decision-making.
3. Good communications should be recognised as vital and ensured to be effective.
4. Competent personnel should be sought;
5. Top management support should be ensured.

The weighting of these aspects and their importance would vary with the type of project.

In Baker, Murphy & Fisher - “Factors affecting project success” [5] - the major cost of overruns were found to be related to:

- lack of project team goal commitment
- lack of project team spirit and sense of mission
- inadequate control procedures
- over-optimistic status reports
- decision delays
- inadequate change procedures
- insufficient use of progress/status reports
- insufficient project manager authority and influence
- overall lack of similar experience

They recommend the following strategies for success:

- flat organisation structure (for large projects) and adequate sized team
- establish good public relations
- establish success criteria salience and consensus

- prevent initial over-optimism
- create a healthy atmosphere
- put the project manager and his team close to client and project site (for large projects)
- develop good overall coordination and relations pattern

The World Bank's experience from several projects suggests that it should always be reviewed and ensured that each actor is motivated, managerially competent and technically competent; that attention should be paid to gaps in technical and managerial skills; and that plans should not be faster than what can be accomplished through training existing staff [8].

2.3.2.3 Social political and environmental aspects

Kelley [28] says that social, political and environmental factors are increasingly more important to projects - "The larger the project, the more turbulent will be the impact on environment".

Hayfield [28] expresses the need to build up a positive and welcome environment in which to work, as the project will stay even after the particular company involved at the early stages of pre-production has gone.

Baker, Fisher & Murphy [5] found "unfavorable public opinion" to be one element of the perceived failure of projects. Yet, in their opinion, too much public involvement is not good for the project and may result in a "tempest in a teapot". The important factor would be to create a good image of the project with the minimum required levels of public participation. In relation to this aspect, Feldman's opinion [22] is that activists are not sufficient reason to alter decision-making, unless other factors favoured them (e.g. lack of sufficient authority in the implementing agency). Yet, although decision-making do not change their views because of protest, it may cause delay in the implementation of the project, he adds.

Concerning political risk, Miller [52] advises on the ways of dealing with it. He suggests:

- (1) There is less likelihood of future pressure to expropriate if the basic deal and the way it was negotiated are known to be fair, and therefore an outside counsel and expert consultant might be used to advise both parties. (The use of consultants is highly recommended by the World Bank's experts, especially in complex projects where the work load in-house is sufficient, or experts on the country are not available, or simply because it would be a waste of resources to staff up organisations with every need anyway. The use of

consultants would solve this need and would also provide a more objective and acceptable review in delicate matters [59].

- (2) Diversify investments.
- (3) Involve international institutions, such as the World Bank, to establish more credibility in ensuring a fair deal.
- (4) The more countries involved, the better, as the host country would be more cautious.
- (5) Try in advance to eliminate potential sources of conflict and to establish the steps to be taken if dispute arises.
- (6) Joint ventures between disproportionate economic strengths may not make for an amicable relationship.
- (7) Insure against expropriation.
- (8) Develop good relationships with officials in LDCs (Less Developed Countries). Make them feel as though they are counterparts (this means senior management should participate in the discussions).

MPA experience emphasises the need for government support [47]. It is said that political risk is very hard to quantify - "rule of thumb assessment can be made but ultimately substantial political risks must be borne by political agencies". It is also recommended that major projects allow sufficient time for public debate to allow for social and environmental problems.

Ritterbusti [75] refers in particular to international projects and the need to attend to two main risk factors - country environment, and project environment risk - the first including the overall political climate, economic situation and various social, cultural, religious and financial factors. (The project environment risk should include staff and labour requirements, subcontractors, training, availability and quality of local materials, etc.). He emphasises the need to assess this at the early stages of the project and to use managerial tools, such as work breakdown structure and task responsibility matrix.

Some lessons from project case studies can also be taken in relation to social, environmental or political aspects. For example:

- Feldman's study on Concorde [22] showed the great importance of political commitment. ("Concorde was built because the French president was committed; London III airport was delayed because the British Government was not".)
- Morris & Hough's study on the Channel Tunnel [57] concluded that it failed mainly for political reasons (their advice is that, on international projects, one should constrain nationalistic aspirations).

- A study on 57 World Bank projects by Tolbert & Baum [8] revealed that the economic rate of 30 of the projects that were found to be compatible with the social environment was more than twice that of the remaining 27 projects.

2.4 SUMMARY OF THE REVIEW OF THE LITERATURE, IDENTIFICATION OF SHORTFALLS, AND WHERE THIS THESIS FITS IN

• Overview of the Theory and Practices of Project Appraisal

This research started with the analysis of what has been the theory and the practices of project appraisal.

On the theoretical side, much of the literature has been dedicated to the financial aspects of the projects only. This has been noted by several authors, such as Camillus [13], Hastie [30], Hellings [31], King [41], Petit [65], Pinches [72] and Wissema [86]. These authors criticise:

- (i) the emphasis placed on only one of the stages of Capital Budgeting (the evaluation stage), and provide a complete Capital Budgeting system incorporating the organisational influences in the process of decision-making (budgeting and planning procedures, strategy, structural and situational factors, and the company's criteria and procedures) [13, 41, 72];
- (ii) the nearly exclusive consideration of the financial side of projects during the evaluation stage.

In relation to (ii) above, and in recent years, several authors have been emphasising the importance of incorporating other considerations in the analysis; for example:

- the analysis of the strategy and synergy aspects of the project [19, 65, 86];
- the organisational and managerial aspects, technical aspects, environmental factors, social issues and political implications of the project [8, 16, 19, 28, 39, 63]).

On the practical side, surveys carried out on companies' practices also emphasise the financial side of the evaluation (for example, [25, 67, 71, 76]). But the majority of firms expressed that non-financial aspects (legal, environmental, company image, safety of employees or the public, contract commitments, long-term

project potential, etc.) would influence the decisions and were considered as either important or very important factors in the decision-making process (for example, [25, 66, 70]). However, these factors were not part of a systematic or formal appraisal and were mostly appraised by managerial judgement [75].

• **The Shortfalls in the Literature and Where This Thesis Fits In**

(1) From the review of the literature done, it was felt that there is a need for a body of knowledge to understand, systematise and formalise the non-financial appraisal of projects.

This consideration came from the fact that (i) managers were reported not to be entirely satisfied with their current practices of appraisal whenever non-financial risk factors were present in the project (new fields of technology, foreign partners, cultural problems, political sensitivities) [23], (ii) there is a great rôle played by managerial and subjective judgement in the appraisal of non-financial risk [76], and (iii) there is little in the literature to address these factors, in particular in the interface of the project with the outside world [56]. (This research aims to contribute to such a body of knowledge.)

(2) Several studies on the lessons learnt from past projects identified non-financial aspects as determinants for the success or failure of projects (for example, [4, 8, 22, 29, 32, 39, 57, 62]). Most of these studies indicate the need to take into account those aspects in the management of projects, and as early as possible in the life of the project, but do not specifically analyse the rôle of those aspects at the appraisal stage, the risks, and how, when and by whom they should be assessed and minimised. (These are aspects addressed by the present research.)

(3) When the literature addresses the non-financial aspects of a project, its coverage of some of these aspects is fairly limited. For example, while the organisational and managerial aspects are fairly well covered in the literature (as in [2, 14, 26, 37, 59, 89]), the same does not apply to the political and social implications of the project, in relation to which fewer studies can be found. (This research aimed to address these shortfalls by carrying out a comprehensive analysis of all the non-financial aspects of appraisal and by looking at the rôle of these aspects in all the main types of major projects.)

(4) The interrelations between all aspects of appraisal, the trade-offs involved in the decision-making process, and how to gather all the elements for decision-making purposes are further areas where very little was found to have been written. Wissema [85] is one of the authors looking into the decision-making process, but the use of

scores and indices (which he proposes) for ranking and selection of projects, was not found to be favoured by managers in their practices - at least as far as 'qualitative' elements are concerned [43, 76]. (This is a further area addressed by the research.)

In short, project appraisal has concentrated on the financial side of projects only, although there is a trend (also in practice) towards the analysis of the non-financial aspects as well. Nevertheless, very few attempts have been made to put together all these aspects in a framework approach and to provide guidelines for their appraisal (the World Bank methodology and its publications concerning these aspects are one of those attempts). This thesis addresses this gap (the approach followed and the aims of the research are further discussed in Chapter 3).

- **Summary of the Contributions from Previous Work**

The contributions from the previous work reviewed, concerning the shortfalls identified above, are summarised in the following two tables: Table 1, which concerns the overall methodological aspects, and Table 2, which concerns the areas of analysis.

Table 2.1
Overall Methodological Aspects

• - the need to take synergy and strategic aspects into account; - investment programmes must be closely related to organisational planning; - the evaluation must be in the light of the organisational goals and strategies; - active involvement of both corporate and divisional managers in the setting of the strategic plans.	
• - integrate all parts of the project, clearly define major subsystems and interfaces, and use different managerial skills to manage them.	
• - managerial strategies: - phase the project: - to build on experience and to adapt to uncertainty; - to define the amount of work to be done in each phase before moving to the next one (avoid as much overlapping as possible, especially when new technology is involved); - learn from pilot projects or past experience; - define objectives clearly: with complex objectives, search for dominant goals; with several goals, these are best carried out sequentially (concentrate resources on primary goals and, once these are established, move to the secondary ones); - use back-up strategies and plans: - recognition of constant changes and flexibility to adapt; the greater the uncertainty, the greater need for flexibility to facilitate adaptation to the unforeseen contingencies ('blue print' approach not workable); - risks should be identified at the start, and then followed by control;	
• - planning: - should be done all the way during the life of the project - phased to the stage of the project; should be an incremental process; - the larger and more complex the project, the greater need for planning early; initial planning must concentrate on building viable planning bases for the following stages;	
• - key aspect: - recognition of constant changes and flexibility to adapt.	

Table 2.2
Feasibility Studies and Non-Financial Areas of Analysis

*** Feasibility studies**

- - the feasibility stage is economically a very important step. This implies the need to do a thorough feasibility study; alternatives should be looked at;
- all high risk levels should be identified at the start, comprehensively, and not just some of them;
- the variables to look at may or may not be the standard ones; this depends on each individual project (the project manager should be aware of this);

- - take time to establish feasibility; feasibility can only be recognised by the level of confidence achieved in the project team (only for technical aspects can it actually be proven);

- - the analysis should include:
 - I financial, commercial and economic aspects;
 - II non-financial areas:
 - technical aspects;
 - organisational aspects;
 - managerial aspects;
 - sociological aspects;
 - environmental aspects;
 - political aspects;
 - all areas are to be carried out interdependently as they all interrelate and affect each other;
 - trade-offs between all factors should be carried out aiming for the optimisation of the whole package, and not just one particular set of aspects.

*** Organisational and managerial aspects**

- - organisational structure:
 - there is no optimal way to organise - there are trade-offs and the local situation should determine the relative advantages of each option;
 - choice should be a function of size, complexity, duration, technology, uncertainty, and the importance of the project; it should also match the type of project management, planning and reporting systems;
 - either a matrix or project form should be used for most projects; ideally, a project form would be best, especially for the 'big challenge', but for economical reasons matrix is often unavoidable; it is common to

Table 2.2 - continued

- find a project manager on top of a matrix with ultimate decision-making and authority, especially on major projects (this offers stronger leadership and unity of command);
- when a matrix form is used, it is best to:
 - separate functional managers and project managers rôles for higher performance; project managers - outside activities (when, how much); functional managers - technical content (what, by whom);
 - avoid conflicts between functional managers and project managers (functional and project groups);
 - do not supervise functional departments too closely;
- organisational autonomy should rise with the complexity of the project and its environment;
- careful design and dynamic adjustments of structure over time are essential (typically, large projects require a decentralised organisation during production with centralisation before and after; when decentralised, there is a need for a strong (small) coordinating superstructure; bureaucracy increases in the production stages as well, where more mechanistic tendencies appear in the organisation (due to the need to coordinate a large number of personnel));
- do not keep organisations too rigid; do not let organisational charts rule the project; sometimes, regrouping is necessary;
- define well the responsibilities and positions;
- for international projects, minimize overrepresentation but stay as near to the work as possible (project manager and his team);
- partnerships:
 - keep to a minimum the number of participants and make sure they are compatible ones (in international projects, in particular, avoid partners with disproportionate economic power; in public projects, keep to a minimum the number of government agencies involved - a single source of funding and authority is also best);
 - have only one head for decision-making;
 - the analysis of the distribution of power, benefits and influence should guide the strategy, management and administration of the project;

Table 2.2 - continued

- project personnel:
 - - the good selection of all personnel is essential; special attention should be paid to the selection of key personnel - 'the right person for the right job' and not just the ones available;
 - a replacement plan for key positions might be useful;
 - performance is facilitated by project managers' flexibility in staff selection, and by a strong emphasis on training and commitment creation;
 - - projects should have an inside-project senior team to recommend policies to the project board and for implementing them once agreed;
 - a project directorate, composed of outside experts to assess the board on the major project decisions (especially at the early stages of the project when the vital decisions are taken); this avoids personnel and organisational bias;
 - - all project senior management should have experience and multidisciplinary skills (in the project board);
 - ensure each person is motivated, managerially competent and technically competent;
- project manager:
 - technical skills (need to be multidisciplinary skills) and experience are the most important ones, followed by human skills and administrative skills; experience has not to be in the same sector but in the running of past major projects (to know well how projects are developed); managerial skills may vary according to the management level and stage of the project;
 - the project manager has to be innovative, entrepreneurial, and a leader; he should identify all risks earlier and identify all key variables unique to the project and not just the standard ones;
 - his is an 'across the board integrating rôle'; he has to negotiate all the way (needs to compromise between different disciplines);
 - he should see the project as a whole;
 - he should know how to listen; to ask the right questions; to express himself objectively;
 - he should be able to overcome a lack of authority or authority deficiency; competence, personality or persuasive and negotiation ability are the most important qualities;
 - a powerful project manager leads to better performance;

Table 2.2 - continued

- the same project manager or a minimum turnover during the life of the project also leads to higher performance;
- participation/decentralisation:
 - a process that encourages participation of personnel at all levels, giving employees authority to plan their tasks, etc., creates greater motivation and commitment, leading to better performance, as well as it being a valuable source of generating new ideas that management would not come up with;
 - the degree of decentralisation should match the project strategy and complexity of the project environment (the greater the complexity, the greater the need for decentralisation);
 - especially in large and complex projects, the project manager should manage more through other people and through direction; activities under his direct responsibility should be kept to a minimum; the larger the project, the greater the need to delegate more; he should rely more on interorganisational cooperation than vertical project structure;
- decision-making:
 - a single project manager with decision-making authority over the project is best (even when a team approach is used); the project manager needs to have sufficient authority to take decisions and direct the project team; authority should be used for decision-making effectiveness and not as influence modes;
 - avoid taking decisions because of personal and emotional attachment to the project, because of pressure for quick results and apparent progress, or because of political influences;
 - participation styles are correlated with success;
- teamwork:
 - commitment, teamwork and a sense of mission are important areas of attention in project management;
 - need to create a healthy atmosphere; team spirit is particularly important in international projects (personnel coming from different cultures); the project manager, as well as senior management, has a key rôle to establish it;
 - motivation through non-economic incentives is important;

Table 2.2 - continued

- personal ambition and motivation, senior management support, team motivation and clear objectives are amongst the more important success drivers;
- information, communications and report:
 - project manager visibility (know where the project is, where it should have been and its future trend) is vital;
 - accuracy and frequency of information is the most important aspect (up-to-date information; highlight the critical items; keep down paper volume);
 - be careful to avoid overoptimistic status reports;
 - in informal organisations, when formal reports are fewer, there is a danger of assuming that things are happening when they may not be;
 - for effective communications, dotted line relationships are as important as formal ones;
 - good team spirit, team participation and not excessive team structuring are some means to establish open communications;
- * **Social and environmental aspects:**
 - in all matters, allow sufficient time for public debate and inform people in advance;
 - the use of consultants for objectivity and acceptability (and expertise);
 - community participation is the key: involve local inhabitants in discussions to guarantee that they will be motivated and cooperative; listen to what they say; make sure changes are acceptable to them;
 - include an information and motivation component in the project to accelerate the necessary social changes;
 - build up internal flexibility to allow for changes in relation to socio-cultural information;
 - eliminate/modify technical aspects if they make the project socially unfeasible; if appraisal determines the project to be highly risky socially, postpone it or start with a pilot project;
 - create a good public image; build up a positive and welcome environment to work in through the whole life of the project;
 - take social characteristics into account when designing the project - identify all groups;
 - make the project compatible with local values; the purpose of social analysis is to fit design into community traditions and values;
 - do not overestimate the appreciation of the project by the beneficiaries;

Table 2.2 - continued

- the social analysis should include:
 - socio-cultural and demographic characteristics (population density; class composition; etc.);
 - social organisation concerning productivity activities (land tenure; availability of labour; etc.);
 - cultural acceptability;
 - social strategy to elicit commitment;

 - * **Political factors:**
 - substantial political risks should be borne by political agencies;
 - the need for government support for major projects to succeed (public projects);
 - in international projects, minimise political risk by:
 - negotiating the basic deal in a manner perceived to be fair from the start;
 - diversifying investments;
 - involving international institutions for credibility;
 - involving more countries;
 - establishing in advance the steps to be taken if conflict arises;
 - being careful with joint ventures with disproportionate economy strengths;
 - developing good relationships with LDC officials; make them feel to be counterparts;
 - trying to constrain nationalistic aspirations;

 - * **Technical aspects:**
 - avoid concurrency;
 - avoid changes;
 - prove design before final commitment to the project;
 - do not enter into novelty too fast;
 - comprehensively and clearly communicate project definition;
 - have a good design/technology management, especially where there is technical uncertainty or complexity; and
 - assess the appropriateness of technology to local conditions.
-

CHAPTER 3

RESEARCH MODEL AND APPROACH

3.1 INTRODUCTION

The review of the literature presented in Chapter 2 indicated the need for further research in the area of project appraisal, in particular to see the rôle played by the non-financial aspects of projects.

Furthermore, surveys on the practices concerning project appraisal showed that the financial side of the project was the only one to be assessed by companies in a systematic way [25, 68, 71, 76, 79]. Non-financial aspects were considered to be important, and the majority of companies would approve non-profitable projects on other grounds, such as social, environmental, political, or legal factors. These factors were mainly assessed through subjective judgement, and were considered to be 'additional aspects' to be attended to; they were not part of the normal appraisal. In addition, most companies considered their own methodologies not to be satisfactory whenever novelty was involved in the project (such as technical novelty, political sensitivity, or cultural problems).

The above indicates the need to develop an analytical framework that companies could use in order to assess a project in a systematic way, taking into account all its aspects and effects on the organisation, including the non-financial ones. This was the basic starting point of the research carried out.

This chapter presents the research methodology followed and the reasons behind that procedure: how from the literature an initial framework was designed (section 3.2), how from that the research approach was designed (section 3.3), how from research design the work progressed and the methodology followed (section 3.4 - analysis of a case study, and section 3.5 - design of interviews, company selection, extraction of data), and finally, how from the data that came out of the interviews the conclusions were made and presented in this thesis (section 3.6).

3.2 WORKING BASIS - Shortcomings of the literature and design of an initial framework.

The working basis of this research was provided by the literature survey. From the review of the literature, it was felt that there was a need for a body of knowledge to understand, systematise and formalise the non-financial appraisal of projects. When the literature addresses the non-financial aspects of a project, its coverage of some of these aspects is fairly limited (see chapter 2 section 2.4 above). Both shortcomings and contributions of previous work in the area, as summed up in the previous chapter

(pages 48 to 56) provide the basis for the design of a framework to take into account the assessment of all non-financial aspects of a project. Three overall conclusions were taken from the literature reviewed:

1. Recent literature pointed out the need to look at the whole context of evaluation, to the capital budgeting systems and the organisational structure to support it, and to the overall methodology and strategies used in the appraisal (see Chapter 2, Sections 2.2.1, 2.2.2 and 2.2.3). The main propositions were summarised at the end of the previous chapter in Table 2.1: Overall Methodological Aspects.
2. Many of the studies on the causes of project successes or failures clearly showed that the factors behind project disasters (or successes) were mostly non-financial ones: the organisational and human aspects, the technical risk, and the capacity to foresee and manage the political, social or environmental risks of the project (Chapter 2, Section 2.3). Therefore, the need to broaden the traditional analysis by incorporating political, organisational, managerial, strategic, social and environmental aspects is evident. Most of what has been written about these aspects does not specifically concern the appraisal stage, although it is indicated that they should be taken into account as early as possible in the life of the project. How this can be done (when, how, and by whom), what the risks involved in the different areas are, and the ways to minimise them were then the object of further investigation. The main propositions were summarised in the previous chapter in Table 2.2: Feasibility Studies and Non-Financial Areas of Analysis.
3. Little has been written about the process of gathering together all the aspects for decision-making purposes. Weighting indices or scores, as proposed by some authors (e.g. [86]), were not favoured by managers on the surveys analysed; they preferred to assess qualitative elements by subjective judgement.

From those conclusions, an initial framework was designed to include all three of them, and to provide guidelines in each area for the appraisal and for the gaps identified. The framework was therefore divided in three parts (each corresponding to one of the points mentioned above) as follows:

Part 1 - Methodological considerations

aim: to point out the overall strategies and methodological aspects for a successful appraisal system.

Taking as a basis the literature propositions in Table 2.1, the framework aim was to check their relevance in the light of the companies' experiences and point out practical ways in which they can be implemented.

The main propositions are the following:

1. Link evaluation with planning;
2. Phase the project;
3. Learn from pilot projects or past experience;
4. Use of flexibility and recognition of changes;
5. Appraisal should be comprehensive and progressive from the start.

Part 2 - Non-financial areas of analysis

aims:

1. identify all the non-financial areas of analysis and the risks involved in each;
2. suggest ways to minimise the risks identified;
3. provide guidelines for the process of analysis: when to do it, how to do it, and by whom;
4. check the relevance of the different propositions identified in the literature in relation to the above.

The World Bank methodology of appraisal in developing countries, together with the many non-financial factors identified in the literature as determinants of success or failure, provided the basis for the identification of the non-financial areas needed and the risks involved in each.

The World Bank methodology includes the following areas of appraisal:

- 1 - Technical
- 2 - Financial
- 3 - Commercial
- 4 - Economic
- 5 - Sociological
- 6 - Institutional

Taking this methodology as a basis together with the contributions of the authors reviewed in chapter 2, the framework was designed as follows: areas 2, 3 and 4 were

excluded as they are out of the scope of the research; area 5 was divided into social, environmental and political aspects, each of which was considered individually ; area 6 was replaced by both organisational and managerial aspects (incorporating the contributions in this area of the authors discussed in section 2.3.2); and finally, a further area was added to consider the strategic and synergistic aspects (as emphasised by Petit [61], Pinches [72], Wissema [86], etc.).

The framework designed included therefore the following non-financial areas of appraisal:

- Strategic analysis;
- Technical analysis;
- Political analysis;
- Social analysis;
- Environmental analysis;
- Organisational and Managerial analysis.

The contributions of the literature to these areas, as summarised in Table 2.2 (pages 51-56), were taken as a basis for the research. Those contributions are mainly related with the identification of the risks in each area of analysis (aim n°1) and partly with the ways of how to minimise the risks (aim n°2). As discussed earlier most of what has been written about these aspects does not specifically concern the appraisal stage although it is indicated that they should be taken into account as early as possible in the life of the project. How this can be done (when, how, and by whom) and the ways to minimise the risks identified (aim n°2 and 3) were then the object of further investigation (especially aim n°3).

Part 3 - Weighting of all aspects and decision-making.

aim: to identify the key aspects in the process of gathering all the different elements and assess them for decision-making purposes.

As mentioned before little has been written about the process of gathering all the aspects for decision-making purposes. Weighting indices or scores were not favoured by managers who, according to the literature surveys seen, assess qualitative elements by subjective judgement. Therefore the research looked at the nature of their judgement and the ways to ensure an independent judgement by making clear the trade-offs involved in decisions and the relative importance of the different elements. Weighting will always have a subjective element, but this can be based on a thorough analysis of all the aspects. How this should be done is the aim of this part of the framework.

3.3 RESEARCH DESIGN AND GENERAL APPROACH

Given the need identified in the review of the literature for a comprehensive study of all the non-financial aspects of projects and the role that they play at the appraisal stage, a framework approach, as discussed in the previous section, was considered as the best way to provide such a comprehensive study. This would ensure that all relevant factors are considered in a systematic and explicit manner during the appraisal.

The emphasis throughout the research was on the practical ways of dealing with the different aspects of the framework and their relevance in the 'real world'. Therefore, the research was conducted in the following ways:

First, an in-depth analysis of a particular project was undertaken to identify practice as opposed to theory. This permitted an analysis, in a real situation, of how all the aspects interact and the trade-offs involved at the different levels of decisions. The preliminary framework was taken as a basis, analysing the case study along the framework objectives. After this phase the framework was modified according to the main conclusions drawn at this stage (see section 3.4 below).

Second, a selection of companies undertaking project appraisal were interviewed to discuss their methodology and past experience with respect to the non-financial aspects. The interviews were designed in order to probe the different aspects of the framework (after modification above) and to identify aspects where research was missing.

The reason for these two different ways of conducting the research was to benefit from the advantages of each method. The case study method permitted an examination of all aspects of the framework in detail (the analysis was done over a five month period) and to trace all the events, and the reasons behind them, during the development of the project. This method was also a better way (given the depth of analysis permitted) of, at the beginning of the research, gaining an insight into many of the implications, in a real situation, of the issues raised by the initial framework hypothesis. The Cerro Colorado findings were important to identify some of the gaps in the initial framework, especially on social and political aspects where few guidelines were found in the literature. However, being a project-specific analysis it is not possible to generalize its conclusions to types of project irrespective of sector or specific characteristics. Therefore the need for further research. This was done through the interviews. The interviews were used both to test the generalizability of the Cerro Colorado findings, and also to modify aspects of the framework (in particular, the emphasis to be placed on its different areas of analysis should vary depending upon the type of project). The interviews showed that not all aspects of the framework apply equally to projects belonging to different sectors, which confirmed

the need to go beyond the case-study analysis. The understanding from the case-study permitted the interviews to focus on specific aspects to be examined, rather than just on general issues.

The two approaches and the way they contributed to the final framework are further discussed below.

3.4 THE CERRO COLORADO CASE STUDY - APPROACH AND LESSONS LEARNT.

3.4.1 How the case study fits into the general methodology and brief description of the project

As discussed in the previous section, the Cerro Colorado study was the first stage of the research. Being an in-depth analysis of a real situation (with all its complexities and interactions) it served as a way of gaining an insight into all aspects and implications of the framework, as well as an initial testing of the framework hypothesis.

The Cerro Colorado was a large mining project, with a considerable impact in many of the non-financial areas under investigation: social, environmental, political, organisational, and managerial. The project is located in Panama and was jointly undertaken by a Panamanian state company, CODEMIN, and a British company, RTZ, in a 51/49% partnership respectively (partnership agreements were signed in June 1980). It included the construction and operation of an open-cast mine for copper, a mill and concentrator and all the associated facilities and necessary infrastructures such as road access, water supply, power lines, construction camps, and so on. The construction of a town site for permanent housing would have been a Panamanian affair outside the project scope. It was highly possible that the project would construct and operate its own power scheme. The mine size had not yet been defined - studies were done for different scales of operation (between 8 million and 40 million tonnes of ore a year) but it would be likely to be around 15 to 20 million tonnes. The deposit has an estimated inventory of 114 billion tonnes of ore at an average copper grade of 0.78%, based on a cut-off grade of 0.4%. The total cost of the mining operations alone (over the period 1982-1990) was estimated at \$2 billion, which would result in a great strain to Panama's economy (debt, inflation, labour supply, imports, etc.). The location of the project in the province of Chiriqui (approximately 250 Km west of Panama City, on the Continental Divide), brought about severe social and environmental problems. On the social side, the location area was traditionally reserved to the Guaymi, an indigenous community that would have to be resettled and relocated. On the environmental side, the area is very mountainous, with steep sided valleys and torrential streams, with a very high rainfall, and an history of seismic activity. These characteristics made it very difficult to find safe solutions for the disposal of tailings

and for the perservation of the quality of the nearby river system from the effect of waste rock erosion. These aspects are further discussed below (section 3.4.2).

The broad implications of the project in all these areas (and the great difficulty in solving most of the problems) were the reasons why this particular project was chosen.

3.4.2 Aims of the study and approach taken

The study aimed to identify and to analyse, in the light of the framework objectives, the approach taken by RTZ in the appraisal of the Cerro Colorado project, concentrating on the organisational, social, environmental, political and managerial aspects, and on the role played by these elements in the appraisal process.

This required the investigation of:

- RTZ's general principles in approaching the evaluation: what were the phases of the evaluation process, if there were any checklists, if the information on non-financial aspects was actively sought and conscious, etc.(Along the objectives of part 1 of the framework.)
 - The kind of information collected and how, when and why it was broken down into the general components of the project.
 - The way people's attention developed and changed in relation to the various aspects of the project.
 - The relative importance of each component in the evaluation process (different emphases according to the different stages and trade-offs between the various components).
 - The way in which all the information was incorporated into the analysis (type of assessment and decision-making process).
- (To provide information on parts 2 and 3 of the framework.)

The analysis was carried out through the following methods:

- 1 - Use of RTZ internal and external reports, produced during the two year evaluation period and RTZ internal files on the non-financial aspects.

The reports included:

- a preliminary assessment report in April 1980;
- the work programme for the pre-feasibility stage;
- the report on that work - Jan 1981;
- several position papers during 1981;
- final summary report in June 1982;
- a draft pilot plant programme.

The files covered the environmental and the social areas, public relations policies, conference and meeting minutes, background information on the

country and to a much smaller extent some aspects on tax, power and labour legislation (for the mining sector).

2 - Interviews with some of the people involved in:

- (1) the different areas of analysis of the project (the political and economic assessment, the general preliminary analysis, the legal and environmental aspects and the technical areas in relation to organisational aspects and environmental links).
- (2) the project overall coordination (project directors and project coordinator).

The reports and files were used to extract most of the information on the project main issues and the development of the work. The interviews were concentrated on the organisational aspects, the emphasis placed on the several issues, the trade-off policies, and the reasons for the specific ordering of the work. (All reports, files and interviews, are listed at the end of the thesis in "References to the Cerro Colorado".)

3.4.3 Summary of the case study and lessons learnt

The project analysis, under RTZ management, started in 1980 and it has never been completed. The project stopped at the end of the pre-feasibility studies but even before then it was subject to considerable delays because of problems occurring on areas (non-financial ones) initially taken as easily solvable. Eventually, when the project stopped (in June 82) solutions to most of these problems had not yet been reached. Briefly, the main non-financial implications of the project were the following:

1 - Political aspects:

- The project impact on Panama's economy.

The project size and cost meant a great impact on Panama's economy. The total capital cost of the project (about \$2 billion) would be equivalent to at least 50% of Panama GDP ([12]). This would mean a high external debt (with the risk of Panama not being able to pay it), and also a great strain on the economy in terms of increased inflation that would have to be managed carefully.

- "Panamanian factor": unclear lines of decision-making; bureaucracy; etc.

It was very important to reduce bureaucracy at the customs, for example, so that the equipment and material moved as efficiently as possible so as to minimise any additional costs due to delay. During construction, in particular, any delays would be very expensive because the interest charges on the loans would be accruing at around \$2 million per week [12].

- Panamanian inexperience in industry and mining.

Which was one of the reasons why Codemin did not always trust RTZ during the negotiations.

- Nationalistic feelings.

Panamanian fear of another US Canal.

- Lack of diversification of the economy.

To what extent Panama would cope with all the project implications to the country and its capability of managing those implications on a day to day basis, was possibly the greatest uncertainty for the future.

2 - Environmental aspects:

The two main issues were the safe disposal of tailings and the effect of waste-rock erosion on the quality of the nearby river system. These problems were compounded by the project being located in a seismic area with a very heavy winter season (concerns over possible erosion due to the heavy rainfall into the natural flow of the river, or dam failure in case of seismic activity). Options were being assessed under economic reasons, technical feasibility, and environmental impact. The fact that there was no Environmental Code in Panama was also a source of problems as it created a vacuum in which to operate. Acceptable standards for both RTZ and Codemin were difficult to negotiate.

3 - Social aspects:

The main social issue was the effect of the project on the local community - the Guaymi. The Guaymi are an indigenous community that have maintained their way of living for hundreds of years. The project is located in an area traditionally reserved to them called the Comarca (whose legal status needed to be defined).

Concerning the Guaymi there were several issues facing the Project:

(1) Evolution of Guaymi

- Should Guaymi be preserved as a people or should they be integrated in the Latinos culture?

(2) Resettlement and Relocation of 10 - 15 Communities

(who could not physically remain where they were due to project installations).

- were they to be relocated all together or would the shortage of land involve a breaking up of the community?
- could enough land be found to compensate them?
- criteria for relocation?

(3) Compensation Schemes

- levels to be established for compensating the Guaymi whose land would be affected.

(4) Guaymi Employment and Training

- special policies might create friction and segregation;
- need special training;
- flexibility so that Guaymi could adapt more easily.

(5) Definition of a Comarca

(6) Construction of a townsite for permanent housing

- should it be located in Indian reservation?
- or integrated into an existing townsite?
- separate Indian townsite, if non-Indians are to live outside Comarca?
- type of housing?

(The standards of housing, as referred by Mr. Lewis [19], were a serious argument between RTZ and Codemin.)

(7) Participation of Guaymi - in decisions regarding 1 to 6

- problem of leadership - who represented Guaymi?
- aspirations and expectations might differ.

Social opposition was another problem facing the Cerro Colorado. Several groups had a negative attitude towards the project [19, 20, 29]. Among them:

- **Political opposition to the Government** (wealthy families), which was particularly important because of Panama's forthcoming elections.
- **Chiriqui opposition**
 - landowners worried about labour and wages;
 - agriculturally based population (there was a certain element of Chiriqui nationalism which mistrusted the Government and its centrally planned approach as well as its silence on the project).
 - widespread feeling among the silent majority, public opinion in general and **business and academic circles in Panama City** in particular, that the country could not afford the project [15-B].
- **International groups on the issue of the preservation of Guaymi**, like International Survival, CAFOD, etc.
- **The Guaymi Representatives**

A conference in June 1980 and a forum in 1981 voted to oppose the development of Cerro Colorado until the Government recognized their land rights [14-L].

- **The Church**

Mainly they expressed concern for the Guaymi issues and potential destruction of their culture and the spread of alcoholism and

prostitution as a consequence of locating construction workers within the Indian Comarca.

4 - Legal aspects:

Legal agreements had to be made all the way throughout the life of the project. Problems were arising in the legal aspects related to the areas seen above, namely, the social-political situation of the country, the social aspects, and the environmental aspects. In the social-political area, many problems were related to the inexperience of Panama in the mining business, and the large size of the project in comparison with the country's economy - and the need to account for all the implications of these factors. According to the development of the project, some issues were arising that needed to be legislated on, for example alternatives to depreciation and taxation, agreement on the power schemes (the Cerro Colorado itself would require about 20-25% of the present power demand [19]), erection of new procedures for handling imports and any ingress/egress of project personnel in order to speed up the process (existing procedures seemed inadequate as the process was too slow). Legislation on social matters (Comarca, Townsite, Guaymi Foundation, relocation and resettlement, compensation schemes, etc.) [23], and on environmental matters (to create an environmental code), was also needed. There were major concerns as to the possibility of solving all these issues, without delays for the project [23].

5 - Organisational and managerial aspects:

The great geographical dispersion of the people involved in the project (located in three different countries and two different places in Panama) and the difficulty in getting RTZ and Codemin teams to work together, were the main organisational and managerial problems faced by the project.

A detailed analysis of how all the above aspects had been tackled and how they developed throughout the two year period is presented in Appendix A. A summary of the main findings is also presented there. The overall lessons from this case study were:

- 1 - It reinforced the need to take into account the non-financial aspects early in the appraisal process.
- 2 - The great importance of two of the less researched areas of the non-financial aspects: the social and political ones. (It seems that these aspects were optimistically assessed at the preliminary analysis).
- 3 - The power of people and politics in delaying the project. (Political and social reasons were behind many of the difficulties and delays in the negotiations between RTZ and Codemin).

- 4 - The importance of the role of the Government in supporting the project.
- 5 - The changing emphasis in the development of the work, from technical and financial to the non-financial aspects, as time progressed. A lesson from the Cerro Colorado is to start the appraisal with the low cost difficult areas. For example, from the beginning a lot of money was spent on the technical aspects, which were never going to end up being a problem in the project. Cheaper issues (less costly to research), such as the social ones, had not been agreed and defined first, and ended up being much more difficult to solve.
- 6 - The importance of ensuring the coordination of all policies (social, environmental, technical) so that they will run in parallel and not cause delays.
- 7 - The need for a tighter geographical control on the project structure (to improve communications and control).
- 8 - The conclusion that joint teams, Codemin and RTZ, would have worked better than separate ones (would be likely to have led to a greater trust between RTZ and Codemin).

The above lessons were incorporated in the framework. Some were just a reinforcement of the initial hypothesis (1, 4, and 6). Others were new contributions (2, 3, 5, and 7). Detailed findings concerning all areas of analysis were also a contribution to the improvement of the initial framework. These findings, were tested through the company interviews and are discussed throughout the development of the framework, in chapters 4, 5, and 6.

3.5 THE INTERVIEWS - METHODOLOGY AND APPROACH.

3.5.1 Aims and design of structure

Following the analysis of the Cerro Colorado and the modification of the framework, a sample of companies in different industrial sectors was selected to test the more general validity of the framework. A series of company interviews were carried out covering in particular organisations undertaking major projects. Because of their size, complexity, or novelty, these are the projects that present greater risks for the companies and a wider variety of aspects to analyse. The interviews aimed to acquire a wider data base from which to conclude on the relevance of the non-financial aspects of projects; their role, their relative importance, the identification of the major risks, and the best practices in dealing with the different aspects at the appraisal stage, when, how, and by whom the analysis should be done, and how to minimize the risks.

With the above aims in mind, and taking as a basis the literature hypotheses of tables 2.1 and 2.2 and the findings of the Cerro Colorado, a semi-structured questionnaire was designed covering the three parts of the framework: general methodology, non-financial areas, and decision-making. The questionnaire was divided into four main groups. The first one was concerned with the company's general

approach to project evaluation (methodological aspects and basic strategies) and a brief description of their types of projects and business. The second group was concerned with the analysis of the interaction between a project and the company (if the analysis of the project was made in isolation from the rest of the company or if there were any synergistic or strategic considerations included). The third group focused on the identification of the non-financial components of risk that were part of the company's assessment (technical risk, managerial and organisational aspects, societal acceptability of the project, environmental aspects, political and legal factors, or any other aspects relevant to the company) in order to try and find out how these components were taken into account in the appraisal process, how they were assessed, when and by whom, what were the company's practices in minimising the risks, and their importance according to past experience for the success of the project. Lastly, the fourth group of final considerations was for people to comment on the gathering of all aspects to decision-making, on the efficiency of their company's present system of evaluation, the deficiencies felt, and the ways to improve it. (A sample of this questionnaire is presented in Appendix B).

3.5.2 Company selection.

The selection of companies was done according to the research objectives, which basically were to find out the role and importance of the non financial aspects of projects at the appraisal stage. This meant interviewing companies where the non financial aspects are relevant for the success of projects (which, as already referred, was the reason to select companies undertaking major projects in particular); interviewing companies where there was, at least to some extent, a formal appraisal of the non financial aspects (which implied a selection by size - as previous surveys done by Pike [71] and by Stanley & Block [79] indicated that formalisation of the analysis increases with the size of the company); and also interviewing companies belonging to different sectors, in order that as many types of projects as possible were covered (as it was aimed to develop a framework that would provide guidelines general to all sectors (chapter 7) and to investigate the relevance of the various aspects of the framework according to the type of project (chapter 8)).

Interviews were then held with some 20 companies covering the following sectors and companies.

Table 3 - List of sectors and companies interviewed

Sector	Companies
• Public sector	Department of Transport Ministry of Defence Health Department Treasury
• Transport	British Rail
• Mining	RTZ Consolidated Goldfields
• Aerospace and Defence	British Aerospace Smiths Industries
• Oil and Gas	Shell
• Energy	British Nuclear Fuels Central Electricity Generating Board
• Construction	Humphreys and Glasgow Bechtel Foster Wheeler
• Shops	Aquascutum
• Pharmaceutical	Glaxo
• Electronics	ICL
• Mechanical Engineering	Delta
• Consultants	W.S. Atkins
(to some of the previous sectors)	Logica

Although to some extent all companies were able to contribute to the research, some (Aquascutum, Logica, Delta, W.S. Atkins) had a less formalised approach with respect to non-financial appraisal. Nevertheless the recognition by these companies of failures in past projects due to lack of assessment of non-financial aspects, was taken as a valuable argument to the importance of those aspects for the appraisals.

3.5.3 Extraction of data.

The interviews lasted for at least one session of three to four hours each, with one to five members of the company - normally senior personnel in the planning, marketing, strategy and/or evaluation departments. (A summary list of the interviews, with identification of companies, people interviewed, their department, and their position in the company is provided in Appendix B).

The interviewees were sent the questionnaire in advance with the range of topics to be discussed in the meeting. The questionnaire was not intended to serve as a strict list of the issues to be discussed (it was not a 'yes/no' type of questionnaire), but rather as a structural guide for the discussion. Given the broad range of the issues to be discussed and the limited availability of people and their time, as a general rule people's statements were taken at face value and not pursued further. However interviewees were always asked to refer their statements to the outcomes of past projects so that they could be validated against practice. In some cases, further interviews were carried out for further clarification of the aspects discussed.

The emphasis during the interviews was placed on sections two and three of the questionnaire, focusing on the identification of the components of non-financial risk and the assessment practices (when, how, and by whom the assessment is done, and ways to minimise the risks). The interviewees were also presented with the existing literature on those areas, the Cerro Colorado findings, and with findings from previous interviews, in an interactive process so that the final conclusions were cumulative.

3.6 LESSONS LEARNT FROM INTERVIEWS, VALIDITY OF THE FRAMEWORK AND PRESENTATION OF WORK

After each interview conclusions were taken and confronted with the existing hypotheses. These conclusions would be used in an interactive process, as a further basis for discussion in subsequent interviews and as a way of testing their validity. Guidelines could be taken from the cumulative experience of all companies and whenever there was a majority recognition of the importance and validity of each guideline. This was the basic rule for taking conclusions. For example, technical factors have been pointed out in the literature as one of the common causes for project failure, in particular when new and complex technology is involved [18, 28, 40, 57].

During the interviews companies were asked about their own experience in relation to this aspect, and it was generally confirmed that failure to appreciate technological risk is a main source of overruns (ICL, CEGB, BAe, SI, Logica and others). Therefore this was included in the final framework as a general conclusion, and the ways that companies in their experience found more useful to minimise this risk were pointed out as suggestions (see chapter 5, section 5.3). An example of an opposite situation (where an initial proposition was not validated by the research) relates to the decision-making process. The literature proposition (as in Wissema [86]) of using a system of indices and scores to assess the non-financial aspects of projects, was not found to be well accepted nor in common use in practice. Where it is, as in the public sector, several drawbacks have been identified. Therefore the conclusion taking in the final framework, reflecting the experience of the great majority of companies (RTZ, CGFd, Shell, SI, BAe, Logica, Delta, CEGB, etc.) was that indexing and scoring is not the best way of weighting but this should be done by balancing out arguments and by discussion (for further details of the analysis, see chapter 6, section 6.3).

Normally, in justifying a statement or conclusion, only a few examples (experienced by a company or two) were chosen - the ones thought most relevant to illustrate the point made. For example, the need to redesign the organisational structure of a project over time, to attend to the project's own development was illustrated by the Thorp project (BNF) and by the AL Ymaah project (W S Atkins), but was confirmed by all other companies (chapter 5, section 5.7.2). Yet, if there had been disagreement among other companies as to a particular aspect, this is made explicit and is not referred to as a general conclusion. For example, experience and multidisciplinary skills were proposed by the literature as the most essential factors for the choice of a project manager. Experience should be of major projects in general, but not necessarily in the same sector [57, 89]. This was generally confirmed by most companies, yet for particular technological projects (when project risks are mainly technical) it was mentioned that skills in the area are essential (BNF and BAe). Therefore these cases were highlighted when building up the framework (chapter 5, section 5.7.3) and also when applying the framework to the main types of projects (chapter 8).

Differences amongst types of projects were also highlighted. For example, social problems were recognised in many companies to increase the costs, mostly through delays (Shell, RTZ, CGFd, CEGB, and the Public Sector). However, interviews to companies in the Aerospace and Defence sector such as SI and BAe, in the electronics sector like ICL, or in the pharmaceutical sector (Glaxo), showed that these companies do not include social aspects in their analysis as this was said to be as a rule not relevant in their type of business. Therefore these differences were discussed in the framework (chapter 5, section 5.5.1) and especially when analysing the emphasis to

be placed on the different aspects of the framework according to types of projects (chapter 8). Opinions of interviewees or arguments that were not possible to test are referred to as such throughout this thesis.

Obviously there are limitations in this type of approach. On the one hand, the information collected is restricted, given the necessarily limited number of interviews and companies seen, and the time that could be spent in each. On the other hand, the extent to which information was made available by the people interviewed is a further limitation (access to written documentation was not possible in the majority of companies or was extremely limited). How valid then is the framework? The work is not seen as the final word in the knowledge of non-financial aspects of projects but rather as a contribution towards a greater understanding of those elements. The validity of the framework comes from the fact that guidelines were only taken when there was consistency among the companies interviewed as to those aspects, as discussed, and also when these were aspects that have been validated against the outcomes of the companies' past projects.

The interviews and the case study were used to build-up the framework throughout chapters 4, 5 and 6. In these chapters the different experience of companies is discussed. Each of the chapters concerns a particular part of the framework:

- Chapter 4 - methodological considerations;
- Chapter 5 - the non-financial areas of analysis;
- Chapter 6 - assessment, weighting, decision-making and trade-offs

Conclusions are taken in chapter 7 and chapter 8. Chapter 7, summarises all aspects of the framework and compares its findings with the literature. A conclusion that soon came out of the interviews was that for different types of projects there should be different emphasis on the appraisal, as there are specific risks involved according to the type of project. Hence, the relevance of the different areas of analysis also changes from sector to sector. These differences are accounted for in chapter 8, where a typology for the non-financial assessment of projects is built-up and summarised at the end of the chapter.

PART II

THE FRAMEWORK

CHAPTER 4

METHODOLOGICAL CONSIDERATIONS

4.1 INTRODUCTION

This chapter discusses some basic principles and methodological strategies that should contain any evaluation process. It is not a comprehensive analysis of all of those strategies. It mainly addresses the aspects pointed out in the literature as needing further attention, and that were confirmed by companies as important to consider. These aspects include: the need to link evaluation with planning; the need for phasing the project; the organisational support to the process of selection and appraisal; the use of flexibility in the evaluation procedures; and some other overall strategies. Without these background aspects having been properly examined, any process of appraisal would lack the support to work effectively. However they are the area more able to be corrected when companies are revising their appraisal system. This is the reason why they are being considered first in the present thesis (Section 4.2) before moving into the actual areas of appraisal and the attendant risks. An outline of an appraisal, in terms of its contents and stages, is given in Sections 4.3 and 4.4. The main guidelines emphasised in the chapter are summarised at the end (Section 4.5).

4.2 BASIC PRINCIPLES AND OVERALL STRATEGIES

• Link Evaluation with Planning

The literature stresses that investment programmes should be closely related to organisational planning [6, 10, 20, 85]. This was found to be recognised among the companies interviewed. Shell, for example, defines and analyses the strategy of the company long before a particular project comes to evaluation (the planning stage). It is within this analysis that the several options are looked at. The analysis covers:

1. the strategic vision of the company (cf. the present position of the company, perception of the business environment and competitors, potential areas of profits and distinctive competences, and the determination of what the company should be);
2. competitive position of the company;
3. environment (possible scenarios);
4. option planning.

Projects come at the option planning stage, which is seen against the whole strategic background. A particular project that comes to analysis is looked at within the business sector perspective and what is Shell's position in that sector. In British Rail, it is from the planning department that most of the proposals, in particular major investments, originate (to achieve agreed targets negotiated between the Government and the Board). Proposals can also be originated from any other levels in the company, and, indeed, people are encouraged to do so, but once an idea arises it is primordial to relate it to the business objectives, so that the investment programme can be validated in the Rail plan.

Planning and definition of strategies are a necessary starting point, so that the evaluation will be in the light of the organisational goals and strategies. This has been emphasised in Delta so that project discussion can have a standard by which it can be judged and not be performed in isolation.

When evaluation and planning are not linked, this can be a cause for project failure. This was identified by Aquascutum, where, in the past, there was a tendency for a fragmentation of the business; to look at a project from too a narrow point of view (a sector or a shop) without defining it in the context of the whole company. This has also been an area of revision within ICL who again, in the past, had had inadequate direction about relative priorities of business objectives, lack of classification of strategies, and lack of direction about investments. The revised overall process (for the selection of exploitable research projects) was to produce and maintain a plan covering the market segments addressed, the products or services to be delivered, and a phased and resourced plan (one to five years) in which the projects will fit.

Planning throughout the life of the project and in relation to that project is also advised by the literature [38, 56]. It should be an incremental process, phased to the stage of the project. The larger and more complex the project, the greater need for planning early. Again, ICL provides an example of a company where a recent revision has taken into account this need to plan throughout the life of the project. Each research project is required to have an exploitation plan that will relate the project throughout its life to the relevant market. This will initially be on one page, outlining how the results of the project might be used to produce a product and the market for that product; this sets the basis for the programme revision at specific points in time - phase reviews - when a more detailed planning and specification is done if it is decided to proceed [93].

- **Phase the Project**

To phase the project is strongly advised, especially when large amounts of capital and/or a long project life are involved. The reasons for this recommendation include:

1 . A greater facility for stopping the project if necessary

Nobody likes to stop a project once it has started, especially if the decisor-maker is actively involved on it. If the project is phased, a decision whether the project should proceed or not at the end of each phase may be made. These pre-established decision points prevent continuing the work for reasons outside the project, such as: (i) a sense of commitment to the job already (mentioned by RTZ); (ii) a sense of failure if the project stops (ICL, RTZ, etc.); and (iii) people "falling in love with the project" and just go on with it (Delta). ICL mentioned that, even now with its 'phase reviews system', there is the danger of the project coming alive and having a life of its own. This occurs after the project has passed some of the initial stages, when there develops a tendency to keep it. This is mainly for two factors. The first is related to the financial side of the project. ICL builds results into business plans, where assumptions are made about the revenue contribution of the project, and it is then difficult to take them out. This is the wrong way of looking at the initial expenditures - to see them as investments rather than as costs. This is the wrong way of thinking - if a company cannot afford to write a project off (if the project is no good), it should not have taken it in the first place. The second factor is related to managerial ego. It is important for the culture in the organisation, such that people do not see cessation as a failure. Failure has to be accepted as possible, and failure in a project should not destroy the people that are involved in it, as the reasons may have lain outside their control.

2 . Money being spent in steps

Phasing avoids unnecessary expenditure as the work is taken progressively, according to the results of the previous stages (for example, no money would need to be spent to assess the project's impact on society if the project is not economically feasible in the first place (RTZ)).

The greatest increase in costs should be when risks are lowest. The initial stages should therefore concentrate on surveying the risks in all areas, not in simply developing the work. The aim is to get the minimum risk at the time of maximum exposure. The graph below illustrates this point.

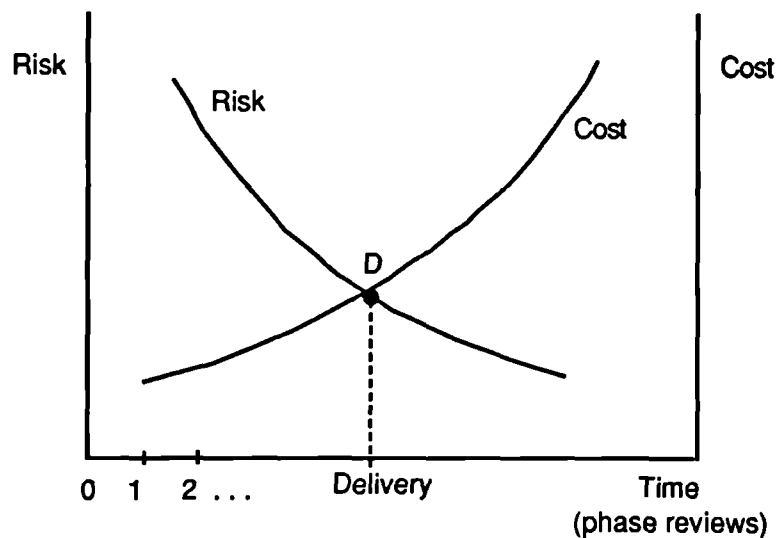


Figure 4.1 - The graph depicts a rough guide to the ideal increase in costs versus the decrease in risks (for an ICL project)

Cost grows at an exponential rate. At the start, it is basically an engineering cost until the project is developed. At point D, the product is ready for delivery. This is the point of no return. The phase reviews (0, 1, 2, ...) had ensured that risks are low enough at this point. The increase in money at each phase would have to correspond to a decrease in risk. D should be delayed as long as necessary (and possible) to ensure risks are low, since at this time costs rocket due to the high market costs of this business. By doing this the company is maintaining its options as long as possible.

3. Assumptions being reviewed

As the project is reviewed at each phase, initial assumptions can be continuously checked. This is particularly crucial for R&D type of projects, where technological risk is high and things visualised at the beginning may not happen when actually done, although the need is for a continuous retest of the assumptions to see if they still hold.

4. Building on experience

Each phase increases the amount of available information, work done, accuracy of estimates and knowledge of the particular environment.

5. Avoiding concurrency or overlapping between phases

The overlapping of phases can be an important factor for project failure. This happened in BNF's experience when, at times, there was a tendency to rush from design to construction without the design phase being completed. If the project is phased, and the amount of work to be done in each phase is previously defined, this can be minimised. It also prevents the 'cost of enthusiasm' when, for example, the technical personnel "know" what they want to do and implement it immediately without it being properly tested. This has been experienced by both ICL and BNF. When there is inadequate definition in any particular phase, people tend to get an optimistic perspective that the work would take less time than might be normally expected.

• Organisational Support

The overall process of selection and appraisal needs to ensure that adequate organisational support is in place. This may be needed in many different aspects:

1. The organisational support for the encouragement and creation of ideas (look at the type of chain until the decision is taken: ideas lost? encouraged? slow process? ways of incentivising new ideas?). For example, ICL is currently setting up an office of innovation to take business advantage of new ideas. It was felt that the normal process of selection would fail to cope with completely novel concepts. Yet some ideas that apparently would be senseless can prove worthwhile at a later stage. Obviously, it has to be in the same core business but may not be straightforwardly related to current priorities (in which case they would be dismissed immediately through the normal process). The office of innovation is to support these ideas, which may originate in any sector of the company, and to be a channel for their originators until they can go to the normal process of review. In this way, people feel confident to come forward with their ideas as they know they will not be instantly dismissed. The process of analysing these proposals and seeing if they are worthy is therefore done inside the company and in a structured way.
2. The need for training people: train analysts, train strategists in business planning procedures, etc. (this was part of the corrective actions to be taken in ICL; other companies realised the importance to do the same).

3. The need to change the culture of the organisation so that people will put more effort into the appraisal and take it seriously (this is particularly true for the public sector, where the appraisal system has been up-dated and improved, but many people according to Mr Henderson (Health Dept.) still see it as a waste of time).
4. The need to attend to possible changes on the organisational structure of the company. For example, a place where there are short lines of communication and where the atmosphere is friendly will favour the debate between people. This was said to be the situation at Delta headquarters.

- **Flexibility**

A blueprint approach is not workable. There are continuous changes in the project environment and each situation is different. It is essential that people are aware of these changes, recognise them and adapt to them. The risk from unforeseen circumstances can be minimised if people have back-up strategies and plans for the identified major areas of uncertainty. It is the degree of diversity and complexity in the environment that should determine the degree of flexibility in the strategy planned [63]. The greater the uncertainty, the greater the need for flexibility to facilitate adaptation to the unforeseen contingencies. This is very much dependent on the capability of the main people responsible for the project (Project Director, Project Manager), but it can also be attended to organisationally. For example, by training people how to think rather than using a mechanistic dependency on the written procedures (this has been a current policy in Delta).

- **Keep Track of What is Going on in the Field and Interrelated Fields**

This was emphasised by Shell, so that new opportunities can be detected and immediately assessed in terms of a preliminary feeling. It is also very important for companies that have to bid for several projects and face a short time for bid preparation. If a company can expect in advance where the opportunities lie, it can also prepare for them in advance. This is the policy of Smiths Industries (SI), who continuously maintain close contacts with governments, manufacturers, etc., so that they will have advance knowledge of the opportunities coming up and assess their value.

- **Learn from Pilot Projects or Past Experience**

This can be used to up-date tools and methodologies - with the feedback from project monitoring. Logica, for example, is currently trying to develop an expert system to advise on the methodologies to use according to the different projects; the system is based on knowledge stored by continuous feedback from monitoring of past projects.

4.3 EVALUATION STAGES

According to the principle of spending in steps, the evaluation work should be done in a progressive way, each stage increasing the depth of the analysis. The stages might vary according to the project, but, in most cases, the following ones can be identified:

1. Preliminary analysis (before commitment, bid, etc.)

The aim is to assess the technical and economic viability of the project and its general desirability in terms of its strategic sense and the risks presented. Commonly, it covers the classical type of project evaluation (financial and technical analysis) and looks at the alternatives available. The non-financial aspects (apart from strategy which, at this stage, can be a major decisional factor) tend to play a very secondary rôle; they are generally assumed as normal unless a particular grave condition strikes out. This was found to be the practice in most companies (RTZ, Shell, SI, British Rail, etc.). However, they all agree that it is important not to forget to identify all high-risk levels at this stage, and not just the ones on the financial or technical side. The difference between preliminary analysis, prefeasibility and feasibility, should just be one of the depth of the analysis rather than of breadth.

In long-term projects, this stage can take about two or three months to complete, or even more.

2. Prefeasibility Stage

This stage's main emphasis is still on the technical and financial aspects of the project. Yet all other dimensions should be looked at in greater detail so that they can be taken into account when trading off alternatives.

A 'yes' decision at the end of this stage has to be the result of fairly high confidence in the implementation of the project - as the next stage may involve a great amount of money. This stage can take up to one year.

3. Feasibility Stage

This is the final set of studies before construction or implementation starts. It deepens the analysis in all areas. All major issues (including technical, financial, social, environmental or political) should be solved by the end of this stage so that the risk would be minimised when implementation starts. It can take up to two years to complete.

All three stages are flexible and can be more or less detailed and prolonged, according to the specific project and the people involved. The work programmes should be defined both by timing and content so that people will not rush to a deadline. (Project failures were reported to be linked with "rushing to do the job" by several companies: BNF, CEGB, ICL, SI, etc.)

The feasibility stage is economically a very important step; it can take 2.5 to 5% of the total cost to investigate the project up to the decision point (oil or mining businesses). It therefore requires a thorough analysis. This is the practice in Shell, where it recommends and encourages the widest thinking on the proposals as soon as they appear. The tendency to develop a project at a very early phase without feasibility being established should be avoided. This tendency was a past concern in British Rail, which now emphasises the need to "enforce a pause for thought" before decision.

4.4 FEASIBILITY STUDIES - OUTLINE

The contents of a feasibility study should allow for flexibility, as discussed earlier. They should not be a checklist. They should be seen as a guide to discipline creativity and avoid unnecessary risks. Quoting Tolbert and Baum [8], "Checklists should not become a substitute for creative thinking in tailoring the feasibility study to the particular characteristics of the project". As long as a mechanistic dependency is avoided, manuals can be used to ensure an independent appraisal. For example, Delta encourages its subsidiaries to develop checklists of items or aspects that a project should satisfy in order to set a benchmark, so that discussion will come not to justify the project but to proceed it. (An appraisal through a body independent of the project sponsor, as used by British Rail, is another way of ensuring the appraisal is objective and avoids implementing the project for solely emotional reasons.)

Manuals can provide a systematic, objective and comprehensive study of a project. They may constitute a good framework - if they are not a straightforward checklist - for people to operate within, and a way of minimising unnecessary risks. People with wide experience can look at them in a constructive way (flexible way). There is always a core of questions which are the same for any type of project. Frameworks should address these questions. Then it is up to the capability of the

personnel involved to determine any particular area of analysis, outside the standard ones, and to decide on the emphasis to be placed on each aspect. Experienced people should therefore be placed in the decision-making positions to ensure an effective appraisal.

An outline of the feasibility study can be summarised as follows:

- **Analysis of the project background:**
 - clarify objectives of the project;
 - analysis of the problem being solved by the project and what the alternatives are.
- **Locate the project into the business context (strategic analysis):**
 - does the project fit into company strategy;
 - analysis of weak/strong points of the company; locate the project in this context; what is the project potential?
 - compatibility of the project? how does the project fit into the existing current activities? synergy? does it take advantage of existing skills, experience, etc.? does it bring early spin-offs in technology, competition? what are the unquantifiable future benefits?
 - risk of the project versus risk of the company? same products, markets?
 - structural implications to the company? (changes to be made elsewhere if benefits are to be achieved).
- **Resource analysis:**
 - check company workload, availability of materials and personnel.
- **Technical viability:**
 - does it involve new or established technology?
 - is it viable?
 - what are the risks?
- **Financial/economic viability:**
 - is it profitable?
 - possible to finance?
 - ways?
- **Commercial and marketing analysis:**
 - is it marketable? what is the company share of the market?
 - commercial arrangements?
 - analysis of competitors?
- **Legal aspects:**
 - related to technical specifications, environmental norms, or others.

- **Organisational and managerial analysis:**
 - type of organisational structure?
 - selection of project personnel? (qualifications, expertise)
 - partnership arrangements? (clarify rôles and responsibilities).
- **Social analysis:**
 - is project acceptable to society?
 - can it be subject to delays? (e.g. public enquiries, activist action)
 - predictable social response to the project?
 - ways to minimise opposition and delays?
 - ways to create good relationships with locals?
- **Environmental and safety aspects:**
 - project impact on environment?
 - range of environmental protections, measures, their consequences, costs, etc.;
 - safety considerations to workers, to environment, to people nearby.
- **Political aspects:**
 - project is of a political nature?
 - depends on Government funding, operating permission?
 - what kind of political interference can it be subject to? consequences?
 - is it located in an area of political instability? possibility of nationalisation or pressure over benefits?
 - ways to minimise or insure against these risks?
- **Any other issues relevant to the particular project.**

All the above areas are to be dealt with interdependently as they all interrelate and affect each other. Some of these aspects will be discussed further in the next chapter (the main non-financial types of risk and how to deal with them).

4.5 SUMMARY

This chapter discussed the overall principles and strategies that should support any evaluation system. Some were highlighted by companies as leading causes for project failure and were the subject of revision in their up-dated systems. They were:

- fragmentation of the business (projects looked at in isolation and not in the business context);
- rushing to implement the project without a proper analysis being carried out;
- deciding on or proceeding with the project for subjective or emotional reasons;
- inadequate definition of work and risks in any of the project stages.

Throughout the discussion, some suggestions were made in relation to the above factors to ensure an appraisal system that will work more effectively (taking into account what has been experienced by companies as good or bad practices). These suggestions may be summarised as follows:

1. Investment programmes should be closely related to organisational planning. The evaluation must be in the light of the organisational goals and strategies. Planning and definition of strategies should therefore come in the first place and they will set the tone for the evaluation. Planning throughout the life of the project, and in relation to that project, is also fundamental; initial planning must concentrate on building viable planning bases for the following stages.
2. - Projects should be phased. The benefits include:
 - building on experience and adapting to uncertainty;
 - establishing point-decisions on project go-ahead;
 - greater facility of stopping the project;
 - avoiding phases overlapping (if work at each phase is previously defined);
 - avoiding cost of enthusiasm;
 - continuously checking initial assumptions;
 - money being spent in steps (start with a survey of all risks instead of immediately developing the work).
- Work Programmes should be defined by both timing and content.

3.
 - Use flexibility in the evaluation procedures to adapt to changes and particular situations. Manuals can be used, and indeed are important, to provide a systematic, objective and comprehensive study of the project, but should always be seen as a guide and not as a straightforward checklist. Back-up strategies and plans should be defined for the major areas of uncertainty and risk identified.
 - Train people how to think rather than using a mechanistic dependency on the written procedures.
4. Use pilot projects or feedback from project monitoring to learn from past experience.
5. Keep track of what is going on in the field and interrelated fields so that new opportunities can be detected and immediately assessed.
6. Look to organisational support for the encouragement and creation of ideas and for the training of specialists. Change the culture of the organisation, if necessary, so that appraisal is taken more seriously.
7. The appraisal should be comprehensive since the start, but done in a progressive way (in terms of the depth of analysis). All high-risk factors should be identified at the start, including the non-financial and non-technical ones.

CHAPTER 5

NON-FINANCIAL AREAS OF APPRAISAL

5.1 INTRODUCTION

This chapter deals with the non-financial aspects of projects at the appraisal stage. The main areas of analysis (strategic, technical, political, social, environmental, and managerial and organisational) are covered. For each area, the following aspects are discussed:

- the purpose and importance of the analysis;
- the key issues and risks involved;
- the type of assessment (how, when, by whom, and contents);
- the way to avoid or to minimise risk.

The discussion will be supported by empirical evidence and some of the points illustrated by company practices¹. Comments by the companies are accepted at face value and were neither investigated nor intended to convey criticism or praise of the companies.

The aim of the chapter is to give a general and broad view of all non-financial aspects that are common to major projects. Later on (Chapter 8), some of these aspects will be further discussed according to the type of project.

The chapter is divided into six main sections (5.2 to 5.7), each corresponding to a particular area of analysis. At the end of each section, a brief summary will draw the main points of the analysis together.

5.2 STRATEGIC ANALYSIS

5.2.1 The Purpose

The analysis looks at the interaction of the project with the company, and how well the project fits within the organisational goals and current activities. On its own, it is difficult to define a project as good or bad; it may be good for one company but bad for another - if, for example, the project is in the line of business the company wants to expand (good) or contract (bad). Hence, the need to analyse the strategic component of the project.

¹Names of the companies will either be referred to explicitly or will appear in brackets after the example is given.

5.2.2 Main Issues and Risks

The project interaction with the company can be examined in three ways: strategy, synergy, and risk.

Strategy looks at the compatibility of the project with the objectives of the company (at both corporate and functional levels). For example:

- Does the project fall within the overall vision of the company?
- Does it bring any early spin-offs in marketing, technology, etc? What are the unquantifiable future benefits?
- Does it strengthen any corporate weak point?

Synergy looks at the compatibility of the project with the existing activities and the benefits from their combination. A project without any synergy is seldom considered (ICL, Glaxo, Consolidated Goldfields). Synergy ensures that projects take advantage of the company's strong points - skills, tools or experience; it avoids the duplication of work; and it looks to see if all units involved in the project are capable of handling it - people, materials, expertise - to avoid inconsistencies. This risk of inconsistency was stated by ICL as one of the important things to be aware of; at times, people would have a too restrictive view of a project - a technological vision - and would develop it without ensuring that it was being channelled to reach the market (setting up a new sales force, training people, etc.). Obviously, however brilliant the project, without it being distributed there are no profits for the company. Therefore, both things should be linked together (setting up a sales force, which is a project in itself, would be equally sterile if done in isolation).

The third aspect - risk - should be seen at two levels:

- The inherent project risk: can the company afford it?
- The project effect on the overall risk of the company.

The latter is particularly important for major projects capable of influencing the risk significantly (the smaller the project, the more it can be viewed on isolation - as long as the company is doing lots of small projects). Obviously, a project that fluctuates in a way that puts the company at risk should not be undertaken unless it can be counterbalanced by some other project moving in an opposite pattern. A project that is in an area where there are already too many risks would become less attractive.

Without these three areas of analysis, the company is acting without an integrated vision of the business - having eventually too much risk in an area, not using the company strengths, duplicating work, etc., which will be reflected in its

performance. Aquascutum pointed out this lack of analysis - fragmentation of the business - as one of their past weaknesses to correct.

5.2.3 The Analysis - How, When and By Whom

To assess the strategic relevance of a project it is important that the company overall strategy is clearly defined in the first place. Vague statements about policies and missions of the company are not sufficient. It is important to have a clear direction about the relative priorities of the business and the type of investments to go for. This was found at ICL and is part of the corrective actions taken there.

Analysis of strategy, synergy and risk are all interrelated issues and should not be performed independently. For example, when defining the strategy, the company has to be clear as to the type of risk it wants to take. Usually, a company will aim for some kind of diversification so that the risks are spread. This can be done by a combination of two or more areas of products, where at least one gives a steady income, allowing the other some fluctuation. This is the case of Goldfields, for example, combining both stone and gold as main activities. Gold is very subject to market fluctuation, but a greater risk can be taken in this area as the stone market - a less fluctuating one - gives a steady income to support it.

Diversification does not necessarily mean a combination of different activities. For example, in an oil company, all projects will be affected by the oil market - they are all linked together as the same factor is affecting the projects. The company can then spread other risks by, for instance, spreading the location of its activities (political risk). The aim is always to have a good balance of the risks so that the company will be safer than the individual projects. A well rounded balance will also allow some projects to be taken for prestige and not necessarily for profit.

The analysis should also be done in conjunction with the synergistic aspects: a company should not diversify into areas which are completely new to it; it is important to have a clear idea of what kind of projects the company is capable of doing, for which it has the necessary skills. When spreading into new areas, which may be necessary to reduce risk, gain experience or any other strategic reason, this should be done slowly and in small increments. Failures of this nature (jumping into novelty too fast) were reported in the past experience of several companies, like British Nuclear Fuels (BNF) or British Aerospace (BAe).

Some companies may face a business where risks in novelty are crucial to be taken for competitive reasons. For example, Glaxo is a pharmaceutical company and part of its long-term strategy is to acquire capability background in new areas of research; therefore, it has to invest large sums of money in high novelty and high risk areas, where the immediate pay-off may not be money but a better understanding of

diseases (long-term strategy). But there is the risk of spending too much into researching new products that may never reach the market or make profits. The company has to have the scope to afford the inherent risk of the project; otherwise, it should not take it. There has to be a balance between old and new fields so that the risk of a project in a new field can be absorbed by the company.

To check if the project fits well with these aspects - strategy, synergy and risk - it is important that the analysis should be carried out by a group of people with knowledge of all areas of the company. This will ensure that synergy is looked at and inconsistency avoided; it would also ensure that the project fits, strategically, in all sections. This is the practice of ICL and Glaxo, where strategy is a crucial aspect to the development of a project. In ICL's recent system of analysis, a greater relevance has been given to the non-financial aspects of proposals, in particular to the strategic aspects. The analysis is performed through a 'strategy panel' which covers basically long-term strategic aspects (the short-term is covered in the financial analysis). The panel is filled, for each project, with a yes or no answer, resulting from the consensus of a peer group of strategy directors representative of all five units of the company. This is to ensure coordination, in particular between sales and manufacture, to check all implications on the company and the interrelations between sectors. This is done at the earliest stages of the project in order to be effective, but it is continuously reviewed through 'phased stages' to check if the assumptions still hold. The new system is seen as a great improvement on the traditional emphasis on the financial side, and its great advantages are to ensure business coherence (as it involves all units), implement strategies (checked through the panel items), and ensure that products relate to ICL strength points (methodologies, experience, etc.).

Similarly in Glaxo, great relevance is given to the strategic analysis of its research projects in order to see them in the context of the whole company. This is assured by review meetings at directorate level involving all units to ensure coordination and avoid duplication (research is done at specific sites agreed in those meetings).

Shell also gives great relevance to the strategic aspects and proposes six items of analysis to place the project into the business context. They cover the main aspects discussed earlier and show the importance they are given in practice. These items are as follows [105]:

1. **Potential of the project** - which are the project's inherent strong points (for example, if it is an innovation, if it expands the market, if it produces a new product or an established one but which is superior to its competitors, etc.).

2. **Competence and management resources** - to make the project a success (for example, previous experience, project improves efficiency or eliminates a competitive disadvantage, etc.).
3. **Compatibility** - see if a project fits in with current activities and projects, if there are benefits from possible spin-offs, such as experience, skills, market position, which will in the future improve prospects in other activities.
4. **Dynamics** - see the demand curve of the product, and if the project catches the upward phase.
5. **Risk** - see the effect of carrying out a project on the overall risk of the company (if it contributes to a greater variety of products or markets, reduces the overall risk, or if the product moves out of phase with the other company products, etc.); see inherent project risk: is it financially bearable by the company if it goes wrong?
6. **A Directional Policy Matrix** is used to locate the project in terms of the company's present competitive capabilities (vertical axis) and the prospects for commercial enterprises (horizontal axis). This should serve to narrow the choices between options and indicate the most suitable ones.

In all cases, the analysis is done at the early stages of the life of the project and subsequently monitored.

5.2.3 Summary

This section discussed the importance of analysing the project interaction with the company - strategy, synergy and risk - and highlighted the issues and risks involved and the ways to deal with them. These aspects are summarised below:

- **Key issues in the analysis:**
 - strategy
 - synergy
 - risk of project versus risk of company
- **Risks involved:**
 - fragmentation of the business
 - not using company's best capacities
 - duplication of work
 - inconsistency
 - too much risk in one area

- **Ways to avoid risk:**
 - strategy
 - predefine it clearly and comprehensively;
 - review it throughout the appraisal;
 - synergy
 - check consistency in all units;
 - make sure project has some synergy, to benefit from current experience, etc;
 - keep innovation in small steps;
 - risk
 - see how much company can afford;
 - diversification: be clear as to the type of risk company wants to take (usually spread risks by geology, politics, etc.), but also be clear what kind of projects the company is capable of doing;
 - the aim is to get a good balance of risk and doing things at which the company is good.

- **Assessment:**
 - when
 - as early as possible in the life of the project;
 - who
 - senior personnel (to have a clear idea about strategy, to have experience in assessing risk);
 - all units represented (to ensure coordination);
 - how
 - all areas interdependently;
 - use a strategy panel (ICL);
 - use a list of items (Shell), or ensure knowledge of those items (senior personnel will have it);
 - use of a Directional Policy Matrix (Shell).

5.3 TECHNICAL ANALYSIS

5.3.1 Main Issues and Risks

Technical factors have been pointed out in the literature as one of the common causes for project failure - cost and time overruns (Cohran [18], Hayfield [28], Kharbanda & Stallworthy [40], Morris & Hough [57]). It was confirmed by several companies that failure to appreciate technological risk is a main source of overruns (ICL, CEGB, BAe, SI, Logica and others). This was particularly true when new and complex technology was involved.

In the Aerospace and Defence sector, where continuous research and new technology are a typical feature, it is the technical side which presents the major risks

to a project. This was referred to by both British Aerospace (BAe) and Smiths Industries (SI). In SI, the large amount of investment goes for bids involving completely new equipment (in new aircraft programmes, up-dated systems, etc.), so getting estimates wrong is very common. Cost estimates are very difficult to predict because, given the long time span of work - an average of twelve years - there will always be new technical specifications in the course of the project (in this field, R&D is very fast, so mid-life revisions are always needed). Changes are frequent, as well as new technology being not completely understood when the project starts, which adds to overruns and delays. Nearly always, SI said, these two factors occur - the project starts running out of time, an extra team is put on the project, and the price goes up. But anything is better than total failure, it was added. In BAe, failures linked to difficulties in achieving performance - due to technology not being established properly at the beginning - are the most common type.

Technology badly established initially is also among the main causes of delays in CEGB and BNF. CEGB referred to "failure to appreciate technological risk" and "not making a gradual transition in technological progress"; the use of prototypes, which could be a way of limiting the risk, is not common either. BNF referred to "inadequate or wrong definition of what is being tried to achieve" and "changes at a too late a stage". According to BNF, projects cannot tolerate too much change, in particular after the feasibility stage. Generally, it is the increase in quality which is the motivator for changes - and this (end) objective may justify it - but this has to be balanced by the difficulty in assessing to what extent the change will have consequences. Even a small change will have effects in many disciplines, and the full impact of it is, most of the time, not known - here lies the risk.

Also for British Rail, it is badly assessed technology that is one of its biggest areas of risk. In principle, it was said, when new technology is involved, it should be done in small steps - for example, buy a few pieces, assess, then buy the rest; but there is a tendency to be over-optimistic immediately and assess the risks badly - which leads to overruns and delays.

In projects where R&D is very fast, it is very easy to get estimates wrong and overspending. This was seen in the Aerospace and Defence sector, as noted above, and is even more the case of electronics companies, like ICL, where research is at the heart of the business. Even when the product is totally visualised at the beginning, ICL said, when it is carried out it is seen that it needs something unforeseen to get it wrong (for example, the software program requires more megabits; the technology is not available; certain types of component that were assumed to happen, etc.). Logica, a consulting company in software, pointed out underestimation of the complexity of the task and new technology as their main areas of risk. When new computers are involved, the risk lies mainly in the quality of performance.

5.3.2 The Assessment - Why, When, How and Who

All the above examples show the importance of ensuring a good technical assessment. This was the declared policy of all the companies, especially those dealing with complex technology.

This analysis is normally started at the earliest stages of the project. Together with the financial return, it is seen as extremely important. Yet this is an area that leads to most of the overruns and delays. In some sectors, where R&D is fast or where very high technology is used, it is very hard to completely avoid it. Still, some checks can be made to limit the risk. These are some of the ways:

(1) Understand the technology before the project starts

As seen, badly established technology is a common cause of failure. Therefore, it is worthwhile to take the time to understand the technology, not rushing the design phase, and not overlapping design and implementation (insofar as schedule urgency allows it).

(2) Train personnel

Where staff are not familiarised with the technology, they should be properly trained before the project starts. This is Logica policy: for example, when new computers are involved, personnel receive special training on their use to reduce the risk of poor quality of performance (when inexperienced staff are used - in Logica - they will always be accompanied by key personnel so that a minimum standard of quality is always guaranteed).

(3) Use standards of technology compatible with skills of personnel

Trade-offs between the level of technology and availability of skills are often done. According to W.S. Atkins, a consultant company to many Third World countries, availability of skills and the need for training can be very important in those countries. It is, in their experience, common for Third World countries to want to use the newest possible technology, irrespective of their capability to handle it. Eventually, proven and familiar technologies will have a better chance of being implemented successfully than the newest sophisticated ones. This is also confirmed by World Bank experience [8].

(4) Avoid changes as the project proceeds

This can be done by spending more time at the planning and design stage (balanced, of course, against the fact that this itself involves too much delay, which can be crucial in very competitive businesses, such as electronics or pharmaceuticals).

(5) Use of prototypes

This is applicable when projects use new equipment, materials, etc., involving technology not yet tested. The CEGB and British Rail both mentioned prototype use as a step against technological risk.

(6) Obtain other opinions

One of the main deficiencies with the system of assessment, for SI, is the fact that it relies very much on the judgement of engineers about what needs to be done. To counterbalance this, it is Smiths' policy to check the assessment through a second party. But it was said it is still easy for both to get things wrong. It is also ICL and BAe policy to do a second check to limit the risk of wrong estimates or wrong assumptions. British Aerospace referred to an engineering tendency to look at things as easier than they will turn up to be when assessing the risks; normally, a second judgement, based on experience, will be done by senior personnel, "doubling the number" it was called.

(7) Use good personnel with lots of experience

This is valid in whatever area of analysis - experience is irreplaceable. Experience can answer questions like:

- have we done it before?
- what was it like?
- can it be applicable to this area? (comparative process)
- what mistakes did we made?.
- how could we have done better?

(8) Use new technology in small steps

This was referred to by several of the companies as a way of limiting the risks of unknown technologies - it is easier to handle novelty in small steps and increase its use gradually (British Rail, British Aerospace, Bechtel, etc.).

(9) Go for safer technologies versus cheaper ones

This was particularly mentioned by the CEGB. It is their experience that it is worth going for safer technologies, even though they may cost more, than rely on the cheapest, but less effective, ones that might bring problems later on, leading to greater losses.

(10) Use of good milestones

This is ICL policy - to make certain milestones to allow the review and confirmation of assumptions, including demonstration of capabilities.

Technical risks may also be transferred or shared. The use of joint ventures or partnerships are a way of doing this. The CEGB makes use of this.

In some cases, risk can be transferred to clients. Logica, for example, insures against risky technologies by explaining the risks to the client and defining to what extent the company itself might be contractually liable. It is their policy to get an acceptance by the client of the contents of the work and procedures to do it. Construction companies use a similar process or cost-plus contracts, especially in off-shore construction, where high technology is involved and technical risks are high.

Once all risks are assessed, then it is a matter of judgment if there is a great advantage in proceeding with the project, even if the risks are high. (Logica, for example, has rejected some projects through its Quality Assurance Department because, among other reasons, the technology was too risky.) If a project with high risks is taken on, then the process will be to try to minimise those risks by using some of the ways mentioned above. When carrying out the assessment, it should also always be kept in mind what would be the effect if that assessment was incorrect - to see the consequences and allow for contingencies (ICL philosophy). To take a risky project would also be a matter of how much contingency the project can afford (Smiths Industries).

The final decision will always involve some kind of trade-off - safety versus cost versus quality of performance versus necessity for training or even versus political aspects (the CEGB, for example, being a public company, has to balance the necessity of importing technology against the need to give the British the knowledge of advanced technology).

5.3.3 Summary

Technical risks are normally associated with:

- risky technologies;
- new technologies;
- badly established technology;
- underestimation of the complexity of the task; and
- changes.

In projects where R&D is very fast, it is very easy to obtain wrong estimates and overspending. Changes, new technical specifications, are common. The risks are:

- overrunning - cost;
- delays - time;

- poor quality of performance.

Several ways of minimising the risks were suggested; these are as follows:

- understand the technology before the project starts;
- get personnel trained;
- use standards of technology compatible with skills of staff;
- avoid changes as project proceeds;
- trace the impact, in all disciplines, of any change;
- use prototypes;
- avoid overoptimism in the assessment of the risks;
- get other opinions;
- use good personnel with lots of experience;
- increase technology in small steps;
- go for safer technologies rather than cheaper ones;
- use of good review milestones;
- use of joint ventures to transfer knowledge of technology.

The assessment should be done at the earliest stages of the life of the project, reviewed throughout, and it should always be kept in mind the effects of that assessment being incorrect - to allow for contingencies. In some cases, risks can be transferred to clients through contract specifications and including contingencies for overspending. A further way of limiting the risk is to share the project - if this is too risky for the company alone to take it.

5.4 POLITICAL ANALYSIS

5.4.1 Main Issues and Risks

Most major projects will face some kind of political interference - through the need for permission, through funding, through legislation, through public inquiries, etc. These interferences are greater in the case of public projects (where ultimate decision-making lies with the ministries) and in the case of overseas projects (where risks are also high if in an area of political instability, if nationalistic feelings arise, etc.).

Public companies such as the CEGB and BNF referred to political influences in their decision-making. For example, decisions to build new power stations or any major investment, in the CEGB's case, are subject to the approval of the whole governmental and democratic bodies (request to the Secretary of State, permission to

build, permission from the Treasury for finance, permission from the Nuclear Institute, etc.). In these decisions, those bodies take the whole economy into account, not just the corporate aspects (for example, the policy of importing technology or not *versus* giving the British the knowledge of high technology). After all necessary permission being sought has been given, the project then goes to the company Board to decide finally if it still wants to go ahead with it. Public inquiries may well come into this if there is opposition (social, environmental, safety, etc.). All this slows down the process and it is therefore necessary to take these delays into account and minimise them (for e.g. by preventing a public inquiry).

In the transport sector, British Rail is also under the ultimate authority of the Ministry of Transport through the need to agree its plans and general objectives, and the need for funding. The Secretary of State, by agreement with the Board, calls in a selection of major projects (more than £5 million) for his personal authorisation and, occasionally, some less expensive ones of a particularly controversial nature.

In social projects (Health, Transport, Defence, etc.), all major policy guidelines are political, coming from the relevant ministries and the Treasury (the ministries always give the final go-ahead, although this is mainly based on the appraisal). A recent failure in the Defence sector (the Nimrod project) was due to the political decision of buying British instead of importing from America, which in the end was scrapped after spending £1 billion over a ten year period.

Another public project (the case of the British Library) was recently reviewed by W.S. Atkins, as it was facing several delays and overruns. Among the reasons identified were:

- i. Delays due to the political nature of the project, i.e. a project under Governmental expenditures.
- ii. Badly set up organisation (no champion was devoted to the project, personally or professionally; no clarification of authority and responsibilities; the project manager had no direct control over the multi-lateral contracts, etc.).

These latter aspects, on the organisational side, were confirmed by several departments in the public sector (Health, Transport, Defence) as quite common. Contrary to private companies, in the public sector there is a lack of clear responsibilities and assignment of authority to a project champion, so that projects would run quicker and more efficiently. This will be discussed further below.

Overseas projects are always subject to political interference: through legislation, through imposition of partners, etc. Risks can be very high, depending on the location of the project. Risk factors may include:

- **Size of the project** (a project involving a large amount of money may prove too demanding for a small country with a weak economy - problems with financing it if the foreign country has a share in the project; problems of increasing inflation due to the pressure on imports of materials or equipment, etc.).
- **Inexperience** (this will add to the cost of the project by the need for training personnel in all areas; managerial inexperience may also cause problems of efficiency).
- **Lack of resources.**
- **Nationalistic feelings** (these may lead to social opposition, nationalisation, pressure over the benefits, etc.).
- **Bureaucracy, unclear rules of decision** (leading to delays in decision-making).
- **Different expectations of the project** (a factor that may lead to pressures over the project benefits).

All the above factors were experienced in the Cerro Colorado project and were feared among the most difficult problems to overcome. (The Cerro Colorado was a \$2 billion project in a country with a \$3.5 billion GDP - all 1981 prices. This would have imposed a tremendous strain on the domestic economy - debt, inflation, labour supply, imports, etc. Would Panama cope? Furthermore, bureaucracy was high and this would slow down the day-to-day decision-making.) Therefore, where the project is located can be an important factor. This was confirmed in other cases. Construction companies, for example, such as Humphreys and Glasgow (H & G) and Bechtel, take it as one of the criteria to decide what projects to bid for (bid for UK projects only if there is enough work at the time, rule out highly risky countries, etc.).

ICL, BAe and SI also take political considerations into account when deciding, at a strategic level, where to invest or with whom to negotiate (e.g. sell to South Africa?). When several countries are involved, decisions are influenced by political aspects. For example, in the Esprit project, ICL had to take decisions according to the other Europeans (Europe is part of ICL long-term strategy). Also, in the establishment of partnerships, political considerations can be taken into account. This is SI philosophy - to check the relations of their potential international partners with their respective governments.

Therefore, either because the project is in a country of political instability or risk, or because it is a project of a political nature (public projects), or because it involves international partners, or simply because the project is subject to

governmental permission, funding or legislation, it is necessary to include an assessment of these influences and its effects for the project.

5.4.2 The Assessment - When, Who and How

- **When**

The assessment starts at the very early days of the project, so as to be an input in the decision of making a commitment to the project: bid, option, etc. It should be reasonably detailed and span all possible risks as this is the time to stop a project for political factors - since, if the risks were too high, there should be no reason to commit any resources to the project in the first place. This is the view shared generally by all companies, although, in practice, it does not always happen. In the Cerro Colorado project, for example, a very rough analysis was done prior to the option on the project being taken. Only towards the end of the prefeasibility stage (one year later) was a detailed analysis of the economic and political situation of the country done. Retrospectively, it was said by RTZ's political expert that the analysis should have been done much earlier to have been more effective.

On a day-to-day basis, people responsible for the project should be constantly aware and assess all political implications of all issues, and taken them into account on the decisions made.

- **Who**

For a comprehensive assessment of the political situation of a country, and the political implications to a project of Government interference, subjective judgement is not enough. It should be based on expert analysis. Companies that do include a political risk analysis in their appraisals do it normally on that basis - internal or external experts. RTZ, for example, has its own full-time expert. The use of consultants is also practiced (Shell).

Both Shell and RTZ are companies operating world-wide and in countries where political instability is expected (Latin American countries, for example). This is probably the reason why full-time staff and experts are normally employed in the analysis. In other companies, where the political side of projects is not so clear and does not assume the same relevance, decisions taking into account political implications are taken at the Board level, based greatly on its members' judgement and knowledge. For example, in British Aerospace, if a problem is foreseen (such as should trading be done with certain countries?), a decision would go to Headquarters for clarification. The same happens in Smiths Industries (most of Smiths Industries' work is with North America or Europe, which does not cause any problems, but, previously, there had been experience of political risk in work done in South America; the risks were judged at Board level).

- **How**

The assessment should be as broad as possible. In the experience of companies like RTZ and Shell, the following ways of carrying it out proved important:

- Talks with the Government, and governmental bodies, to assess stability and intentions as to the project (mainly at high senior management or Board level).
- Visits to the country by the analysts to assess the economy and politics.
- Talks with previous companies operating in the area, to gain a knowledge of their experience within the political and economic situation of the country.
- Use of previous economic or political reports on the country (e.g. World Bank reports).

This was the process used by RTZ in the Cerro Colorado project; other companies (Shell, Consolidated Goldfields) use similar approaches. Through this process, a clearer and more close knowledge of the real situation is acquired than when companies base their judgements on country risk indices. This is too narrow a view of the problem, as indices do not allow the weighing of the different elements and the identification of the risks of each specific project so as to take measures against them.

5.4.3 Ways to Minimise Risks

A thorough analysis, along the lines mentioned above, is the first step to prevent risk - since in that way the risk factor can be identified and measures can be taken to minimise them.

When overseas projects are concerned, it is extremely important to establish good relations with the host country, and its inhabitants, from the start. This can be done by, among other possible ways:

- recognition of the reasonable requirements and aspirations of the host Government;
- participation of nationals in the profits;
- involvement of nationals in management at all levels;
- assurance, through participation of nationals on the Board (in partnership projects);
- listening to local views.

The above were measures taken in the Cerro Colorado project, where it was necessary to gain Panamanian trust. Panamanians were always involved at the major decisions

through their participation on the Board and through discussions with Government officials of all major issues. This dispelled the initial suspicious feelings against 'the exploiter' (foreigners), which is quite common for overseas projects. Also, Shell takes the same view - to involve the nationals as much as possible on all levels of management. This way, locals will feel that the project is their own and not that it is an exploitation of their resources. It therefore avoids nationalistic feelings.

Other ways of limiting political risk would include: the involvement of international institutions, such as the World Bank, for credibility (it was used in the Cerro Colorado project); the involvement of other countries in the project; and, in the context of the overall risk to the company, the diversification, as much as possible, of the places of investment.

5.4.4 Summary

Political risk is particularly important in public projects and in international projects. Public companies are more subject to political interference than private ones - through funding, permissions, decision-making, political policies etc. - they need Government support for major projects to succeed.

Overseas projects are always subject to political risk. Risk factors include:

- size of the project (in comparison with the size of the economy);
- inexperience (technical, managerial, etc.);
- lack of resources;
- nationalistic feeling;
- imposition of partners;
- bureaucracy and unclear rules of decision-making;
- different expectations of the project.

Several guidelines were suggested to minimise the risk and to assess it. To minimise the risk:

- A comprehensive assessment of the economic and political situation of the country should be done as early as possible. To be effective, it should be done at a time prior to the initial commitment. It should include the economic structure of the country, political stability, past experience of foreign companies, etc.
- Steps to be taken in case of conflict should be established in advance.
- Nationalistic feelings should be constrained. This can be done by:
 - negotiating the basic deal in a manner perceived to be fair from the start;

- developing good relations with the country's officials and with the inhabitants (obtain their trust; make them feel a counterpart; take their views into account);
- recognising the reasonable requirements and aspirations of the host Government;
- involving the nationals in management at all levels;
- participation of nationals in the profits;
- participation of nationals on the Board.
- When selecting an overseas partner, it is best to check their political relations with their Government.
- International institutions can be involved for credibility.
- Involve other countries and diversify the countries of investment.

To assess the risks:

- Use experts (internal or external people) on the analysis.
- Talks with the Government and governmental bodies to assess stability and intentions as to the project.
- Visits to the country by the analysts to assess the economy and politics.
- Talks with previous companies operating in the area to gain knowledge of their experience within the political and economic situation of the country.
- Use previous economic and/or political reports on the country.
- On a day-to-day basis, be aware of all political implications of the different issues, and take them into account in making decisions.

5.5 SOCIAL ANALYSIS

5.5.1 Main Issues and Risks

Almost any type of major project will have some degree of social impact on the local community. This may include an impact in terms of: employment (jobs created by the project); financial benefits (e.g.local spending by workforce); health (if a project is dealing with harmful substances, such as nuclear projects, or if it is causing damage to the environment in terms of pollution or others); housing (for the work force); resettlement (if the project installations are on currently inhabited land); or any other damage (for example, constructing infrastructures or any installations and opening a route to these might destroy cultures, houses or other property). If the

negative aspects are not recognised and properly dealt with, they may lead to social opposition, causing delays to the project or eventually making it stop.

International projects face even greater challenges brought about by: the problems of understanding a new culture - important for good communications; the problems of staffing - the need to give opportunities to locals so that they will feel the project is their own and not mere exploitation of their resources; or, particularly when ethnic minorities are involved, the problems of the preservation of their culture and integration of their values in the project's policies.

Social problems are recognised to increase the costs, mostly through delays. This was found to be true for companies in the process sector, where Shell, RTZ, and Consolidated Goldfields (CGFd) all place great relevance to social analysis, in particular because many of their projects are overseas; for companies in the energy sector, where delays were mostly due to public inquiries; in the construction sector, where social analysis is done by companies when they act as consultants for the appraisal and design stages of projects, as well as carrying out the construction part; and in the public sector. Companies in the Aerospace and Defence sector, such as SI and BAe, in the electronics sector, like ICL, or in the pharmaceutical sector, Glaxo, do not include social aspects in their analysis as this was said to be as a rule not relevant in their type of business. The same non-regular analysis of social aspects was said to be the case in Delta (electronics), Aquascutum (stores), and Logica (software consultants).

Nowadays, an increasing number of companies believe that it should be corporate duty to be fully involved and share the responsibilities in the formation and implementation of social policies. This was a view shared by Shell, RTZ, CEGB, SI, BNF, CGFd. It helps to establish good communications with the local people, it was said, and build up their trust (essential for long-term stability).

In the experience of Shell and RTZ, it is best to take good care of people at the design stage and attend to their views rather than risking problems throughout the life of the project (bad working environment affecting productivity; strikes; pressure over profits, or risk of nationalisation in some countries; extra costs in repairing things that could have been dealt with earlier, etc.). It is also CEGB experience that it is better to avoid, if possible, long public inquiries - due to social opposition - which are its major cause of delays. Therefore, there is a need to incorporate social analysis in the appraisal process so that problems can be identified and solved in time.

5.5.2 The Analysis - How, When, Who and Contents

• The contents

The depth of the analysis may vary according to the particular project, but the following aspects should be covered:

- assessment of the project's impact on society (both positive and negative), and in particular on the local population - on health, housing, social organisation, land rights, education, etc.;
- identification of all social groups affected;
- collection of baseline data - for future comparison and assessment of project impact - concerning social, cultural and demographic characteristics and social organisation of production (culture, demography, health, land use, work aptitudes, property ownership, etc.);
- cultural acceptability, and ways to minimise possible opposition;
- ways in which the project design can fit into community values;
- establishment of standards for the most critical aspects of the social impact, such as compensations, training, employment selection, housing, resettlement, or any other aspect relevant to the project;
- social strategy to elicit commitment (to the social policies to be implemented, or to create, in general, a welcome environment to the project).

• **Who**

Much of the above can be obtained by discussions with locals and experts (collect data; set acceptability, etc.). This is part of CEGB, Shell and RTZ methodology.

Consultants should be used for expertise and independent judgement, when needed, to ensure greater acceptability of social policies. This is recommended by experts of the World Bank [8], and is common practice among RTZ and Shell. The use of consultants reduces the suspicion that people may feel to the real intentions of the project promoters when sensitive matters have to be decided.

The figure of a full-time social expert within the company can be advisable, if the company deals regularly with projects with considerable social impact. The benefits would be a quick and sound identification, at the very initial stages, of the relevance of an early social assessment, and to rule on long-term social policies, such as housing, employment, health or education. Other people (internal or external) would still be necessary for the different areas of work during the subsequent stages.

• **When**

Social work can begin in the very early stages of the project. The CEGB, for example, starts negotiations with the local authorities several years prior to development; at the time of strategic studies (station planning), local authorities are informed about the probability of an application for a site in the locality, so that discussions will advance.

In this way, public inquiries, and their subsequent cost in delays, may be avoided or at least anticipated.

The work should be in parallel with the technical evolution of the project so that it can affect decisions, and also be in coordination with the environmental work. This was RTZ policy during the Cerro Colorado project, in order that social considerations could provide input for technical decisions on site selection, selection of alternatives, etc. When social analysis is not seen as really relevant to the project and is taken as an extra study that can be done independently of all other analysis, it loses its real effectiveness as it will not affect decisions at the time they are being made.

- **How - organisationally**

On the internal side, and to achieve liaison between the social and managerial sides of the project, site management should be involved with the organisation of the social work, as for any other activity. This is important in order to coordinate the social side with the project engineering side and the management of any other project activities, such as housing and training, that need to take into account social factors. This was one of the problems dealt with in the Cerro Colorado project since, at the beginning, there was little interaction between site management and the Codemin social group (a Panamanian team).

Externally, to interact with the different social partners, a group representative of local interests should be formed to receive and consider information on the project and its policies. This happened during the Cerro Colorado work. This is the same picture for other companies. The CEGB, for example, attends to the local issues through the establishment of local liaison committees. In the public sector, this is also the policy: Community Health Councils in the Health Department; the Public Consultative Group in the Transport Department, etc.

To accelerate the necessary social changes, the World Bank suggests the inclusion of an information and motivation component in the project [8]. This can be done through the project liaison groups with the community.

- **How - assessment**

The assessment of social reactions to a project - to what extent people believe they will benefit from a project or how they will balance it against the inconveniences - is often taken by qualitative judgement and experience. For example, in deciding on which site for the project, the CEGB knows from experience that: areas of high unemployment will accept the project more easily since they will need the jobs; and Thames sites are inadvisable because major construction in that area is often subject to many delays due to bad industrial relations, etc. This might be a good basis of assessment in some cases, but for a comprehensive assessment it should be complemented by an expert study on

the impact of the project on the communities. This is common practice in companies such as Shell, RTZ and CGFd; it is also part of CEGB assessment when new sites are involved. When using judgement, there should be an awareness not to overestimate the appreciation of the project by the beneficiaries, which according to Baum & Tolbert is a common mistake [8]. A similar over-optimism was confirmed in RTZ, especially among the technical staff, always assuming that 'social' is an easier thing to deal with and what matters is that the project is technically (and financially) viable. There was also a feeling that people would soon see the benefits of the project and then accept it. But if the appraisal determines a project to be a high risk socially, it is advisable to postpone it until the problems are solved, or to start with a pilot project. This is also RTZ philosophy, which is shared by others such as Shell and CGFd.

5.5.3 Ways to Minimise Risk

The methodological aspects considered so far as to what the how, when, by whom and contents of the analysis should be are all important steps to minimise social risk - as this can then be taken into consideration beforehand and properly analysed. Together with the methods of analysis, there are the attitudes to be taken into account in the relation to the problems found, and the company's own principles towards social aspects in general. The following are some of the principles and attitudes that companies have been experiencing as helping to minimise social opposition and creating good support for the project:

(1) Taking social characteristics into account when defining a project

For this, it is important to build up internal flexibility to allow for changes in relation to socio-cultural information; to be able to eliminate or modify technical aspects (or others) if they make the project socially unfeasible or incompatible with local values; and to design policies in a flexible way to account for adjustment to local habits. All this needs constant dialogue and interaction between the project social teams and all other teams, and an overall project manager taking into account the mutual implications of the different policies. An illustration of how social characteristics were taken into account in a concrete project is given in the analysis of the Cerro Colorado (in Appendix A) (for example, finding standards of housing that would respect indigenous habits; defining an employment policy that would allow them gradual adaptation from the traditional agricultural and seasonal work to permanent employment, etc.).

(2) Learning about the country

In order to formulate adequate project policies to the local cultures, the more that is known about the country and its people, the better. This should not be intellectual

knowledge. It is important to look at the people as they are, not as we see them. The better way of doing this, according to Mr Dherse (an RTZ project director), is by living among them to do a real investigation (rôle of a 'participant observer').

(3) Compensating for the damages so that people would not, at least, be worse off after the project

This might be difficult to achieve where people have to be moved or are indeed deeply affected in their way of living. For example, in the Cerro Colorado project, irrespective of all promises, the indigenous people were still arguing about and opposing the project being on their own lands (this was aggravated by a chronic indifference to their situation that they faced from the Government).

In minimising hostility, it is important that the criteria for compensation should take into account local values and traditions, even when things look worthless to the promoter's own culture. Also, the loss of future revenues should be included.

(4) Listening to what people say

Community participation is a key to minimising social problems. Many companies recognise this: Shell, RTZ, CGFd, CEGB, and the public sector. People like to be informed about what is going on, otherwise suspicion will arise and opposition can start on that basis. It is therefore important to keep local people informed and, more than that, to listen to their views and proposals, to consult them as to the related decisions, and to encourage as much as possible their participation, so that they will be motivated and cooperative, and to make sure that changes are acceptable to them.

(5) Persuading people of the project benefits by:

- giving them priority as to the benefits of the project;
(This is commonly done by employing people in the area so that they will benefit directly. This was RTZ policy in the Cerro Colorado case; it is also Shell philosophy to staff local companies with local people, and also CEGB and BNF policies so that people would accept a plant in their surroundings easier (especially difficult if these are nuclear plants).);
- giving workers good housing conditions (which will also beneficially affect their productivity);
- using sites where people will greatly benefit, such as areas where unemployment is high;
- using local resources; and
- making cash injections into the local community to compensate for the inconveniences;

(If the project is implemented by a public company, this can be done at a governmental level by deciding to ensure that a greater amount of taxes will be employed in the area).

(6) Aligning the company objectives with the objectives of the country

This was particularly emphasised by Shell as a way of achieving a greater acceptability for the company's projects. It is particularly relevant for overseas projects where susceptibilities against foreigners are greater.

(7) Training managers to be aware of the outside world and deal with social problems (also a Shell policy)

(8) On a long-term basis, developing good links with the local communities

Even in the case of companies whose projects do not normally bring any social effects, the necessity of building up a positive and welcome environment for the company to work in is recognised (it affects the workers' productivity, strikes, etc., and it prevents political pressures in projects overseas). This is SI, RTZ, CEGB and Shell philosophy. Smiths Industries normally gives local support for general activities, such as social, educational and medical facilities, etc. The same long-term perspective is taken by RTZ through the creation of 'social foundations' generally linked to part of the project's dividends. The aim is to achieve a positive environment and a feeling of communication and interest throughout the life of the project. This kind of support is a realisation of social aspects to a larger extent than the needs of the project itself, but it was felt just as important to establish a good atmosphere towards the project and a good environment to work in.

(9) Creating a good public image

This is relevant to all types of company, so that the company will be welcome. It is normally taken into account through the public affairs department.

The public sector, in particular, enrolls in a series of initiatives to find a good image to present to the public (for example, the establishment of days when the Royal Docks are open to the public). This is greatly needed because of the necessity to justify their expenditure in the eyes of the public (public money).

Creating good publicity for a project can also affect the possibility of financing it. The Channel Tunnel achieved this by convincing people that it is a good project so that they would be able to finance it, even if the return is not on a short-term basis.

Social considerations can also be taken into account for internal matters. For example, in deciding which people should go to places like South Africa, etc., where political views may be an obstacle to some personnel, Logica would always attend to people's views. The same happens when the company allocates people to work in satellite or nuclear weapons projects. Also, in Smiths Industries, people would be allowed to voice any objections to working on Defence projects, in which case their views would be respected.

5.5.4 Summary

Social analysis is done in order to assess the project impact on society, society's acceptability of the project, possible delays on account of social opposition (and how to minimise it), and to find ways in which the project design can fit into community values. The analysis should cover:

- assessment of project impact on society, in particular the local people;
- identification of all social groups affected;
- collection of baseline data, for future comparison and assessment of project impact, on all aspects affected by the project;
- cultural acceptability;
- establishment of standards for the most critical aspects of the social impact;
- social strategy to elicit commitment.

To assess the risks, experience and judgement can be a good basis on which to assess people's attitudes in some cases, but it is better to rely on experts (in-house or external consultants). If appraisal determines the project to be a high risk socially, it is advisable to postpone it or start with a pilot project. This work should be done in parallel with the technical evolution of the project, so that it can affect decisions. For that, site management should be involved with the organisation of the social work, as for any other activities.

To minimise the risks, the following were suggested:

- take social characteristics into account when designing a project; make the project compatible with local values; build up internal flexibility to allow for changes in relation to socio-cultural information; eliminate or modify aspects if they make the project socially unfeasible;
- learn about the country and the people;
- compensate fairly for damages (taking into account local values and traditions);

- listen to what people say; establish Liaison Committees where all social partners can meet to discuss and receive information on the project; listen to people's proposals and views; do it early in the life of the project;
- persuade people of the project's benefits by:
 - giving them priority on the benefits of the project (employment, good housing conditions, cash injections into the local community, etc.);
 - use sites where people will most benefit from the project, such as areas of high unemployment;
 - use local resources;
- align the company's objectives with the objectives of the country;
- train managers to be aware of the outside world and deal with social problems;
- develop good links with the local communities throughout the whole life of the project through general support of local activities, etc.;
- seek a good public image.

5.6 ENVIRONMENTAL ANALYSIS

5.6.1 Main Issues and Risks

The aim of environmental studies is to minimise, if possible, all damage caused by a project to the landscape, air, water, or any other element. Environmental impact is particularly important when major construction is involved, and in the processing, mining and energy sectors. In the public sector, about 10% of the programmes in the transport department are built on environmental grounds (to improve the environment by use of a bypass, tunnel, etc.). Safety and health aspects are normally associated with the environmental studies.

The need for the analysis is, in most cases, determined by the need to comply with the existing regulations on levels of pollution, noise, etc., especially in developed countries where there are well established laws setting the limits for environmental damage. Also, it is in developed countries where social opposition is strongest, since there is a greater awareness of the importance of preserving the environment. W.S. Atkins, who has carried out several consulting projects in undeveloped countries, finds that many companies in these countries tend to be much more relaxed about the environmental damage. If companies can get away with the minimal costs, then they will, even if the same aspects would be regarded as unacceptable by well developed countries. The risk is that, later on, if companies were too relaxed with the standards

initially, problems might arise and cost much more - the Bhopal case should be inadmissible nowadays. Also, social opposition may occur and delay the project - even when legislation does not yet exist in a country, international groups such as Greenpeace, Friends of the Earth, etc., tend to intervene and draw the attention of the local people to the consequences of not protecting the environment. (In Panama, for example, during the Cerro Colorado project, all sorts of international groups campaigned for the need to preserve the environment.) Therefore, even when the law does not rule on environmental matters, companies nowadays should have their own minimum standards to apply, whatever the country. The commitment of a company to study the environmental impact of a project can also alleviate fears of the population and therefore create a better climate for the development of the project (Shell's experience).

5.6.2 The Analysis - Who, When, How and Contents

• The contents

The environmental work, like the social work, may be more or less detailed according to the specific project - the relevance of its impact on the environment. The following are guideline points as to what the work should cover:

- assessment of project impact and identification of points of ecological sensitivity to minimise the damage;
- collection of baseline data for standard comparison during project operations (air quality, water quality, etc.);
- experimental work; and
- health and safety considerations.

General guidelines may be insufficient for specific projects that need a detailed knowledge of the local environment. Shell policy, for example, is to consult local people for a detailed analysis - experts, local universities, etc.

• When

The work needs to be carried out in the early stages to be effective, in order to provide trade-offs to design selection, site selection or other alternative selections. These studies may need to be phased with the project development so that the conclusions reached at one stage can be taken into account to define the next set of work. An example is given by Somerville in an internal paper on oil and gas exploration of Shell UK in estuaries [106]. Some of Shell UK's oil and gas exploration takes place in estuaries within which there are complex matrices of environmental features that make it impossible to generalise about the possibility of carrying out a particular operation

without specific knowledge of the operation and the planned location. Therefore, the environmental assessment starts with a series of background studies and assessment that serve as a basis for site selection. (This work is done strictly in parallel with the technical side.) Only when the location of any oil and gas structure is known can the next phase in the environmental approach be undertaken.

- **Who**

Some companies, such as Shell, RTZ, CEGB, have special groups within their organisation (or an environmental expert) who provide support and advice for the environmental studies and assessment. This can be complemented by the use of external consultants when the environmental problems are complex and cause fears among the population - it will bring independent judgement and expertise to the analysis. This is the practice of Shell, RTZ and CGFd. Also, the use of local skills for a better knowledge of specific problems in the area is advised by them.

An environmental officer should be appointed to the project in the early days. This figure is useful in coordinating all environmental aspects (in the project team and all the external people used) and should report to the project manager on site (for consideration with all other areas). This was used in the Cerro Colorado project to coordinate the environmental work. It is also Shell policy, in its projects, to establish a managerial position to coordinate all the environmental work.

- **How - assessment**

Frequently, environmental studies are carried out according to existing laws and regulations. As mentioned earlier, this is the experience of W.S. Atkins worldwide. It is also true, as a basis, for all companies doing environmental work - CEGB, BNF, Shell, RTZ. Some companies however have their own internal standards, within the legislation, that are updated in light of new scientific and technical developments (Shell, RTZ, CEGB). The project impact is assessed by the experts (internal or external) in the light of these standards and the current legislation. Access to local knowledge and experience may be a vital part of background environmental assessment. Shell, in particular, emphasised the benefits to be gained from local knowledge.

- **How - an approach by Shell**

Shell was one of the companies to be seen to pay more attention to the environmental side of projects (partly due to the nature of its projects - process). In the company's Statement of General Business Principles, one can read that "It is Shell policy not only to comply with the refinements of the relevant legislation but to promote in an adequate manner measures for the protection of the health, safety and the environment for all who may be affected directly or indirectly by their activities. Such measures include:

prevention of air, water and soil pollution, precautions to minimise damage, product safety".

An example of how such policy is put into practice can be taken from Somerville [106]:

- Environmental expertise was supplied by a group which provides advice and support to all of the activities of Shell UK Exploration and Production. Liaison with external parties is managed by experts in public affair planning and environmental affairs.
- Prior to the award of the licences for the estuaries, environmental factors were analysed. After the award, a cautious approach was taken, phasing the activities so as to see their implications on the environment (e.g. in the initial phase, any seismic exploration was done with the generation and interpretation of seismic data, and general environmental studies had been carried out in order that sites identified for exploratory drilling can be measured against both the geological and environmental background).
- Early consultations with local authorities bordering on the operational area, port authorities, water authorities and sea fisheries committees were held (the Department of the Environment is responsible for coordinating consultations and for the production of the 'Government view').
- Consultation was carried out in a positive attitude, paying attention to the benefits to be gained from local knowledge.
- Background environmental studies covered a series of aspects relevant to the estuaries. It is Shell experience that general guidelines for the study would be of limited use as peculiarities were present. To deal with them, contacts were established with universities close to the area and, although some guidance on the scope of the study was done, Shell was open to newly identified topics.
- Some areas seen:
 - fishing: a survey of fishing activity was carried out; compensation would be paid if necessary; close contact with the fishing organisation for consultation was established, and it was a successful example of positive consultation and liaison;
 - local regulatory background: a thorough understanding of any local regulatory constraint is considered an essential part of the study (in addition to general regulations);

- ecology: the importance of understanding the relationship between physical habitats and the occurrence of different species;
- shipping: it was clear that some areas should be avoided, including the main shipping lanes;
- others: amenities in the estuaries, marine anchorage, waste disposal, coastal geomorphology, meteorology, coastal land use, submarine pipelines, cables, etc.

The studies served as a basis for site selection for further operations.

The main perceived risk was of any major oil spillage, and contingency plans were taken and developed in consultation with local authorities and governmental departments. Each new phase of operations would involve further, more extensive consultation with the Department of the Environment and further studies to carry out the best possible environmentally responsible option (subject to technical considerations).

With the commitment taken by Shell in the setting and development of the environmental studies, much of the fears of the potential impact of oil and gas exploration were alleviated.

Another Shell internal paper by Kees Van Rijn and Westbroek [108] illustrates Shell's approach to safety and health matters. Safety considerations are also a central part of the evaluation studies, serving as an input to design at an early stage. Teams of different disciplines assess possible hazards and the interrelated health and safety considerations (and environmental issues), and their conclusions and recommendations are reported and used to complete the design of the plant and for the preparation of operating manuals and safety instructions. Where some escape of product (chemical substances) cannot be avoided, additional equipment to protect plant workers or the environment against exposure must be included in the design.

5.6.3 Ways to Minimise Risk - Principles and Attitudes

Most of what has been mentioned before as to how to minimise social risk is also applicable to the environment, as social opposition can be one of the consequences of the environmental impact. Therefore, the same need to:

- inform people and listen to them; inform all interested and affected people (a liaison company/external parties should be carried out, as for social risk);
- compensate for any damage;
- prevent a feeling of mistrust or suspicion by using independent experts (can be given by the use of international contract organisations with

recognised experience to satisfy all parties - local, shareholders, Government).

As discussed earlier, Shell's approach also provides some additional attitudes as to how to minimise the risks:

- By the use of a positive consultative approach for cooperation and support from a wide range of people.
- By given a high priority for safety and protection of the health of the work force and people living nearby; in addition, it is also Shell policy to ensure that local authorities, hospitals and fire brigades are fully informed about the products handled in case of an emergency.

To prevent risk, minimum standard should not be traded off against cheaper costs - the project should stop if *environmental considerations* so demand. RTZ's philosophy is that standards may vary according to the country - the first rule is to abide by the law (as long as it is economically and environmentally acceptable). Trade-offs involve: *economic reasons, technical feasibility and environmental impact acceptability*. It is also RTZ's experience that, in establishing the environmental criteria, the most practicable means might be more realistic than best available standards - which may be impracticable for technical or economic reasons. The most practicable means policy takes into account:

- the best proved relevant technology available;
- the nature and gravity of the situation;
- the operating and capital cost.

As in Shell, relevance is given to health, safety and other related aspects, according to the company's philosophy: which is that environmental performance is not merely a matter of legalistic regulatory criteria, but depends on first class operation from top to bottom.

Finally, the methodological aspects considered earlier, i.e. how, when and by whom the analysis should be done, are all ways of minimising risks (by preventing them and taking them into consideration in decisions).

5.6.4 Summary

The aim of environmental studies is to try to minimise all damage to the landscape, air, water, etc., caused by projects. The need for the analysis is, in most countries, determined by law. Even when this is not the case, the commitment of a company to

study the environmental impact of a project alleviates fears of the local population and therefore creates a better climate for the development of the project.

The analysis should cover:

- the collection of baseline data for future comparisons;
- experimental work;
- assessment of project impact on the environment;
- health and safety considerations.

General guidelines may be insufficient for particular projects - the need to consult external people (experts, local universities, etc.). The use of external experts - local and international - can also provide independent judgement on the assessment, which may be needed to satisfy all parties involved or affected by the project. An environmental officer should be appointed at the early stages, to coordinate all aspects (internal and external). Reporting should be done to the project manager on site, to coordinate with all other areas. The project should be phased in its development so that the conclusions of the environmental studies at one stage can be taken into account to define the work to be done at the next stage.

To minimise environmental risks, experience has shown the following attitudes and principles to be beneficial:

- Use a consultative approach for cooperation and support from a wide range of people.
- A liaison company/other parties should be established (to inform all interested and affected people).
- Compensate for the damage.
- Pay attention to the benefits to be gained from local knowledge (it may be a vital part of background environmental assessment).
- Do not trade off minimum standards by cheaper costs.
- Use of most practicable means taken into account:
 - best proved relevant technologies available;
 - nature and gravity of the situation;
 - operating and capital cost;
- Give high priority to safety of workers and people living nearby; have "first class operations from top to bottom".
- Do not try to get away from the environmental effects of the project, even though the law in the country is not well established - Bhopal situations should not occur as the consequences would be too high (apart from complete loss of company image in that situation).

5.7 ORGANISATIONAL AND MANAGERIAL ANALYSIS

5.7.1 Main Issues and Risks

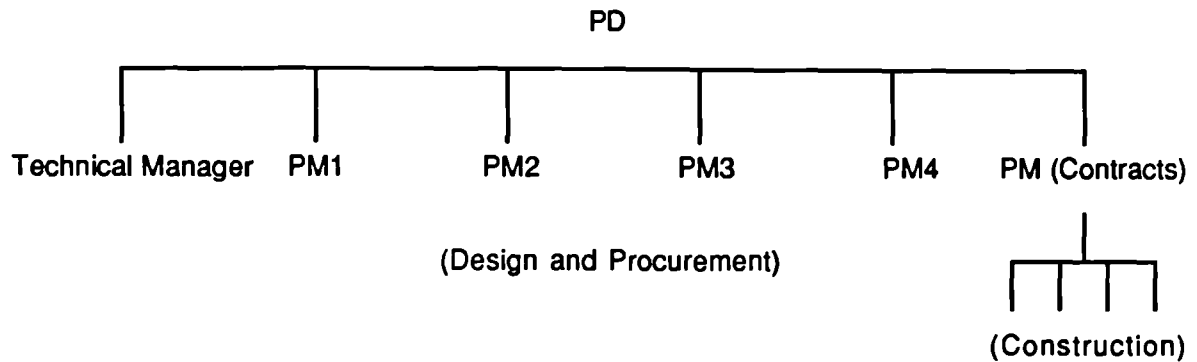
Organisational analysis is related to the way the organisation is set up in order to meet the project needs and characteristics for maximum efficiency. The necessity for proper organisation is common to all projects, irrespective of type. In W.S. Atkins' consultancy experience for many projects, this area is one of the main sources of project failure or inefficiency (particularly due to the project's bad communications and bad interfaces). This goes in accordance with the lessons from many case studies in the literature (Stallworthy & Kharbanda [39]; Morris & Hough [57]; Baker et al [5]). Other companies stressed the importance of organisational and managerial factors for the success of their projects, in particular Smiths Industries (in need of good management and good leadership), BNF (in need of coordination between disciplines and need to project the organisational structure as much as possible), and the CEGB (in need of experienced management). Therefore, much importance is placed upon constructing the right organisation for the project. Organisational structure, partnership relations, communications and report system, rôle of project manager and his selection, selection of key personnel, and work atmosphere and motivation are all factors that can positively contribute to a better project performance. These aspects have been reasonably covered in the literature (cf. Chapter 2). The following pages aim to emphasise their relevance by using the interviewed companies' experience to illustrate the problems faced and the way they were dealt with or analysed.

5.7.2 Organisational Analysis

• Organisational structure

This is a very important aspect. According to Mr. Sykes, from Consolidated Goldfields, very often everything is right except the organisational structure.

The literature pointed out that there is no optimal way of organising - there are trade-offs and the local situation determines the relative advantage of each option (Honandle [34]). It emphasises the need to adjust the project structure according to its size, complexity, duration, technology, uncertainty, and importance (Youker [88]); or the necessity for not keeping organisations too rigid, such as not to allow redefinition of responsibilities, groups, etc. (Hayfield [28]; Kelley [38]). This was confirmed by the companies' experience. The organisation structure of Thorp - a BNF current project - was set up, attending specifically to the large size of the project. It also has been carefully redesigned over time to attend to the project's own development. The present Thorp structure is as follows:



PD : project director
 PM : project manager

Fig.5.1 - Thorp organisational structure

The structure runs under a matrix type. Because of the particularly large size of the project, several project managers were appointed to manage fractions of the work: some for design and procurement work, and a project manager for construction (a strategic manager to select and supervise contractors). In smaller projects, these PMs would be project engineers under the coordination of a unique PM (or PD). The project director (PD) only started one year ago. Until then, before any construction started, the technical manager coordinated the whole work (the technical manager is the project manager appointed at the start of the project for the feasibility stage).

The Al Ymaah project, for the construction of airfield facilities, carried out in conjunction with British Aerospace and Saudi Arabia, is another example of how the organisation needs to be set according to the project characteristics. A project organisation was planned by W.S. Atkins (acting as consultants), taking into account the project's geographical spread of activities (Saudi Arabia and the UK) and the integration of all partners. The main objectives were:

1. To establish a good flow of information between the UK and Saudi Arabia.
2. To integrate BAe, W.S. Atkins and Saudi Arabian teams, and to provide a good use of joint resources.

(from W.S. Atkins' file on the project). The actual structure followed the scheme below:

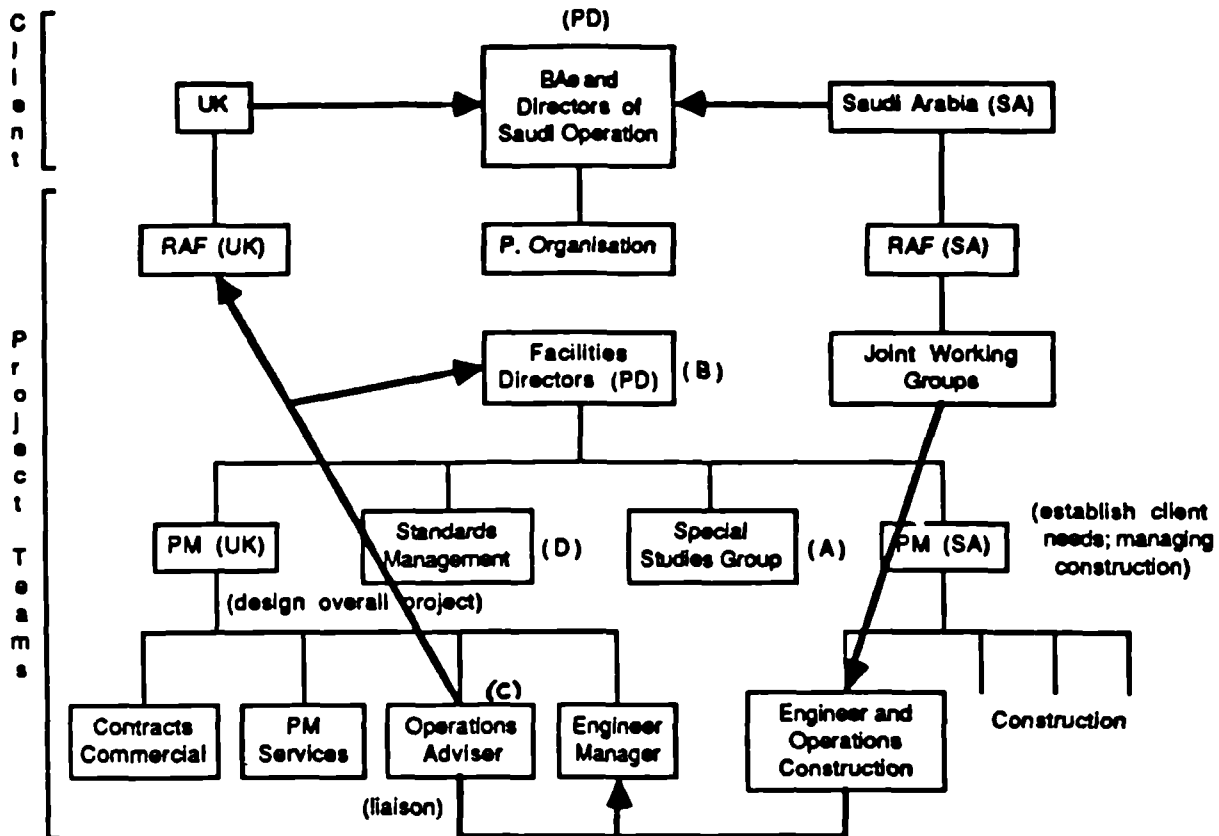


Figure 5.2 - The AL Ymaah project organisational structure

- (A) A Special Studies Group was incorporated in the project organisation to investigate problems arising during the execution of the project and in particular to establish procedures and analyse strategies during the setting up phase of the project. The objective was then to undertake non-routine tasks so that it would not detract from the team's efforts in managing the project on a day-to-day basis. It drew on consultants.
- (B) The Facilities Director (PD) would be responsible for the definition of the strategy and the implementation of policies set by BAe and Saudi Arabia. He is responsible for the fulfilment of total project responsibilities for the airbases. Both PMs report to him. He is linked to the Board.
- (C) The Operations Adviser will make the liaison between the UK and Saudi Arabia, i.e. between the design and the implementation/construction. He provides all links between the UK air force (RAF) and, through the joint working groups, the RAF of Saudi Arabia (to know Saudi Arabia requirements). Therefore, the thick line, ———, establishes the flow of information between the UK and Saudi Arabia.
- (D) In this particular case, where four airports are to be constructed, a Standards Manager was appointed.

In another project - the British Library - the organisational structure was redefined in order to define more clearly the lines of responsibility and authority between PM and contractors (the previous structure was carrying a lot of delays and bad management).

The literature also relates the type of organisation to the life cycle of the project (e.g. Adams & Bardnt [2]). The Cerro Colorado organisational structure is a clear example of such dynamic adjustments. Initially, it was a very flat type of structure, with a small centralising coordinating team; informal relationships were the prime ones, to allow for an easy and quick flow of information and communications. Later on, at the beginning of the construction, the organisation would start to become more rigid and less centralised as a great number of people would be involved, needing greater control. It is RTZ's experience that, at the early stages of the project, the organisation needs flexibility to allow contacts to be easily made; after construction, since clarification of the work to be done is greater, a more rigid structure would suit the project best (clearly defining the lines of communication). This tendency to increase bureaucracy in the production stages had been pointed out earlier (Morris [58]; Adams & Bardnt [2]).

A further literature proposition is that, for most cases, a matrix form of organisation is advisable (Chapman [6]; Morris [58]; Youker [88]). Most companies do use a matrix type of organisation. This was used in Thorp; it was used in the Cerro Colorado project; it is in common use in Shell projects; and also by BAe, SI and the CEGB.

According to Mr Halford, from BNF, a matrix type of structure can usually work well and it is economic; a very large project should have totally task-oriented people (projectised), at least once into the main design stage - on very large (and complex) projects, there is the risk of lack of coordination between disciplines if the project organisation is not separated from the rest of the organisation (100% of people's time). This had been pointed out in the literature [6, 57]. Morris says that, ideally, a project form would be best, especially for the big challenge (major or complex projects), to ensure good coordination between all disciplines. It is often common to find a project manager on top of a matrix with ultimate decision and authority, especially on major projects [58].

In the CEGB, the project organisation is set up by the company's project management department at Barnwood. This will be done after the viability studies have been done, in London, and the design is completed (Barnwood). The project management department has several projects going on at the same time. Each project will be appointed a PM to procure, contract, etc. A matrix type of structure will be set as follows:

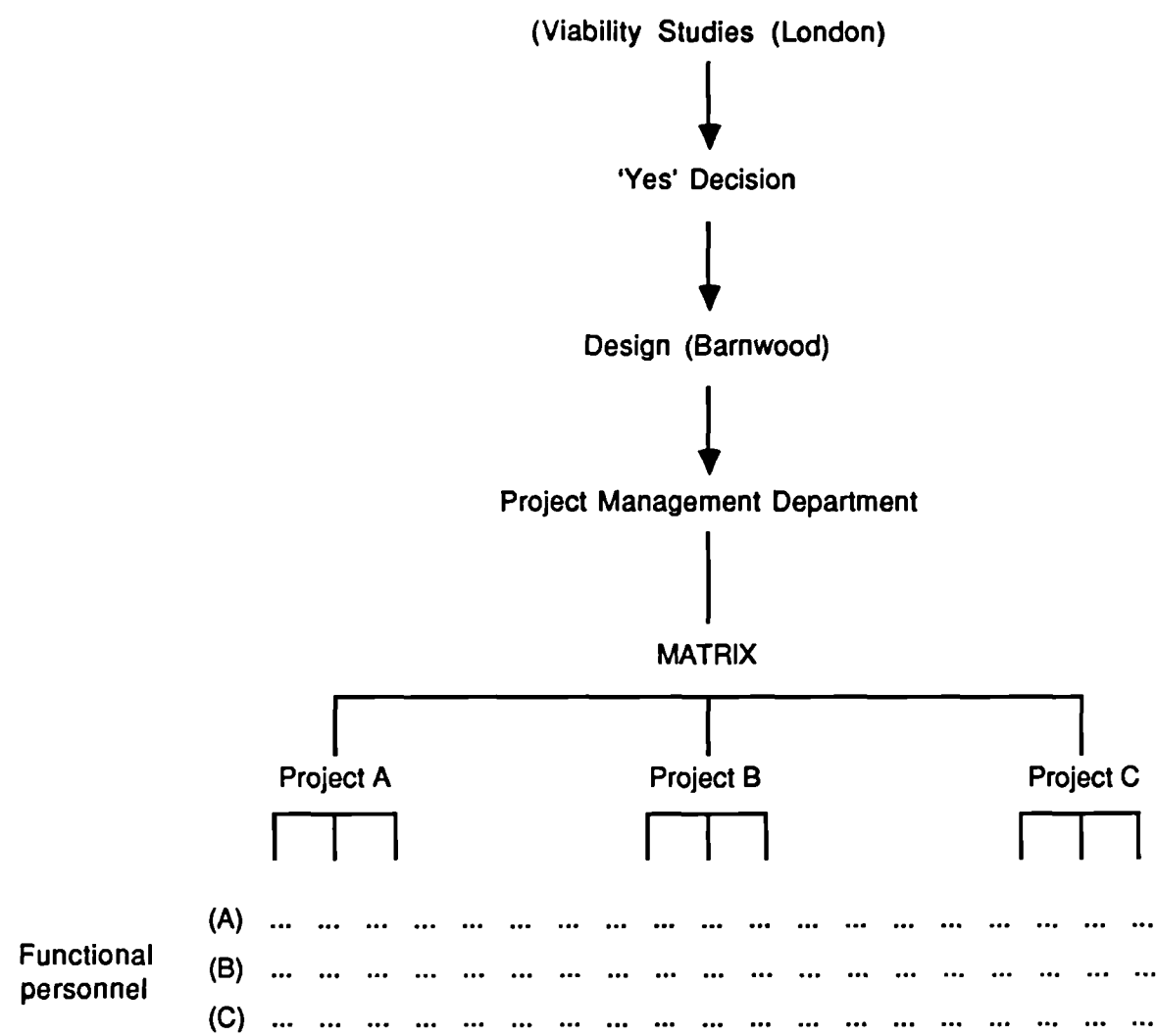


Fig. 5.3 - Typical organisational structure for CEGB project management department

The lateral functions - to all projects - cover: financial, computing, legal, planning, etc. Each person will have, therefore, two bosses under the matrix - for example, the planning function will be done for each project and for the functional planning.

The way the structure is set up from the beginning has some drawbacks. For example, there is not much interaction between the first assessment at London and the development of the project. To account for this, some feedback on the project development is implemented so that policies are updated at London. Also, some people from Barnwood (project manager) will be heard at the earlier stages before commitment. Within the Barnwood centre, some modifications had also occurred in the organisation for greater efficiency. Initially, there was a strict divide between design and the project manager, which the project manager felt was inappropriate as the design was being handled by people who would not build it. Nowadays, a project manager is appointed at the design stage and is involved with the development of the design. These

adjustments in the organisation shows the importance felt of ensuring through it a good coordination between all stages of the project, and all disciplines.

• **Partnerships**

For big projects (big risks), it is natural to do them in joint ventures, to share the risks. Sharing a project may also be necessary for financing reasons, or because of governmental imposition in overseas projects. Sykes recommends that the number of participants should be kept to a minimum and to make sure that they are compatible; in international partnerships in particular, partners with disproportionate economic power should be avoided [80]. Sykes also recommends, in the case of joint ventures, that the companies should make sure the key participants will hold together (interview). The risk of a better alternative altering one or more of the partners at a later stage may make the project unviable. It is important then to ask initially in what circumstances might the partners leave and insure against that eventuality (this is basically a political judgement). A third recommendation is that, when in partnership, only one company should be nominated as the leader and day-to-day decision-maker (operator). This is the policy of both Smith Industries and Shell.

Shell policy is normally to be the operator when in partnerships. The company has two types of partnership:

1. When Shell selects the partner to spread the risk (e.g. North Sea oil exploration: Shell/EXXOM). Shell is responsible for the operation most of the time. This avoids conflicts in the day-to-day running of the project. Major decisions go to the joint committees (this was also the system used in the Cerro Colorado by RTZ).
2. When dealing with smaller partners from local countries that are normally imposed by the foreign government laws (at least 50% of the joint venture normally has to be owned by a national company). It is recommended that particular attention should be paid to the balance of skills and experience between the various partners. When the partners are small, Shell tries to carry out continuous monitoring and have financial guarantees.

When a partner is imposed by a country's law and this partner lacks expertise, it is Shell policy to negotiate for some key positions to be filled by the company's own staff (at least at an initial stage).

In Smiths Industries' experience, some partnerships can actually make the project much more expensive - if they will have to be taught the skills. Hence, this is another aspect to check out when selecting a partner. Smiths Industries exercise great care in choosing their partners, and most of their projects are done in partnership:

- at top level, arrangements are made to forge links with other companies;
- on the political side, SI try to choose reliable partners (seeing their position with their governments);
- extensive checking is done on: past performance, skill, experience, track record, etc.

Whenever there is a partnership, it is also SI policy that only one company stays with the leadership to avoid conflict.

The Cerro Colorado project shows some of the risks of partnerships and ways to minimise them:

1. The need to establish a sound relationship with the partner (gaining trust and confidence is essential to solve problems and reach solutions).
2. The necessity for commitment to both parties to the project - essential to decision-making. Decision-making can be made difficult if there is a frequent change of personnel in one or both sides; or, in the case of a publicly owned company like Codemin, when the objectives are not established independently of Government pressures. Bureaucracy and lack of delegation can also make decision-making difficult.
3. Different perspectives of the project by both partners can add to problems in communication - there is a need to clarify it.

- **Communications and report system**

The literature point out the importance of accurate and frequent information (Hayfield [28]): update information, highlight critical items, keep down paper volume. This is naturally true but there is also the danger of the perfect information. Accuracy has to be occasionally traded off against time or money (Delta's experience). The literature suggests [28] that, for effective communications, dotted line relationships are as important as formal ones. Especially at the very early stages, the emphasis on horizontal and informal communications, where no rigid lines of communication and report are established, may be the best way to have immediate and updated information

for decision-making purposes. This is RTZ's philosophy. Short lines of communication make it easier at these early stages to reach compromises on all dimensions (people in a team would have direct access to someone in another team for quickly solving any problem that might arise). The danger of assuming things are happening when they may not be in this type of informal organisation was well pointed out by Morris [58]. It should be borne in mind.

On international projects, where some activities may have to be spread geographically (for efficiency and economic reasons), additional attention to the communications is needed. This was W.S. Atkins' priority in the project mentioned before, the Al Ymaah. This is also an area, in W.S. Atkins' experience, responsible for many inefficient projects. A Cerro Colorado lesson was also that there should have been a tighter geographical control on the project structure, so that communications would have been easier. A further lesson from the same project was that joint teams (Codemin and RTZ) would have worked better than separated ones - to improve communications and mutual trust.

5.7.3 The Human Element

This is an equally important area to look at in organisational terms - to have the right people in the project. This was stressed by all companies. The use of good people with lots of experience was mentioned in ICL as one of the most effective ways to minimise risks.

- **Project personnel**

Special attention should be paid to the selection of key personnel: the right person for the right job, and not just the ones available [28]. This is particularly true at the early stages, when critical decisions have to be made. To ensure this it is common in RTZ, that the initial stages of a project would have a considerable amount of part-time personnel (senior management with great experience that may be used simultaneously for other work; later on, they may give way to full-time lower and middle management). Also, in Logica, people with high experience are, in many cases, used part-time in order that they may be used in the maximum number of projects.

Experience and multidisciplinary skills were the most prominent characteristics necessary in senior people. In Smiths Industries, skills are assessed in conjunction with the project being done. To take the project, it is examined at an early stage to ensure that it fits into the existing skills. This is done according to the breakdown of project tasks - each task responds to particular skills that are required

and, according to this, people are selected. Attention is also paid to ensure that there is no overload (see people's availability).

To ensure expertise and a good team of people, in many companies special care is given to training. Logica places a great emphasis on this. Shell, on overseas projects, developed a scheme of 'training the trainers' so that local people can be used and be capable. In Third World countries, according to W.S. Atkins' experience, skills availability and the need for training can be crucial. A successful approach is to match the technology level with the existing or possible skills.

A replacement plan for all senior key positions is recommended in the literature [28].

• **Project manager**

Like all other key personnel, the project manager should have broad experience and multidisciplinary skills. His rôle is to see the project as a whole, in all aspects, so that trade-offs can be done carefully. This starts since the initial stages. It is important to ensure the coordination of all policies (social, environmental, technical, etc.) so that they will run in parallel so as not to cause unnecessary delays. Therefore, the need of multidisciplinary skills. For particular technological projects, it was mentioned by BNF, skills in the area are essential; some other people (Morris & Hough [57]; Sykes [89]) put more emphasis on experience of major projects in general, but not necessarily in the same sector. In British Aerospace, like BNF, preference is given to people within the company (to know enough about the company's procedures, systems, etc.). For an overseas project, it would be best to have someone who had experience overseas. In all cases, experience is the vital aspect, as amateurs will rarely succeed. Other qualities are looked at when selecting a project manager, namely:

- human skills: ability to motivate, to communicate, to listen, to get on well with people, etc.;
- administrative and managerial skills: ability to identify risks, proper control and appreciation of the job, etc.;
- ability to delegate when necessary (especially in large and complex projects, project manager should manage more through other people and through directives).

A minimum turnover of project managers is commonly the best way of leading the project [59]. But, in some cases, when each stage of the project requires special

abilities, some people may be best suited to the initial stages but not to the development stage and *vice versa* (this was pointed out by some people's experiences).

- **Team work and motivation**

According to the literature, personal ambition and motivation are amongst the most important success drivers [4, 57]. Great emphasis is placed on motivation by companies (Logica, Smiths Industries, Delta, Shell, RTZ, BNF, etc.). Motivation of people is seen by these companies as essential to create stability on the site and to lower absenteeism. Motivation through non-economic incentives is very important: through variety of work (Logica); by working on a prestigious project; by working with new technologies in leader areas (good for morale in Logica's experience); providing opportunities for people moving into other areas (also Logica practice); encouraging people to take an active interest in their work (e.g. Smiths Industries do this through 'employee councils' where people get together and discuss their company and its business; it also promotes a sense of involvement); by providing good working conditions (this was a source of conflict between RTZ and Codemin in the Cerro Colorado project, as Codemin did not share this view to the same extent); etc. So that motivation is kept, the selection of teams should consider to how well the people involved get on together (as well as how people will perform the job need). This is also RTZ practice. Team spirit is particularly important in international projects - people coming from different cultures. The project manager, as well as senior management, have a key rôle to establish team spirit and create a healthy atmosphere in which to work. The rôle of project manager and teams was emphasised by Glaxo as very important, in particular when time is critical - because, if there is not a good relationship, time can be spent in solving human problems and opportunities are missed.

5.7.4 Key Aspects

All organisational variables (structure, people, communications, motivation, etc.) interact. It is from the integration of all variables and their adaptation to the project's needs and environment that a good level of performance can be achieved. Individually, some guidelines were given as to the more effective ways of organising, and the choice and management of the human element.

(1) Choice of organisational structure

- It should be flexible enough to attend to size and complexity of the project and to move with the project's life cycle (careful design and dynamic adjustments over time are essential).
- It should establish a good flow of information between all relevant parties and define clearly responsibility and authority (especially in the later stages).
- It should adapt to the project's needs in terms of:
 - areas to implement;
 - special groups needed;
 - formal versus informal communications;
 - overall structure (matrix versus projectised).
- Either a matrix or a project form should be used for most projects.

(2) Partnerships

- Partners should be selected paying attention to:
 - past performance;
 - skills and experience;
 - political relations;
 - capability of holding together.
- The minimum number of participants is advisable with only one operator; responsibilities of each partner should be carefully defined in advance.
- Commitment of all parties to the project, and a sound relationship between them is essential to solve problems and reach solutions.
- When a partner is imposed by a country's law and this partner lacks expertise, it is advised to negotiate for some key positions to be filled by the company's own staff (at least at an initial stage).

(3) Communications

- Dotted line relationships are as important as formal ones, in particular at the early stages, which might be the best way to have immediate and updated information.
- In international projects it is best to avoid spreading activities through too many locations for a tighter control and to improve communications.
- In partnerships joint teams improve communications between the partners and can lead to mutual trust.

(4) The human element

- Good selection of all personnel is important.
- All project senior management, including the project manager, should have experience and multidisciplinary skills to be able to coordinate all areas of the project, and to have a good judgement ability to identify the risks soon enough.
- Teams should be selected according to:
 - how people will perform the job (expertise);
 - how well they will get on together (for communication to flow).
- Team spirit is particularly important in international projects; senior management have a key rôle to establish it and to create a good atmosphere for the project.
- Ensuring that every person is well motivated raises productivity, creates stability and lowers absenteeism; non-economic ways of motivation are as important as economic ones.
- Some non-economic motivators include:
 - variety of work;
 - working on a prestigious project;
 - working with new technologies in leader areas;
 - providing opportunities for people moving into other areas.
- The rôle of project manager and teams is very important, in particular when time is critical - because, if there is not a good relationship, time can be spent in solving human problems and opportunities are missed.

Both aspects - organisational and human - are complimentary. The right organisation without the right men will not be efficient. The same applies in the reverse case: having the right people with good experience in a badly set-up organisation.

5.8 OVERALL SUMMARY

This chapter looked at the non-financial areas of project appraisal (strategy, technical, social, political, environmental, organisational and managerial), identifying the major risks in each area and suggesting guidelines on how to carry out the analysis (on content; on when to do it; on who should do it; and on the ways to minimise the risks identified). These guidelines were summarised throughout the chapter, at the end of each area, and will be drawn together at the end of this section (in Chapter 7), when a summary of the framework is provided.

CHAPTER 6

ANALYSIS AND INCORPORATION OF ALL NON-FINANCIAL ASPECTS IN DECISION-MAKING

6.1 INTRODUCTION

The previous chapters identified the main non-financial areas of risk in a project, how to analyse them - assessment procedures, when, how and by whom - and suggested ways to minimise the risk. It is the aim of this chapter to discuss some proposals on how to gather all the non-financial aspects identified for decision-making purposes (ranging from everyday decisions to major questions of going further with the project, at any stage, or stopping it altogether), and to discuss their rôle, as a whole, in the analysis.

Section 6.2 deals with the rôle of the non-financial aspects of the analysis versus the financial ones (practices and recommendations), Section 6.3 deals with the assessment, weighting and decision-making process (how and by whom), and Section 6.4 provides some guidelines for a trade-off policy between the different components.

6.2 THE ROLE OF THE NON-FINANCIAL ASPECTS IN THE EVALUATION

The financial return of a project is no longer the only criterion to consider in the selection of projects. Many companies, especially large ones, are giving a greater emphasis to non-financial aspects and are including them in their formal appraisal procedures (for example ICL, Shell, RTZ, Consolidated Goldfields, BAe and Smiths Industries).

Generally, a project's first assessment - to take an initial commitment - is on a strategic level as well as the project's financial profitability or affordability. Strategy is commonly the only non-financial consideration taken into account and given a formal analysis at the very initial decisions. It always comes out very strongly, if not a determinant factor. In Smiths Industries, for example, very large projects are taken to decision-making earlier on in the evaluation process and they are basically looked at strategically - the long-term result of doing the project or not, early spin offs, technology the project might bring, etc. These aspects assume greater importance than the financial side (because, although the financial impact will be looked at, SI could absorb half the cost of a project if it is strategically desirable to take it and, for example, they might allow a payback period of 18 years instead of a normal 12 years). The same strategic importance occurs in R&D projects. For example, projects can be

done just to acquire further knowledge in the field: technology electronics, as in ICL, or a better understanding of diseases, as in Glaxo. Finance will just appear to see whether the company can afford the project or not; if it can, the decision will be entirely non-financial.

After commitment, the technical and economic sides are the main ones to be looked at - and the ones in which work is concentrated at the beginning (processing and mining industries, aerospace and defence, and construction companies). These aspects also follow a relatively standard procedure of appraisal. Social, political or environmental risk assessments are more difficult to carry out and their analysis tends to be very much dependent on the perception of their importance by the various people involved. Attention to these aspects tends to develop according to the development of problems. Issues will be examined depending on the project rather than having a standard list. Both Shell's and RTZ's philosophies is initially to assume social or environmental factors as normal, unless special circumstances stand out. According to the gravity of the issues, they will be taken into consideration earlier or later in the analysis. Both companies agreed that, in principle, this should be done before substantial resources have already been committed to the project. Political stability, particularly for overseas projects, is normally part of the first evaluation package (based on general knowledge with some expert information, as seen in Chapter 5). A detailed analysis is generally carried out afterwards, but then it loses a lot of its effectiveness (as it can not be an input in the initial decision to commit to the project).

The importance given to the non-financial aspects varies greatly according to the company's dimension. According to W.S. Atkins, smaller companies often engage in social or environmental analysis only to the extent required by the company's public image and, in many cases, would be ignored if they can get away with it. This may also depend on the country in which the project is being developed (on the existing legislation). Environmental assessment tends to come before social, to comply with the existing regulations of the country, and to see if the project is still affordable after meeting those requirements.

The rôle of these non-financial aspects is to assist in putting the quantitative analysis into perspective, when decisions are to be taken. Shell uses them as possible scenarios to complete the basis for a detailed risk analysis. The financial dimension always has to be acceptable, but, if the finance is right and there is, for example, too much social opposition, the project still may not go ahead as it will experience problems later. Most companies recognise that social, environmental or political factors, if not dealt with initially, may increase the project costs, mostly through delay. Therefore, the analysis of the non-financial elements should start at the prefeasibility stage as early as possible. It should also be performed in parallel

(technical, environmental, social) so it can provide inputs into the selection of alternatives (in all areas).

In some cases, non-financial factors are the objectives of the project itself - for example, safety and environmental protection projects. In these cases, finance is of considerably less relevance.

6.3 TYPE OF ASSESSMENT, WEIGHTING AND DECISION-MAKING

• Type of Assessment

Social, environmental and political factors are not normally subject to a formal analysis. Manuals cover in detail the quantitative and economic aspects and leave the non-financial and qualitative ones to a free format comment (as issues to be part of the agenda in the decision-making process, if thought relevant). The assessment is greatly qualitative in many companies (Smiths Industries, British Rail, CEGB, BAe). Past experience is the key to assessing the risks, as referred to by all companies. It is therefore important to have a track record of past managerial expertise to check the credibility of judgements (and use consultants if needed). To minimise the risk of judgement, the assessment would always keep in mind what the effect of it being incorrect is and taken it into account (for back-up strategies and weighting the risks). In the experience of W.S. Atkins, in most cases the analysis is done and develops according to external events, not according to internal decisions (for example, as a result of the media drawing attention to the damage to the environment caused by the project; because of a competitor's criticism; etc.).

One of the deficiencies with the present systems is that they are very dependent on people, personal experience and judgement as to what needs to be done. This was felt by Logica in particular. Logica is now trying to store this expertise in a framework of analysis to the different types of projects.

A few companies are already trying to establish a standard format for the qualitative assessment (non-financial aspects) so as to provide a checklist for both assessors and decision-makers (for example, Shell). Others, like Delta, put the emphasis on training people to analyse the project thoroughly - using their mind to think and dig around as much as possible. However, relying on creativity can be an unnecessary risk. With or without a checklist as a guide, the analysis should be systematic and thorough for all projects, calling on many people covering all disciplines.

- **Weighting and Decision-Making**

Analysis and judgement are complementary. The analysis is needed to provide the necessary background for decisions (subjectivity is too poor an indicator of risks - though good decision-makers need to be very perceptive people as well). However, the assessment of risks needs more than analysis - it may start with analysis, and never forget it, but the assessment also requires sound judgement as to the risks likelihood and effects. This view of the complementarity between analysis and judgement is generally shared by companies. In the public sector, for example, one can read in a manual of project appraisal: "the final decision must, however, be taken as a matter of judgement illuminated, but not mechanistically determined, by the assessments in the framework" (COBA Manual of Appraisal, Transport Department [95]). In Allen Sykes' experience, in the end 40% is analysis and 60% is sound judgement (Consolidated Goldfields interview).

Some literature, as in Wissema [86], proposes a system of indices and scores to assess the non-financial aspects of a project. Decisions will be taken on the basis of these scores. This was not found to be in common use in practice. In the public sector (Health Department) however, a similar system is used as a way of assessment, but several drawbacks have been identified in this process. Benefits are assessed against different criteria, quantified, scored and combined into an overall score for each option by assigning a relative weight to each criterion. The assignment of weights will require judgements, partly on questions of uncertain factors and partly on questions of value. The weights and scores are decided by appraisers in the local teams and are based on what they think the importance of the benefits are (they can also take advice from doctors, managers, nurses, etc.). It is found that many times proposals reach the departmental level without justification for the scores given, and they also lack precision about the benefits (it depends on the appraisals which items are included, which reveals a certain lack of systemisation and consistency). The shortcomings of the weighting score method, as practiced by the Health Department, were therefore:

1. The risk that only some of the attributes are included and that other important ones are overlooked.
2. An overall score is crucially dependent on the weights and ratings - but these are often derived from participants with different perceptions of the relative importance of each attribute.
3. There is no consistency across projects.

Most companies think that indexing and scoring is not the best way of weighting (RTZ, CGFd, Shell, SI, BAe, Logica, Delta, CEGB, etc.). Weighting is by balancing out arguments and discussion. In the CEGB, for example, non-financial elements are mostly

taken qualitatively, and managerial judgement will be on the basis of balancing out all the elements identified and their influence on the project. The same was referred to by Delta: weighting is balancing all aspects by debating their importance. In the end, this debate will enable a final decision to be reached.

Weights and scales may be set as a way of establishing limits, but, beyond that, trading off is always by discussion until a consensus is found. The use of weights is too restrictive (according to the companies) because:

1. The balance of what is important changes with the stage of the project (ICL experience). If, for example, strategy is preeminent in the early stages, subsequently technical specifications will dominate the discussions.
2. All criteria are important. They may all be simultaneous reasons to implement a project without having to see which is the one with more weighting. This is also ICL and Glaxo experience. Allen Sykes expressed the opinion that, in large projects, it has to be an 'all or nothing' approach. Minimum standards in all non-financial criteria have to be met. The rule is: anything that can damage the project has to be a yes. There are no weightings attached. The trade-offs are to be discussed, and is not advisable to decide on them by the use of a pre-defined set of weights.

Therefore, rather than using a weighted matrix of scoring indices, weighting and decision-making should be a matter of pooling every aspect into a panel with all the factors identified (that is where the analysis is crucial) and looking to all things in combination: see the chance of all risks combining; look at all combinations of different criteria; and ask if most of them will be likely or not. In doing this analysis subjectively, personal views are not sufficient. It is important to ensure sound judgement. This means:

1. Experienced people (with the capability of giving feedback from past projects).

British Aerospace, for example, considered this a vital element, so that in assessing risks people would have the experience of:

- having done it before;
- what it was like;
- what applications are possible.

This makes comparative processes possible (to see if the same things are applicable in other areas).

2. Having experts and other relevant people assisting the Board on decision-making.

It is good practice to involve operating managers at the discussions, as they will be the ones to implement the project and they can provide information on the implementation side. For example, this was found in Delta. Also, in Smiths Industries, apart from the Board, decisions would include the main people responsible in the future for the implementation of the project and possibly the chief engineers. This wider group of people will ensure coordination and a link between strategic and operating considerations. In other companies, although weighting is left to the Board, experts make recommendations and give their reasons why. This is CEGB practice (the experts are very much the frontier people calling in various specialities and coordinating the picture presented).

Sykes [80] suggested that, organisationally, a project would benefit by adding a 'project directorate' to the traditional 'inside project' senior team (that recommends policies to the project board and implements them once agreed). The former would be composed of outside experts to advise the board on major project decisions (especially at the early stages of the project, when the vital decisions are taken). This would avoid personal and organisational bias, and would add to the expert advice for balancing out all the factors.

3. Providing information to the decision-makers of past projects in the same or similar areas.
4. Providing a systematic and thorough background analysis of all aspects.

This is the rôle of the analysis in decisions. Although the weighting is done at the board on a senior level, it comes mostly from the information received. Logica said that weighting in their projects comes partly from the forms filled in by the people working on the projects. Also, in Delta, the information and data that is carefully prepared by internal personnel forms the basis for the discussions. The same or similar rôles form the analysis in all other companies. Non-financial elements should be described in the information provided as explicitly as possible, objectively, logically and systematically to allow people to weight them against the financial results (in companies, like British Rail and public departments, it was said that, although they include a non-financial analysis, it often tends to be lightly analysed, summarily addressed and not taken seriously by appraisers).

5. Encouraging a wide and rational debate in order to avoid decisions to be taken on emotional grounds or personal attachment to the project.

A risk to avoid, as found in the health department, is that the process of argumentation can be dominated by a strong character - not necessarily with the best or right opinions. According to Sykes, great decision-makers are people who normally have a high degree of humility, are not boastful, and are aware of how easy it is to let emotion enter in (Consolidated Goldfields interview).

Expert judgement, managerial judgement, past experience, common sense and consensus are therefore the main bases of assessment, weighting and decision-making. With these bases, common criteria are allowed to all projects, irrespective of the existence of a set standard of weights. That is because:

- questions are common to all big projects;
- the process calls on many people and is done through several meetings;
- the analysis is very thorough and systematic.

6.4 TRADE-OFF POLICY

Trade-offs between all factors should be done aiming for the optimisation of the whole package. It is the 'all or nothing' approach already mentioned and also defended by some literature (e.g.[8]). The rule, as discussed above, is to make sure that everything that is damaging to the project has to be a 'yes' factor. Saving this, trade-offs will always occur between the different components, as it is impossible to have the best standards in every policy: there are maximum limits - the economics of the project, for example - and minimum limits - minimum standards for the environment, society, etc. The latter should not be traded off for cheaper costs.

Companies, private ones in particular, normally trade-off on a profitability basis. Yet some aspects involving social or environmental measures are being increasingly recognised by them as important. Environmental or social schemes that were acceptable 10 years ago, said the people at RTZ, are no longer used: there is a greater awareness of the importance of establishing good relationships with locals, government, etc., and that money should be spent on this.

The trade-off policy is never standard - each project is considered in terms of its own risks and alternatives. The philosophy of Smiths Industries, for example, is that if a project is too risky, the lesson from the past is that management should not go after it, as the cost of failure is unthinkable (not only for the financial side, but

mainly for their reputation and for moral considerations). The same happens with other companies. The weighting of the different aspects and consequent trade-offs may depend on the type of project (e.g. in the pharmaceutical sector, the reliability of drugs cannot be traded off by cheaper costs, while in other projects not involving human risks some experimentation could be allowed); they may also depend on where the project is located (if in Latin America, political factors would have a greater emphasis than, say, in Australia), the time of the evaluation (whether it is particularly important for the company to employ its workforce, as in the construction business, or to find new resource exploration sites, as in the process or mining industries), and the laws of the country (for the environment, etc.). Public companies may need to trade-off on a very different basis, i.e. not according to profitability objectives. For example, the uses of national versus international suppliers versus costs and the need for importing technology or not balanced by the need for giving the British the knowledge of advanced technology.

Attention should also be drawn to the different levels at which trade-offs can occur. Trade-offs can start at decisions taken by project teams, and people are not always aware of the consequences when they decide, on their own initiative, which things to do or to rub out. Hence, good coordination and good senior people is important.

6.5 SUMMARY

Non-financial aspects are being increasingly taken into consideration when selecting projects. The rôle of these aspects is to assist in putting the over-emphasised quantitative analysis into perspective, since finance alone is no guarantee of project success. Companies recognise that elements such as social, environmental or political can, when not dealt with, add to costs in projects and to delays, and even eventually make the project unfeasible. The analysis of all element should start at the prefeasibility stage, as early as possible.

Assessment of risks is normally done by expert judgement, managerial judgement, past experience and consensus. Proposals in the literature on using scoring methods and indices for weighting are not well received in practice. The reasons are that this is too limited a view of weighting as:

- the balance of what is important changes in the project (weights would have to continuously adapt);
- all aspects have to be seen in coordination; all are important and it is not possible to put them on a scale;
- anything that damages the project (risks) has to be a 'yes' factor; there are no weighting scores.

Decisions are then mostly taken by discussion and balancing out arguments. All aspects are brought into a panel and seen in coordination. The success of these processes depends on:

- experience of people;
- ability to feedback from past projects;
- good background analysis (systematic and thorough);
- having experts and other relevant people assessing the Board or decision-makers.

The risks of which to be aware include:

- not letting emotional reasons rule (provide a wide and rational debate);
- not letting a strong character (not necessarily with the right ideas) dominate the discussions.

Trade-offs will occur in this process of balancing arguments. All risks will have to be balanced. In the end, it is a matter of how much the company can afford. Trade-offs between components can occur, but all major aspects in social, environmental, political or other areas would have to be 'yes' factors; minimum standards should be established which should not be traded off by cheaper costs. The aim is to maximise the whole package of factors and not just a particular one (such as finance in many cases).

CHAPTER 7

SUMMARY OF THE FRAMEWORK

7.1 INTRODUCTION

It is the objective of this chapter to summarise the framework developed throughout the three previous chapters, and draw all the guidelines together.

The main conclusions and findings concerning each area of analysis are summarised in section 7.2 (tables 7.1 to 7.9, at the end of the section). A comparison with the literature propositions is established in section 7.3. All new aspects added by the research are indicated by a [+] sign; all others, incorporate the literature contributions that were found relevant and discussed further by the research (their relevance was seen in the light of the companies experience).

7.2 SUMMARY OF THE FRAMEWORK AND MAIN CONCLUSIONS

- **Feasibility studies**

The contents of a feasibility study should allow for flexibility, as discussed earlier. They should not be a checklist. They should be seen as a guide to discipline creativity and avoid unnecessary risks. This framework is to be seen in this context. It addresses the core of questions which are the same for any type of project. Then it is up to the capability of the personnel involved to determine any particular area of analysis, outside the standard ones, and to decide on the emphasis to be placed on each aspect. Experienced people should therefore be placed in the decisional positions to ensure an effective appraisal. Table 7.1 summarises the main areas of analysis. All the areas are to be dealt with interdependently as they all interrelate and affect each other.

- **Overall principles and strategies**

Table 7.2 summarises the overall principles and strategies that should support any evaluation system. Some were pointed out by companies as main causes for project failure and were the subject of revision in their up-dated systems. They were:

- fragmentation of the business (projects looked at in isolation and not in the business context);
- rushing to implement the project without a proper analysis being carried out;
- deciding on or proceeding with the project for subjective or emotional reasons;

- inadequate definition of work and risks in any of the project stages.

- **Strategic analysis**

This area discussed the importance of analysing the project interaction with the company - strategy, synergy and risk - and highlighted the issues and risks involved and the ways to deal with them. These aspects are summarised in Table 7.3.

- **Technical analysis**

Failure to appreciate technological risk is a main source of overruns. This is particularly true when new and complex technology is involved. The guidelines for the technical assessment are summarised in Table 7.4.

- **Political analysis**

Political risk is particularly important in public projects and in international projects. The guidelines for the assessment are summarised in Table 7.5.

- **Social analysis**

Social analysis is done in order to assess the project impact on society, society's acceptability of the project, possible delays on account of social opposition (and how to minimise it), and to find ways in which the project design can fit into community values. The guidelines for the assessment are summarised in Table 7.6.

- **Environmental analysis**

The aim of environmental studies is to try to minimise all damage to the landscape, air, water, etc., caused by projects. The commitment of a company to study the environmental impact of a project alleviates fears of the local population and therefore creates a better climate for the development of the project. Table 7.7 summarises the guidelines for the analysis.

- **Organisational and Managerial analysis**

All organisational variables (structure, people, communications, motivation, etc.) interact. It is from the integration of all variables and their adaptation of the project's needs and environment that a good level of performance can be achieved. Both aspects - organisational and human - are complimentary. The right organisation without the right men will not be efficient. The same applies in the reverse case: having the right people with good experience in a badly set-up organisation. Table 7.8 summarises the guidelines given as to the more effective ways of organising, and the choice and management of the human element.

- **Assessment, Weighting and Decision-Making process**

Table 7.9 summarises the main guidelines on assessment, weighting and decision-making process.

In the following pages Tables 7.1 to 7.9 are presented.

Table 7.1
FEASIBILITY STUDIES - OUTLINE

- **Analysis of the project background:**
 - clarify objectives of the project;
 - analysis of the problem being solved by the project and what the alternatives are.
- **Locate the project into the business context (strategic analysis):**
 - does the project fit into company strategy;
 - analysis of weak/strong points of the company; locate the project in this context; what is the project potential?
 - compatibility of the project? how does the project fit into the existing current activities? synergy? does it take advantage of existing skills, experience, etc.? does it bring early spin-offs in technology, competition? what are the unquantifiable future benefits?
 - risk of the project versus risk of the company? same products, markets?
 - structural implications to the company? (changes to be made elsewhere if benefits are to be achieved).
- **Resource analysis:**
 - check company workload, availability of materials and personnel.
- **Technical viability:**
 - does it involve new or established technology?
 - is it viable?
 - what are the risks?
- **Financial/economic viability:**
 - is it profitable?
 - possible to finance?
 - ways?
- **Commercial and marketing analysis:**
 - is it marketable? what is the company share of the market?
 - commercial arrangements?
 - analysis of competitors?
- **Legal aspects:**
 - related to technical specifications, environmental norms, and any needed legislation.

Table 7.1 - continued

- **Organisational and managerial analysis:**
 - type of organisational structure?
 - selection of project personnel? (qualifications, expertise)
 - partnership arrangements? (clarify rôles and responsibilities).
 - **Social analysis:**
 - is project acceptable to society?
 - can it be subject to delays? (e.g. public enquiries, activist action)
 - predictable social response to the project?
 - ways to minimise opposition and delays?
 - ways to create good relationships with locals?
 - **Environmental and safety aspects:**
 - project impact on environment?
 - range of environmental protections, measures, their consequences, costs, etc.;
 - safety considerations to workers, to environment, to people nearby.
 - **Political aspects:**
 - project is of a political nature?
 - depends on Government funding, operating permission?
 - what kind of political interference can it be subject to? consequences?
 - is it located in an area of political instability? possibility of nationalisation or pressure over benefits?
 - ways to minimise or insure against these risks?
 - **Any other issues relevant to the particular project.**
-

Table 7.2
BASIC PRINCIPLES AND OVERALL STRATEGIES

	1.	Investment programmes should be closely related to organisational planning. The evaluation must be in the light of the organisational goals and strategies. Planning and definition of strategies should therefore come in the first place and they will set the tone for the evaluation. Planning throughout the life of the project, and in relation to that project, is also fundamental; initial planning must concentrate on building viable planning bases for the following stages.
	2.	- Projects should be phased. The benefits include: • building on experience and adapting to uncertainty; • establishing point-decisions on project go-ahead;
[+]		• greater facility of stopping the project;
		• avoiding phases overlapping (if work at each phase is previously defined);
[+]		• avoiding cost of enthusiasm;
		• continuously checking initial assumptions.
[+]		• money being spent in steps (start with a survey of all risks instead of immediately developing the work).
		- Work Programmes should be defined by both timing and content.
	3.	- Use flexibility in the evaluation procedures to adapt to changes and particular situations. Manuals can be used, and indeed are important, to provide a systematic, objective and comprehensive study of the project, but should always be seen as a guide and not as a straightforward checklist. Back-up strategies and plans should be defined for the major areas of uncertainty and risk identified.
[+]		- Train people how to think rather than using a mechanistic dependency on the written procedures.
	4.	Use pilot projects or feedback from project monitoring to learn from past experience.
[+]	5.	Keep track of what is going on in the field and interrelated fields so that new opportunities can be detected and immediately assessed.
[+]	6.	Look to organisational support for the encouragement and creation of ideas and for the training of specialists. Change the culture of the organisation, if necessary, so that appraisal is taken more seriously.
	7.	The appraisal should be comprehensive from the start, but done in a progressive way (in terms of the depth of analysis). All high-risk factors should be identified at the start, including the non-financial and non-technical ones.

Table 7.3
STRATEGIC ANALYSIS

• Key issues in the analysis:	
-	strategy
-	synergy
-	risk of project versus risk of company
• Risks involved:	
-	fragmentation of the business
-	not using company's best capacities
-	duplication of work
[+]	- inconsistency
-	too much risk in one area
• Ways to avoid risk:	
-	strategy
[+]	- predefine it clearly and comprehensively;
	- review it throughout the appraisal.
-	synergy
	- check consistency in all units;
	- make sure project has some synergy, to benefit from current experience, etc;
[+]	- keep innovation in small steps.
-	risk
[+]	- see how much company can afford;
[+]	- diversification: be clear as to the type of risk company wants to take (usually spread risks by geology, politics, etc.), but also be clear what kind of projects the company is capable of doing;
[+]	- the aim is to get a good balance of risk and doing things at which the company is good.
• Assessment:	
-	when - at the preliminary analysis;
-	who - senior personnel (to have a clear idea about strategy, to have experience in assessing risk);
[+]	- all units represented (to ensure coordination);
-	how - all areas interdependently
[+]	- use a strategy panel (ICL);
[+]	- use a list of items (Shell), or ensure knowledge of those items (senior personnel will have it);
	- use of a Directional Policy Matrix (Shell).

Table 7.4
TECHNICAL ANALYSIS

-
- **Risks are normally associated with:**
 - risky technologies;
 - new technologies;
 - badly established technology;
 - underestimation of the complexity of the task; and
 - changes.

 - **The risks are:**
 - overrunning - cost;
 - delays - time;
 - poor quality of performance.

 - **Ways of minimising the risks :**
 - understand the technology before the project starts;
 - get personnel trained;
 - use standards of technology compatible with skills of staff;
 - avoid changes as project proceeds;
 - [+] • trace the impact, in all disciplines, of any change;
 - use prototypes;
 - avoid overoptimism in the assessment of the risks;
 - get other opinions;
 - use good personnel with lots of experience;
 - increase technology in small steps;
 - go for safer technologies rather than cheaper ones;
 - [+] • use of good review milestones;
 - use of joint ventures to transfer knowledge of technology; share the project - if this is too risky for the company alone to take it.

 - **Assessment:**
 - when - as early as possible in the life of the project;
 - reviewed throughout;
 - who - technical personnel;
 - [+] - double-checked;
 - [+] - how - kept in mind the effects of that assessment being incorrect.
-

Table 7.5
POLITICAL ANALYSIS

- **Risks:**
 - Public companies are more subject to political interference than private ones:
 - through funding, permissions, decision-making, political policies etc.
 - they need Government support for major projects to succeed.
 - For overseas projects political risk include :
 - [+] • size of the project (in comparison with the size of the economy);
 - inexperience (technical, managerial, etc.);
 - lack of resources;
 - nationalistic feelings;
 - [+] • imposition of partners;
 - [+] • bureaucracy and unclear rules of decision-making;
 - [+] • different expectations of the project.
- **To minimise the risk:**
 - [+] • A comprehensive assessment of the economic and political situation of the country should be done as early as possible.
 - Steps to be taken in case of conflict should be established in advance.
 - Nationalistic feelings should be constrained. This can be done by:
 - negotiating the basic deal in a manner perceived to be fair from the start;
 - developing good relations with the country's officials and with the inhabitants (obtain their trust; make them feel a counterpart; take their views into account);
 - recognising the reasonable requirements and aspirations of the host Government;
 - [+] - involving the nationals in management at all levels;
 - [+] - participation of nationals in the profits;
 - [+] - participation of nationals on the Board.
 - [+] • When selecting an overseas partner, it is best to check their political relations with their Government.
 - International institutions can be involved for credibility.
 - Involve other countries and diversify the countries of investment.
 - [+] • On a day-to-day basis, be aware of all political implications of the different issues, and take them into account in making decisions.

Table 7.5 - continued

- **Assessment:**

- | | | |
|-------------------|---|---|
| [+] - when | - | To be effective, it should be done at a time prior to the initial commitment. |
| [+] - who | - | Use experts (internal or external people) on the analysis. |
| [+] - how | - | Talks with the Government and governmental bodies to assess stability and intentions as to the project. |
| | - | Visits to the country by the analysts to assess the economy and politics. |
| | - | Talks with previous companies operating in the area to gain knowledge of their experience within the political and economic situation of the country. |
| | - | Use previous economic and/or political reports on the country. |
| [+] - contents- | | It should include the economic structure of the country, political stability, past experience of foreign companies, etc. |
-

Table 7.6
SOCIAL ANALYSIS

- **Risks involved:**
 - possible delays on account of :
 - social opposition
 - public inquiries
- **Ways to avoid risk:**
 - take social characteristics into account when designing a project; make the project compatible with local values; build up internal flexibility to allow for changes in relation to socio-cultural information; eliminate or modify aspects if they make the project socially unfeasible;
 - learn about the country and the people;
 - compensate fairly for damages (taking into account local values and traditions);
 - listen to what people say; establish Liaison Committees where all social partners can meet to discuss and receive information on the project; listen to people's proposals and views; do it early in the appraisal;
- [+] • persuade people of the project's benefits by:
 - giving them priority on the benefits of the project (employment, good housing conditions, cash injections into the local community, etc.);
 - use sites where people will most benefit from the project, such as areas of high unemployment; and
 - use local resources;
- [+] • align the company's objectives with the objectives of the country;
- [+] • train managers to be aware of the outside world and deal with social problems;
- [+] • develop good links with the local communities throughout the whole life of the project through general support of local activities, etc.;
 - seek a good public image;
 - if appraisal determines the project to be a high risk socially, it is advisable to postpone it or start with a pilot project.
- **Assessment:**
 - when - The work should be done in parallel with the technical evolution of the project, so that it can affect decisions.
 - who - It is better to rely on experts (in-house or external consultants);

Table 7.6 - continued

- | | | |
|-------|------------|--|
| [+] | - | site management should be involved with the organisation of the social work, as for any other activities. |
| - | contents - | <p>The analysis should cover:</p> <ul style="list-style-type: none"> • assessment of project impact on society, in particular the local people; • identification of all social groups affected; • collection of baseline data, for future comparison and assessment of project impact, on all aspects affected by the project; • cultural acceptability; |
| [+] | - | <ul style="list-style-type: none"> • establishment of standards for the most critical aspects of the social impact; • social strategy to elicit commitment. |
-

Table 7.7
ENVIRONMENTAL ANALYSIS

- **Risks Involved:**
 - possible delays on account of :
 - social opposition to the environmental impact;
 - public inquiries;
 - legal demands on the environmental standards (if not met).

- **Ways to avoid risk:**
 - Use a consultative approach for cooperation and support from a wide range of people.
 - A liaison company/other parties should be established (to inform all interested and affected people).
 - Compensate for the damage.
 - [+] • Pay attention to the benefits to be gained from local knowledge (it may be a vital part of background environmental assessment).
 - Do not trade off minimum standards by cheaper costs.
 - [+] • Use of most practicable means taken into account:
 - best proved relevant technologies available;
 - nature and gravity of the situation;
 - operating and capital cost.
 - Give high priority to safety of workers and people living nearby; have "first class operations from top to bottom".
 - Do not try to get away from the environmental effects of the project, even though the law in the country is not well established - Bhopal situations should not occur as the consequences would be too high (apart from complete loss of company image in that situation).

- **Assessment:**
 - when - • in the early stages to be effective, in order to provide trade-offs to design selection, site selection or other alternative selections;
 - strictly in parallel with the technical side;
 - [+] • these studies should be phased with the project development so that the conclusions reached at one stage can be taken into account to define the next set of work.

Table 7.7 - continued

- | | | |
|------------------------|---------------|---|
| -who
[+]
[+] | -

 | <ul style="list-style-type: none"> • an environmental officer should be appointed, at the early stages, to coordinate all aspects (internal and external); • the use of local skills (experts, local universities, etc.) for a better knowledge of specific problems in the area is advised; • the use of external experts - local and international - can provide independent judgement on the assessment, which may be needed to satisfy all parties; • reporting should be done to the project manager, on site, to coordinate with all other areas. |
| - contents- | - | <p>The analysis should cover:</p> <ul style="list-style-type: none"> • the collection of baseline data for future comparisons; • experimental work; • assessment of project impact on the environment; • health and safety considerations. |
-

Table 7.8

ORGANISATIONAL AND MANAGERIAL ANALYSIS

- **Choice of organisational structure**
 - It should be flexible enough to attend to size and complexity of the project and to move with the project's life cycle (careful design and dynamic adjustments over time are essential).
 - It should establish a good flow of information between all relevant parties and define clearly responsibility and authority (especially in the later stages).
 - It should adapt to the project's needs in terms of:
 - areas to implement;
 - [+] - special groups needed;
 - formal versus informal communications; and
 - overall structure (matrix versus projectised).
 - Either a matrix or a project form should be used for most projects.

- **Partnerships**
 - Partners should be selected paying attention to:
 - past performance;
 - skills and experience;
 - [+] - political relations;
 - capability of holding together.
 - The minimum number of participants is advisable with only one operator; responsibilities of each partner should be carefully defined in advance.
 - [+] • Commitment of both parties to the project, and a sound relationship between them is essential to solve problems and reach solutions.
 - [+] • When a partner is imposed by a country's law and this partner lacks expertise, it is advised to negotiate for some key positions to be filled by the company's own staff (at least at an initial stage).

- **Communications**
 - Dotted line relationships are as important as formal ones, in particular at the early stages, which might be the best way to have immediate and updated information.
 - [+] • In international projects it is best to avoid spreading activities through too many locations for a tighter control and to improve communications.

Table 7.8 - continued

- [+] •** In partnerships joint teams improve communications between the partners and can lead to mutual trust.

 - **The human element**
 - Good selection of all personnel is important.
 - All project senior management, including the project manager, should have experience and multidisciplinary skills to be able to coordinate all areas of the project, and to have a good judgement ability to identify the risks soon enough.
 - Teams should be selected according to:
 - how people will perform the job (expertise);
 - [+] •** - how well they will get on together (for communication to flow);
 - Team spirit is particularly important in international projects; senior management have a key rôle to establish it and to create a good atmosphere for the project.
 - Ensuring that every person is well motivated raises productivity, creates stability and lowers absenteeism; non-economic ways of motivation are as important as economic ones.
 - Some non-economic motivators include:
 - variety of work;
 - working on a prestigious project;
 - working with new technologies in leader areas;
 - providing opportunities for people moving into other areas.
 - [+] •** The rôle of project manager and teams is very important, in particular when time is critical - because, if there is not a good relationship, time can be spent in solving human problems and opportunities are missed.
-

Table 7.9
ANALYSIS AND INCORPORATION OF ALL
NON-FINANCIAL ASPECTS IN DECISION-MAKING

- **Type of Assessment**
 - [+] - It is important to have a track record on past managerial expertise to check the credibility of judgements (and use consultants if needed).
 - [+] - To minimise the risk of judgement, the assessment should always keep in mind what the effect of it being incorrect is and taken it into account (for back-up strategies and weighting the risks).
 - [+] - A few companies are trying to establish a standard format for the qualitative assessment (non-financial aspects) so as to provide a checklist for both assessors and decision-makers
 - The analysis should be systematic and thorough for all projects, calling on many people covering all disciplines.

- **Weighting and Decision-Making**
 - Analysis and judgement are complementary.
 - [+] - The analysis is needed to provide the necessary background for decisions.
 - Sound judgement is needed to assess the likelihood and effects of risks.
 - Decisions are mostly taken by discussion and balancing out arguments.
 - [+] - All aspects are to be brought into a panel and seen in coordination.
 - [+] - Weighting indices and scores is not well received in practice (as the balance of what is important changes in the project).
 - [+] - Anything that damages the project (risks) has to be a 'yes' factor.

 - The success of these processes depends on:
 - [+] - experience of people;
 - [+] - ability to feedback from past projects;
 - [+] - good background analysis (systematic and thorough);
 - [+] - having experts and other relevant people assessing the Board or decision-makers.

 - Risks of which to be aware:
 - [+] - not letting emotional reasons rule (provide a wide and rational debate);
 - [+] - not letting a strong character (not necessarily with the right ideas) dominate the discussions.

Table 7.9 - continued

- [+] • Expert judgement, managerial judgement, past experience, common sense and consensus are the main bases of assessment, weighting and decision-making.**
 - Trade-off policy**
 - all risks will have to be balanced;
 - in the end, it is a matter of how much the company can afford;
 - [+] • all major aspects in social, environmental, political or other areas would have to be 'yes' factors;**
 - minimum standards should be established which should not be traded off by cheaper costs;
 - the aim is to maximise the whole package of factors and not just a particular one (such as finance, in many cases);
 - [+] • attention should also be drawn to the different levels at which trade-offs can occur;**
 - [+] • trade-offs can start at decisions taken by project teams, and people are not always aware of the consequences when they decide, on their own initiative, which things to do or to rub out.**
-

7.3 THE FRAMEWORK VERSUS THE LITERATURE

(1) Basic principles and overall strategies

The literature guidelines (table 2.1) were recognized by the companies interviewed as important aspects to attend in their appraisal systems and some have been the object of recent revisions (namely, the need to coordinate evaluation and planning, and the need to plan throughout the life of the project). The importance of phasing the project, being flexible in the approach, and learning from the monitoring of past projects (recommended by the previous work) were all confirmed as fundamental strategies.

When comparing table 2.1 (literature guidelines) with table 7.2 (framework guidelines) it is seen that aspects 1, 4 and 7 (in table 7.2) are common to both. Aspects 5 and 6, and partly 2 and 3, are new suggestions that came out from the analysis of companies experience, and were therefore added to the list of overall strategies.

(2) Strategic analysis

The need to take synergistic and strategic aspects into account has been emphasised by recent literature. This need led to corrective actions within some companies (e.g. ICL, clarification of the priorities of the business in order to assess projects in strategic terms; and Aquascutum, need to have an integrated vision of the company in order to avoid fragmentation of the business). The risks involved, when this analysis is not done, were identified. The best practices of assessment and the best ways of avoiding the risks, were analysed and added to the literature guidelines (table 7.3).

(3) Technical analysis

Technical factors have been pointed out in the literature as one of the common causes for project failure, especially when there is technical uncertainty or complexity. This was confirmed by several companies and several cases where this has happened in the past were examined. The ways to avoid the risks that the literature proposed were also found among the companies practices. Those ways and their effects on past projects were also examined. This examination added to a clearer understanding of the literature guidelines.

(4) Political analysis

The relevance of taking into account political factors at the appraisal stage has not been enough researched by previous work. Most aspects in table 7.5 are therefore new contributions of this research. These includes all guidelines concerning the assessment (when, who, how and contents), and added suggestions as to the way of minimising the risks. These aspects are discussed further in the analysis of the Cerro Colorado

project, where they played an important role.

(5) Social and environmental analysis

Like in the previous area these aspects have not been enough researched, especially the social factors. With the exception of the work published by World Bank staff, little has been written concerning the assessment of these aspects. The framework adds to the previous work by having analysed the relevance of these factors in light of the companies experience, in result of which some new aspects were added in tables 7.6 and 7.7. The relevance of these guidelines will further be illustrated by the Cerro Colorado study.

(6) Organisational and Managerial analysis

This is an area reasonably covered in the literature. Most factors in table 7.8 are therefore common to table 2.2 (literature guidelines). The framework made some contribution to the existing knowledge by analysing the relevance, in past projects, of some of the aspects.

(7) Assessment, Weighting and Decision-Making

The financial return of a project is no longer the only criterion to attend to in the selection of projects, as found by literature surveys. Many companies, especially large ones, are giving a greater emphasis to non-financial aspects and are including them in their formal appraisal procedures. The literature proposals on using scoring methods and indices for weighting is not well received in practice. New guidelines were therefore presented in table 7.9, taking into account how companies take decisions and systematising the procedure.

PART III

APPLICATION OF THE FRAMEWORK

CHAPTER 8

APPLICATION TO THE MAIN TYPES OF MAJOR PROJECTS

8.1 INTRODUCTION

This chapter applies the framework developed in Part II to the main types of major projects undertaken by organisations. Major projects were taken in the sense defined by D.C. Fraser as: projects particularly demanding either because of their size, complexity, schedule urgency or because of their demand on existing resources or know-how (as referred by Morris & Hough in [57]). According to Morris & Hough, these projects are found particularly in:

- Aerospace and Defence;
- Electronics-based companies;
- Petroleum and Process industries;
- Mining, Civil and Building;
- Nuclear, Hydro and Power industries;
- R&D projects;
- Social Programming.

Interviews were carried out across these sectors to investigate their methodology of project appraisal and especially the rôle and importance played by the non-financial aspects of proposals on the analysis. In the electronics-based companies, it was found that R&D is at the centre of their business; therefore, this group was included in the R&D projects section. The petroleum and mining industries were found to have similar approaches of appraisal, as they face similar types of problems as far as social, environmental and political aspects are concerned. The same applies to construction companies; when they are commissioned, they are faced with the same type of problems to analyse in the preparation of the project before the actual construction begins. Therefore, they were all placed in the same group of this typology. The energy sector also faces similar questions in relation to environmental and social problems in particular, but being, up to now, public companies in this country, there was a different approach in their methodologies. They were then treated separately.

Interviews were carried out with companies in other sectors, such as mechanical engineering companies (Delta), consultants (W.S. Atkins, Logica), shops (Aquascutum), and transport (British Rail). The approach these companies had to non-financial aspects was found to be fairly unstructured and therefore they are not included in the typology. Nevertheless, these companies contributed to some of the findings of the framework - Part II - and their projects can be looked at in the light of

that general framework (adapting it to particular needs). This could be an area for further work - to expand the typology to other sectors, not just the ones dealing with major projects. (British Rail's projects include some major ones. Yet their normal procedure does not include a thorough and systematic appraisal of non-financial aspects. In general, projects are looked at more deeply on the financial side. Non-financial considerations are at the discretion of the appraisers - but it is not expected to do much searching for them, unless obvious problems arise.)

The sectors discussed in this chapter are therefore the following ones:

- Public sector;
- Electronics and Pharmaceutical (R&D projects);
- Aerospace and Defence;
- Process Mining and Construction;
- Energy.

For each sector:

- (1) a general description of the types of projects involved and the key features of the business is given (as these aspects determine the relevance of the different areas of analysis);
- (2) the relevance of the different areas of analysis, the specific risks involved and their importance identified;
- (3) suggestions on how to minimise the risks identified and improve the appraisal are given (based on the company's experience).

The general framework, in which aspects common to all projects were seen (such as overall strategies and principles concerning the appraisal and all areas, the organisational and methodological aspects, and the guidelines on decision-making and assessment) should be kept in mind and used as a basis for the appraisal of any type of project. What varies is basically the emphasis to be given to the different areas and aspects, according to their relevance in the sector. This chapter aims to point out these differences.

Statements throughout this chapter - concerning the description of each company's type of project, the key features of the business and the company's approach to project appraisal - are mostly based on the interviewee's own statements (when this is not the case, a reference will be given). These statements were taken at face value. Yet, while what was expressed by the interviewees as a fact is also given as a fact all interviewee's opinions are referred to as comment.

The chapter is divided into seven main sections (8.2 to 8.8). Sections 8.2 to 8.6, apply the framework to each type of project according to the objectives discussed above. At the end of each section, a brief summary of the main sector findings is presented. Section 8.7, draws these findings together and into some overall conclusions. The framework, when applied to specific types of projects, should be modified according to those conclusions. Finally, a comparison with the literature is established in section 8.8.

8.2 PUBLIC SECTOR PROJECTS

8.2.1 Introduction

The public sector provides services, such as health, defence, education, prisons, the police and transport facilities. This section is based on information collected within some of these service departments (Transport, Defence and Health) and within the Treasury.

8.2.2 Key features of the business - public versus private and types of projects

The public sector, compared to the private one, presents some particular features that influence its general system of appraisal. These features are the following:

(1) **Social purpose:** Most public projects are carried out not for reasons of profitability, but to attend to specific social needs: the construction of roads to improve traffic and communications, new hospitals for better health, new prisons to answer to the judicial system, etc. Therefore, financial aspects are not the only prime ones to be examined in the appraisal, but other factors have to be achieved too and a larger range of benefits (and costs) of the project are taken into account, even if they cannot be translated into money (for example, better health, better environment, safety on the streets are all benefits in social terms). Cost minimisation and best value for money are the rules for these types of projects [94].

(2) **Use of cost benefit analysis:** All project appraisals take a wider view than in a private company in the sense that the economy as a whole has to be viewed. This is why Cost Benefit Analysis is used as opposed to a financial one. Cost Benefit Analysis includes non-financial factors which are assessed by: (i) describing those factors; (ii) quantifying them; and/or (iii) giving them a value. Whenever possible, all factors are given a monetary value which is their economic price and not the market price. It is the economic prices that take the implications of the project to the economy as a whole into account. Economic prices value resources by their opportunity costs, that is, taking into account the best possible alternative uses in the economy which market prices do not necessarily reflect (depending greatly on how developed markets are and how perfect the competition is). Other implications, such as the benefits for local employment or inflation, are not to be taken into account at individual projects. They are taken care of within the public sector at other levels (political bodies defining regional policies on unemployment, inflation, etc.).

(3) Bad visibility of benefits: The output of public sector programmes is not normally sold. This brings an extra difficulty in valuing the benefits of a project and seeing if the project is "profitable" or worthwhile. This has been specifically referred to in the Health Department, by Mr Henderson. According to him, output definition takes a long time to be established as it is difficult to see what the benefits are in the first place and if they were achieved. Ideally, according to the departmental manual of appraisal, options should be assessed in terms of their ultimate benefit, that is, their expected contribution to the improvement in the health of patients. However, this is often impossible to identify and measure, in which case intermediate benefits are taken (such as the volume of service activity, in terms of the number of in-patients and out-patients diagnosed or treated, and measures of the service quality in terms of diagnostic accuracy or speed of reporting results). The measurement of benefits is one of the areas that needs to be improved in the public sector, according to Mr Parsonage (Treasury). Departments like Transport and Health have been constantly trying to develop better ways of quantifying them.

(4) Appraisal and DM are much more political: According to Mr Parsonage, project appraisal is much more judgemental in the public sector. This is linked to the difficulty of identifying the benefits. When deciding on different projects and options, many decisions are of a political nature; for example, what the benefits of building a new aircraft are or what are the benefits of new prisons may depend on political judgements that will affect the decisions.

(5) Cost of capital is not visible: Public departments find capital as a 'free good' in the sense that they do not have to borrow the money in the market as private companies do, but are given it. This factor was pointed out by Mr Parsonage as limiting people's incentives to make the best use of a programme, as being 'given' the money makes them become less sensitive to the cost of the project.

(6) Lack of incentives: Both in the Treasury and in the Health Department, the 'lack of incentives' for people working in the public sector was referred to as a drawback of the system. It was the interviewee's opinion that, using incentives, as normally happens in private companies, leads to better management.

(7) Lack of personal responsibility: While in private projects, a project manager or project director is appointed and is responsible for the project, in the public sector there is normally a lack of a 'project champion' figure. This was pointed out by some of the people interviewed (Mr Parsonage from the Treasury and Mr Henderson from the Health Department, in particular) as one of the reasons for less

efficiency in the public sector - as people would not be made responsible for the effects of the decisions taken. The use of performance-related pay, at least at a district manager's level, was pointed out as another way of bringing more personal responsibility for decisions taken within the sector.

8.2.3 Applying the Framework - Key aspects and risks.

- **Methodological aspects:** General guidelines are collected in a booklet ('the green booklet') which is sent to all appraisers. The booklet is to encourage departments to undertake a systematic approach to all projects - to encourage managers to question and justify what they are doing and not merely implement a project just because they think there is a need and want it done, without analysing it formally and looking at alternatives (which, according to Mr Parsonage, was common 10 or 15 years ago). The directives of the Treasury are to concentrate on the definition of the objectives and consideration of the various alternatives as the major considerations. These two are also considered the more difficult steps to assess - the ones which require more thought. The Treasury has been trying to emphasise to the departments their great importance as it is still common for departments to come only with a single option. The weighing up of the uncertainties was also said to be done poorly.

The way that appraisal guidelines are followed varies greatly across the departments. The Transport Department was referred to as the sector where the appraisal system is more comprehensive and goes furthest beyond the Cost Benefit Analysis. In the Health Department, the process needs a lot more systemisation and consistency across projects. This is mainly because the identification of the non-financial aspects (normally associated with the benefits of the proposals) and their weighting is very much left to the description of the appraisers. According to Mr Henderson, the effort placed on the appraisal and accurate values depends on the promoters, and some of them just see the formal process as a waste of time. In the Defence Department (MOD), investment appraisal was said to have a very low profile. Among the deficiencies highlighted by the interviews were: responsibilities are not clearly assigned; there is not a board of central expertise for appraisal, which means that the process is not well formalised (according to the interviews, 'each person looks after his own shop' and 'appraisal is a bit patchy'); and, normally, there are no hindsight checks on the appraisals done (which at least should be done in some projects to take lessons for the future). At present, it was said, there is a greater awareness of senior officers to ensure that the appraisal is done correctly and people are committed to do it and to follow the principles and guidelines issued by the department.

Overall, within the public sector, two other aspects were referred to by Mr Parsonage as being important.

- (1) The handling of risk: In general not much thought is given to the possibility of things going wrong. The process is more in terms of a routine quantitative analysis, doing some sensitivity tests on costs and quantifiable items - but even in these cases, the techniques used are not particularly good (bad cost estimation was referred to by all departments as one of the areas leading to overspending).
- (2) The planning and design stages: Needing more time to set up exactly what is wanted and needed. Many changes occur as the project goes along, leading to delays and extra cash because people rush the development and design stages before implementation. Mr Parsonage felt that, within the public sector, people rush to do the job, while in private companies they take more time to assess and plan, and have less pressure to get things done.

- **Strategic analysis:** This is carried out at the overall level, when senior management in the departments and the respective minister set the overall strategy and plans for the department. Any major expenditure is considered in the context of these plans. Individual project appraisal assumes that the project fits within the plans and looks mainly at the different options, finding the one with the best value for money, and looks at the timing of the different projects (should project X be done before or after project Y?).

For example, in the Health Department, there are a certain number of regions and a strategy is defined between those regions and the Ministry of Health. Projects then have to fit within the strategic plans. The appraisers look only to the different options and assume the project is to go ahead. Interdependence of projects is considered if the project is the first phase of a scheme - for example, the first phase of a new building (for site choice purposes, overhead costs, etc.).

In the Defence Department, the strategic issues are also considered at the overall level. The appraisal assumes the project has a place in the programme and does not consider how well it fits better or worse. The purpose of the appraisal is not whether to go-ahead with the project or not, but is to find the best ways of doing it. The go-ahead is given by a military-political decision. Some decisions place the project in context with the existing equipment or other projects, taking synergistic aspects into account (for example, if deciding on a new helicopter, it will be seen if there is a type of battleship that will carry this type of helicopter).

In the Transport Department, there is also a broad long-term strategy, into which projects will have to fit (for example, strategy to build motorways around the country, strategy to improve some of the old motorways and to keep them away from cities, etc.). Interdependence of projects and synergy is also seen as the appraisal of

schemes taking into account the whole of the effective network (effect on the other existing roads, interaction with other transport, benefits of decongestion on existing roads when the new one opens, etc.).

nonsense

• **Technical analysis:** Most of the time, the public sector does standard things. This is not seen, therefore, as an area of great risks. This is especially so in the Health and Transport Departments, where hospitals or roads have fairly standard designs. In the Defence area, however, in particular when high technology is involved, this is still a major factor of risk, leading to time and cost overruns. In an attempt to transfer the risk, it is current policy to try to negotiate fixed contracts when buying from manufacturers and when R&D is involved. A great deal of work is carried out on contracts by private contractors (for new or old technologies). All these contracts used to be set on a cost-plus basis and, as a result, there was a tendency for the work to be delayed without any worries to the contractors. Nowadays, the policy is to set up contracts in a way so that companies will have incentives to finish on time and within budget: through fixed price contracts, staging the payments at particular milestones (although the milestones can be renegotiated for good reasons), etc. Another step to improve technical risk is to take more time at the planning and design stage. Technology estimation was pointed to by the MOD as one of the major areas of risk. Until recently, the MOD would go to the industry with rough ideas about their requirements for the new equipment and ask for the companies' proposals and choose from them. The procedure now is to refine the target better, that is, to have a better idea of the requirements (which can take two or three years with ongoing research) before seeing what the companies can offer. This also makes the specifications for contracting out material much more clear, therefore allowing for fixed contracts. An alternative way of procuring new equipment within the MOD is to buy what is already developed in other countries. In deciding which technology should be chosen (buying what exists, developing its own new equipment), several factors have to be balanced: (i) the reliability of existing material (very important if in wartime), (ii) its possible obsolescence (which is not strongly felt, as some of the equipment is always being replaced so the overall balance is not obsolete), and (iii) potential for mid-life updates (if it is developed by the MOD, it has a greater potential for updates as it is developed with the newest research available rather than if it is bought off the shelf). All these are aspects normally taken into account in the appraisal. Technical decisions and trade-offs also occur in other departments and are taken into account in the appraisal. In the Transport Department, a common trade-off that has to be made is between design and economics (for example, to design a road that would allow one to see the traffic coming in other directions would be more expensive than the normal type of road). In the Health Department, when new equipment is being bought involving new technology, it

is recommended that "the need and demand for it should be described, and, if a technology has not been widely disseminated and evidence is slight, then it is important that the value judgements surrounding its expected worth should be made explicit" (from the Health Manual of Evaluation [96]). The design of new hospitals took into account mostly non-financial considerations. The buildings are designed on an X-shape format to (i) make nursing care easier, (ii) make distances shorter, and (iii) allow for more windows. It also uses low-rise buildings which makes them less expensive because the foundations are less deep, although the non-financial benefits were the main reason for the choice.

- **Political analysis:** All appraisals in the public sector are more subject to political interference and policies than in the private sector. The final go-ahead with a project and the major decisions depend on the political circumstances. Many policies have an intrinsic political nature and may change according to the political views of Governments. For example:

- (1) Before 1979 (Labour Government), Treasury guidelines were to buy as much domestically as possible ("Buy British" policy). Currently, there is a monetaristic philosophy - buy wherever the best value is obtained. The rule is 'cost effectiveness', irrespective of nationalistic considerations.
- (2) A 'contracting out' policy is in vogue at the moment if it represents the best cost effective option (preservation or creation of jobs inside the public sector, which was the policy of the previous Labour Government, is now in second place). Unless 'contracting out' is one of the options that was considered by the appraisal, it is difficult to get approval for new schemes.
- (3) Conflicts among the different priorities (for example, in the Health sector, new hospitals for mental illnesses versus other acute services, or conflicts about centralisation of hospitals and more modern ones versus smaller hospitals) are all political issues.
- (4) In the Defence area, a number of decisions are of a political nature: the balance of conventional and nuclear arms; certain areas being ruled out, such as chemical weapons; the amount of money to be spent on new models of equipment, etc.

The ultimate arbiter to trade-offs (cost versus environment versus social versus political versus technical) are the political issues, mainly by the ministry concerned. It is up to the minister to give the final OK for the projects and to take any major decisions. This is similar to what happens in the private sector - where the Board level takes the ultimate decision - but there are risks linked to the fact that many decisions

can be based exclusively on a political philosophy not necessarily the best to the success of the project. The case of the Nimrod project has already been referred to as an example of failure due to political decisions (Chapter 5, section 5.4.1). The policy of 'buying British', when importing would have been the most appropriate, led to the failure of the project. There is also the risk of political personal conveniences overriding the appraisal - for example, a decision to build a new hospital or a new road in place X just to win votes in future elections (when other projects would be more effective and necessary). Therefore, although political judgements would have to be made, decisions should always take into account the systematic assessment carried out and the approval of the different options, so that unnecessary risks would not be taken. The trend nowadays is to put less weight on subjective views, nationalistic feelings, etc., and decide on the basis of cost effectiveness. But this is not always applicable to all areas. There are other considerations that, at times, may have to be taken into account; for example, in the Defence sector, for security reasons, the design of certain war equipment is always done internally - to maintain strategic capacity and act as a deterrent to other nations (who will only know that 'something' new is being produced and that research is being carried out).

- **Social and environmental analysis:** A formal analysis of the environmental and social aspects takes part in a systematic manner in the Transport Department's appraisals (see "The COBA Method of Appraisal" [95]). Environmental factors go into the assessment framework without a monetary value; the assessment is carried out mainly in qualitative terms, for example, by using a colour coding process to assess the effects on the environment (classifying them as 'bad', 'good', 'not so good', etc., categories that are associated with colours). Factors like noise and pollution are quantified but not valued. In the end, it is a matter of judgement. What the analysis can also do is to indicate the economic cost of obtaining possible environmental benefits by showing how the economic returns on a road may vary with changes which provide specified environmental benefits. Trade-offs against operating costs are always done but, according to Mr Knowles from the Economic Appraisal Division, a scheme might be carried out just because the environment would be improved - even though the economics are negative (this is the case in the construction of most tunnels where the environment would be preserved, or the use of bypasses for the same reason). Mr Knowles said that about 10% of the programmes are done purely on environmental grounds. On any other projects, the aim is always to minimise as much as possible the damage to the environment.

Public inquiries may be carried out when it is necessary to clarify matters from the point of view of the public in general. They are normally held on all new roads. Obviously, public inquiries slow down the process to develop the project. The

final decision, when public inquiries are necessary, is taken by ministerial judgement. It is Mr Parsonage's experience that if the public is very much against a project, it is difficult to implement it. A political judgement will have to be made. Treatment of these cases vary according to the circumstances. In Mr Knowles' experience, in the case of roads projects, if a road improvement scheme is very important and only one route is possible, for example, even if it upsets the public, ministers will be tough and go ahead. In any case, to avoid unnecessary delays, it is wise from the beginning to take the public's views into account. In the Transport Department, Mr Knowles pointed out that public consultation has a very considerable influence on final decisions. For example, the need to build a bypass in Dartmoor some time ago led to long discussions with the public about the two alternative routes (both having environmental consequences). The dispute took several years to be solved and this is an example of the public's power to delay a project. In the Defence Department, the House of Commons is the place where social related arguments might be held, but it seems that defence is an area where pressure from MPs is less effective (this was the opinion of Mr Sharp, Senior Economic Adviser). Social aspects are not, therefore, very substantial in the department's appraisals in general (it will only be present in ministerial decisions if thought important). Nevertheless, it is general policy at the MOD to create a good image in the public's eyes (to justify public expenses).

In the Health Department, it is the principle that Community Health Councils are consulted for the process of appraisal and the selection of options. But, in practice, it was pointed out by Mr Henderson, the trade-offs are often made by local appraisers taking into account their own personal views and neglecting the views of the public at large. The department is aware of this problem and is trying to improve the situation. Some policies in the department already reflect the consultation of people at large - including doctors' associations and professional bodies. This is the case of the ruling that "maternity units should have at least 2000 births a year", or developing small-scale institutions (such as hospitals for the mentally handicapped), which come largely from taking social considerations into account.

- **Organisational and managerial analysis:** Overall, a great deal has to be improved on the managerial side. Some aspects have already been mentioned:

- (1) The need to appoint 'project champions' to take responsibility for the project from beginning to end.
- (2) The need to educate people to take appraisal more seriously.
- (3) The need to use some kind of incentives so that people would feel responsible for decisions - for example, performance-related payments which would not only reward short-term performances.

Some other areas came out in the interviews as needing attention:

- (1) Mr Parsonage (Treasury) said that major risks within the public sector are associated with the degree of efficiency in the use of manpower, as this is very much a labour-intensive area (in particular, in the Health Department where 75% is man costs). According to him, the main ways to improve projects lie in the organisation of manpower and better management. Training should be done on the managerial side.
- (2) Still according to Mr Parsonage, not much attention is given, in general, to employing the right quality of personnel on a project.
- (3) Mr Knowles said that, in Transport Department appraisals, not enough attention is paid to the people who are to be involved in the project. For example, it is not actually seen if, in fact, the project can employ enough people to work on it, or enough consultants, or if it has the capacity to contract out.
- (4) In the Health Department, Mr Henderson said that analysis of human problems can be an item in the analysis, but it all depends on the appraisals as to which items are included. There is no real guide as to the inclusion of this area in the analysis.
- (5) In the Defence Department, training personnel in project management is being carried out at the moment in order to improve the system. As in other departments, the responsibilities of a project manager are very diverse and it was also suggested that there was a need for incentives for promotion if people are to be committed to a project. The need for training is taken into account if the specific project so requires it. As everyone is a volunteer worker, contrary to the countries where national service is compulsory, they can be trained intensively for highly skilled equipment without the risk of people leaving after a short time. Motivation of personnel was also felt important within the MOD, in particular nowadays given the demographic decline, since this might decrease the number of volunteers too. The use of new and modern equipment is also thought to be a good motivator.

• **Rôle of non-financial factors:** In the public sector, where projects have to be seen in terms of all their implications to society at large, non-financial aspects are as an essential part of the analysis. Cost Benefit Analysis was developed as a technique for assessing value for money in precisely such circumstances. Yet its

coverage is only partial. Quoting "The COBA Method of Appraisal" [95] "CB analysis cannot provide the full measure of the benefits that the community gains, for example, from improvements to roads. It cannot measure the environmental benefits which a road may provide".

Economic appraisal in general (as the financial appraisal in the private sector), is therefore only one element in the appraisal process, and judgement assisted by analysis has to be used to balance economic and non-economic considerations (environmental, social, political, etc.). This judgement should always be based on the systematic assessment of all factors at the appraisal stage, so that the project does indeed reflect the best possible action and attends to the minimisation of all risks without overlooking some of them (the non-profitable ones).

8.2.4 Summary of findings

Given the nature of projects in the public sector - projects with a social purpose - it is necessary for the appraisal approach to go beyond the financial analysis in order to see the implications of a project in terms of society as a whole. The economic analysis - Cost Benefit Analysis - tries to account for all those implications. However, as not all of them can be expressed in quantitative terms, it is also necessary within the public sector to have a broader analysis where all non-financial and non-economic aspects are included (irrespective of being quantitative or qualitative factors). The need for technical, social, environmental, political or organisational analysis is as relevant for social projects as for any other type of major project.

The following are the main aspects that were identified as particularly relevant during the appraisal or that needed to be improved in the current approaches:

(1) In the overall approach and methodology:

- There is a low-key image of project appraisal in most departments; there is a need to change the culture of the organisation so that people take it more seriously. It has been particularly recommended by the Treasury that appraisals should look beyond the cost benefit analysis (economic analysis) and give more thought to the identification of options, clarification of objectives, weighing up of uncertainties and assessing other factors.
- There is a need to give more thought to the possibility of things going wrong (in general, the handling of risks is done in terms of a routine quantitative analysis and using poor techniques).

- There is a need to spend more time at the planning and definition stages, avoiding the tendency to get things done as quickly as possible without a thorough analysis.
- There is a need to monitor projects so that lessons can be learnt from the past.
- The cost benefit analysis itself can be improved by using better techniques for measuring the benefits, for forecasting and for sensitivity analysis.

(2) In the strategic analysis, it was seen that:

Strategic issues do not play a part in the appraisal process. They are examined at the definition of long-term plans between departments and the ministries. The appraisal assumes that a major project has its place in those plans. But it is still necessary that the appraisal of the different options looks at the interdependence between projects and synergistic aspects.

(3) In the technical analysis, it was seen that:

This is an area more relevant to the MOD, as other departments typically carry out standard designs in which the technical risk is limited.

In the MOD and when high or new technology is involved, all precautions, as seen in the general framework, are to be taken, in particular, the need for not overlapping design and development and avoiding changes as the project goes along. Some measures have already been taken to diminish this type of risk or transfer it: to define requirements better before going to the industry; to avoid delays and cost overruns by a different type of contract (fixed prices, payment at particular milestones, etc.); to take more time at the planning and design stages. Technical novelty has, in the case of the MOD, to be seriously weighed by reliability (especially in wartime or possibility of war).

(4) On the political side, it was seen that:

This is a sector which is obviously strongly influenced by political factors: there are guidelines and policies based on political views that have to be followed by the appraisers (such as the 'buy British' and 'contracting out' policies); the last resort for trade-offs is a political one; major

decisions are subject to political approval. Public inquiries are decided on a political level, and privatisation of funds (capital) is given by the ministers for the different projects. To avoid failure, as in the Nimrod case or others due to political judgements, a thorough assessment is needed to be the basis for those political judgements and decisions; political policies should be checked for their implications in terms of efficiency of projects; and political reasons should be clarified, to avoid 'vote-chasing' reasons, or other subjective and personal motives to implement a project.

(5) In the social and environmental area, it was seen that:

This is a very relevant area of analysis, in particular to the Health and Transport Departments, where many public inquiries are carried out in order to assess a project's social impact. The risks of major delays and unnecessary cost on resources for the public inquiry process might be minimised by taking social views into consideration, as much as possible, in the appraisal of the different options. This is an area of which both departments are aware in terms of its methodology, although individual appraisals do sometimes overlook it.

(6) On the organisational and managerial side:

Many deficiencies were pointed out and this was seen as an area where most improvements could be made. Sectors like health are very labour intensive and better organisation of manpower and better management were referred to as the main ways in which to improve projects. Overall, in all departments, there is:

- a lack of personal responsibilities or responsibilities not clearly assigned;
- a need to appoint project champions (as an answer to the above point);
- a need for incentives, to have better quality management (the use of performance-related pay was suggested as a way of making people take responsibility for their decisions and for motivating them);
- a need for training and educating people so that appraisal is taken more seriously;
- a need to check the quality and availability of people for projects.

8.3 RESEARCH AND DEVELOPMENT PROJECTS

8.3.1 Introduction

This section is based on the information collected within two industries where R&D is at the centre of most major projects: electronics and pharmaceuticals. ICL and Glaxo were the companies where the interviews were held and whose systems of appraisal were analysed.

Glaxo is an integrated research-based group of companies operating worldwide and is now the world's fifth largest pharmaceutical company in terms of sales [90].

ICL is one of the biggest UK computer companies. The need for the constant discovery and development of new and more efficient computer systems, and the acute competition in this area makes it a company where R&D projects are constantly being carried out.

8.3.2 Type of projects - research versus development

Research is different from development. The basic aim of research is to learn - it may or may not develop projects. In the pharmaceutical companies, research projects aim to discover new molecules considered worthy of investigation in man. The end product will not always be marketable. According to Dr Towler, Director of Development Planning, for each compound on the market, several compounds had been the subject of research. For example, a programme to develop new remedies for high blood pressure can start with the investigation of 5000 compounds over three years; from there, only two compounds might be recommended, and from these two, only one compound might go to full development and then on to the market. Yet this does not mean failure since, in the process, there was probably room for learning - which is of value for subsequent projects. Similarly, in the electronics area, a project may be developed just to have a basis of knowledge in the central area of business information. This was the case of an ICL project developed just to discover how to manage unstructured information in a computer.

Development projects, contrary to research projects, do not follow instincts. In the pharmaceutical business, the essence of development is to look to the compounds proposed by research and develop them, focusing more on the market. There is less scope for creativity. Similarly, in electronics, the development side is related to products already in existence and have different sources of origin: pressure from competition ('defensive' projects), or recognition of market opportunities ('aggressive' projects).

8.3.3 Key features of the business

The following are factors that characterise these types of businesses.

(1) **High technology:** Computing technologies move very fast, producing more and more complex and sophisticated products. This is due to the constant research going on and the need to beat competitors, in particular the newly industrialised countries such as Korea, Taiwan and Singapore. These countries base their competition on the replication of stabilising technologies at a lower cost. ICL's strategy is, therefore, to move towards products whose technologies would be difficult to acquire or replicate. According to Mr O'Riordan, Manager of Systems Strategy Centre, that means "research and development-based products usable in the early stages of their life by customers, for example, logic engineering-based products, having very short R&D, requiring input from a diverse range of technical skills which only we can provide the industrial and educational infrastructure" [91]. To achieve these high technical and intellectual skills, he proposes better cooperation with the universities. Also, Glaxo projects, according to Dr Towler, involve most of the time new technology (using existing knowledge but introducing new things in each new product).

(2) **Fast R&D:** As discussed in (1) above, electronics nowadays gravitate around new R&D projects for reasons of competition. The way to beat competition is to have a different process based on fast R&D. Similarly, in pharmaceutical projects, research is going on all the time; approximately 10% of a company's turnover goes to R&D worldwide.

(3) **High competition:** The existence of a highly competitive environment determines the need to be extremely aware of market opportunities and to anticipate competitors.

(4) **Timing:** This is linked with the previous point. A study done internally at ICL [92] points out the need for timing projects with the market situation. "For any product to be successful" it says, "it must not only have a place in the market, but be ready when the market starts". For this, it is necessary that research is only carried out timed to produce results ready for the appearance of the market. This is illustrated in that document by the following graph.

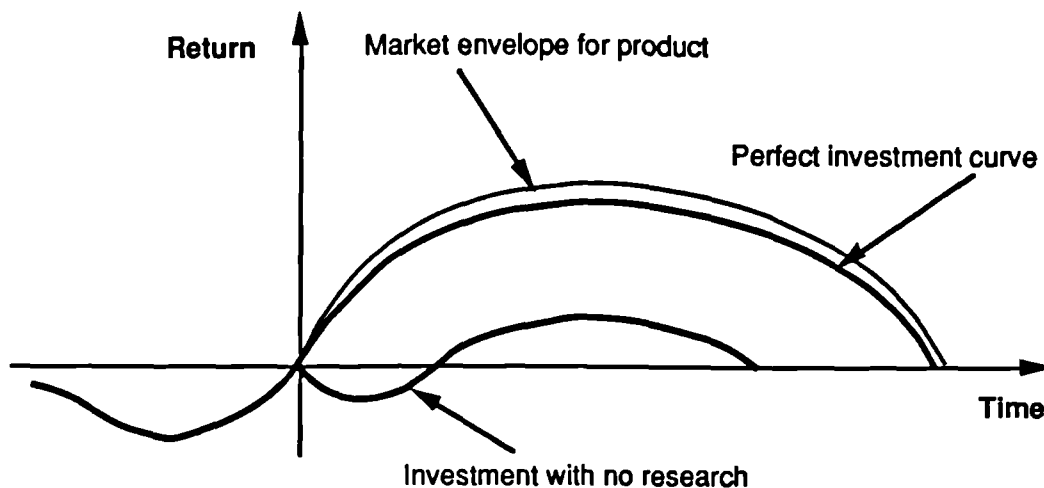


Figure 8.2 - Timing Research with the Market situation

The early research effort (perfect investment curve) allowed the market to be followed closely. Late starters (investment with no research) saw their profits being greatly reduced. An example of the latter case, given by the authors, is the IBM PC Junior. By the time it arrived, there were already other home computers well established in the market and which had advanced upon their original design. The IBM PC Junior was therefore a failure.

(5) Criteria of failure is different: It is essential in this business to develop the technological capability in the research side, even if it is not leading to market patents. The criteria to assess a project are therefore quite different and a project may be implemented for reasons other than profits, without it being seen as a failure. As referred to by Mr McDonald (Marketing & Technical Strategy) some years ago, ICL installed a new computer system in all senior desks to get feedback on its usefulness. The 'usefulness' was a disaster but they learnt a lot by using it (although at the time this was hard to see, it was claimed that, in five years' time, the learning would be there). The financial side on these types of projects is more to assess whether the company could afford it.

Similarly in Glaxo, Dr Towler referred to the need to look at projects in novelty areas, even when the immediate pay-off is not money but a better understanding of diseases.

8.3.4 Applying the Framework - Key areas and risks

- **Methodological aspects:** Project selection and appraisal depends on the type of project - whether it is a research project or a development project. For example in Glaxo research projects are deemed to be worth pursuing on the research side, after considering the following factors:

- (1) Balance of certainty versus novelty (making money versus providing new medicines). (Some areas where novelty is involved are important to look at because: (i) even when the immediate pay-off is not money, there will be a 'learning background' for future projects; and (ii) it is in 'speculative areas' where spectacular profits can be made if projects are successful.)
- (2) Patentability (when novelty is involved, to check whether it is possible to make a patent out of the research).
- (3) Money to regain (market aspects). (Even at this stage - research - the size of the market is looked at because, if it is not big enough, there will never be a development stage.)

The three elements above are seen simultaneously.

In development projects, more specific issues are looked at - technical, legal and safety issues. Simultaneously, there would always be the question of marketability of the drug, given its effectiveness (i.e. 'is the medicine good enough?' and 'can money be made back from it?' are the basic questions). Marketability is assessed by looking at what competitors are doing and the company's place in the market. Timing is vital, not only because of profits lost, but because of competitors coming into the market first.

Also in ICL, there is a difference in the way projects are selected and analysed according to their types. First of all, some projects may be carried out for internal purposes - for example, installing computers in the company which are made by the company. The reasons to implement a project in these cases include:

- (1) Contribution to effectiveness (i.e. not because the project must give a certain return but because it makes the company more effective if, for example, it leads to better decision-making).
- (2) Taking company's own medicine (i.e. not selling to others what the company does not use itself).

- (3) For validation (use the company as guinea pigs to prove and check that the product works).
- (4) To learn (e.g. the project previously referred to, of installing a new computer system on all senior desks to get feedback on its usefulness).

For projects with an external impact, ICL had recently (approximately six years ago) started a new project appraisal process through which a greater relevance is given to the non-financial side of projects. The project life is divided into a series of phases (from feasibility to withdrawal); at the end of each, the project is analysed and reviewed according to different emphases. According to Mr McDonald, ICL did not do it previously and a project "would have a life of its own" (as people would be reluctant to stop it once it had started). The criteria of assessment changes across the different phases, starting with a concentration on strategic issues and moving later on into the technical, commercial and marketing viability of the project. The aim is to get a continuous decrease in risks as time progresses, so that the project will have a minimum risk at the time of maximum exposure in cost - normally after design when the commitment to prototypes occur and equipment is needed to be bought (until then, project cost is more an engineering/human cost).

The above process is felt to be inappropriate in some of the projects on the research side of the business. This is the case, according to Mr David Horth (Manager of Innovation Office) of new ideas which fall in a completely different area of the activities in which the company is engaged. For this reason, and to take business advantage of new ideas, an Office of Innovation is currently being set up. Also on the research side, Mr Babb (Manager of Logic Engineering Group, Systems Strategy Centre) referred to the inadequacy of the existing procedures of selection of research projects conducted on a corporate basis (research to open up new business centres or to make major adaptations to existing ones). The problems were identified in an internal talk on the subject [93] and recommendations were made as follows:

- (i) that an exploitation plan for all research projects, constantly reviewed, would be made (containing a market research component);
- (ii) to set up a long-term Research Investment Committee (that would formulate the exploitation plans, value the proposed projects, and start/stop projects);
- (iii) to set up a clear area of responsibility for research findings, i.e. who pays (for example, Business Centres, ICL, STC (Systems Strategy Centre)).

• **Strategic analysis:** The strategic and synergistic aspects of R&D projects are examined in ICL through a 'Business Analysis' procedure (related to all business centre strategies) and a 'Business Coherence' procedure (related to the 'Strategy Panel' analysis). An internal report on the analysis of these procedures [92] identifies some of the existing problems and come out with some proposals to avoid them. These problems, already discussed in Chapter 5 , were identified as :

- inadequate direction about relative priorities of business objectives;
- lack of classification of strategies;
- lack of direction about investment, revenue and profits.

The above would normally make it difficult to clearly assess a project against the overall strategies of the business. The corrective actions proposed were to coordinate business planning and strategy creation, and to train strategists in business planning procedures.

In the Business Coherence analysis a panel is filled for each product ('strategy panel') with a yes/no answer in which the considered relevant aspects are addressed. The panel is supported by senior management (strategy directors) of business divisions to see if the project is worthy from an overall company perspective. According to Mr Arnell (Business Strategy Unit) all non-financial aspects will have to be acceptable and they can break a case if they are not. In his view, the panel should be expanded into detailed strategies to be implemented. In the Strategy Panel, synergy is of prime importance. The panel is intended to ensure the coordination of all units in the project, and that the products are directed to ICL's points of strength. The participation of the representatives of all units will ensure coordination between all sectors. This is particularly important, according to Mr Arnell, between the sales department and the manufacturing department. But, the fact that some projects are developed without being properly channelled was identified as leading to many failures.

Similarly in Glaxo, strategic and synergistic aspects are key aspects of analysis for research projects. Strategy is defined at the top and projects are prioritised accordingly, making sure there is a balance between research in risky (new) areas and certain (old) areas. For any drug company the risk taken in new areas, depends on the size of the company and the interaction between all projects (if profits are coming from certain drugs, it allows more money to be placed in speculative ones, for example). Monthly reviews at directorate level constantly analyse the impact of projects on one another. Synergy is decided at the early stages of the project but is always reevaluated through the development stages (as also happens throughout the 'Phase Reviews' process at ICL). The current thinking is to go into areas where there is the greatest need and markets. That is, market-driven research

(look at therapeutic needs; see where 'gaps' are; work R&D in these areas). This also appears to be the trend within ICL.

- **Technical analysis:** Together with strategic issues, the technical assessment of projects are the key areas of R&D feasibility studies. Risks in this area were referred to by both companies as one of the main causes of project failures. In Glaxo, risks are mainly associated with technical issues (the safety of drugs, the toxicity, and the formulation).

In ICL, technical strategy covers a great deal of the issues in the panel, and technical reviews are constantly carried out throughout the phase reviews process. Still, given the high technology and the fast R&D in the computer business, technical factors were given as the main reasons for project failure. According to Mr McDonald, it is very easy to get estimates wrong and overspend due to technical reasons. Sometimes, he said, it is quite impossible to avoid it, as things are difficult to visualise completely at the beginning (before development is undertaken). Nonetheless, he suggests the following as some of the ways to minimise the risks:

- (1) avoid 'cost of enthusiasm' (when technical people think they know what to do and want to rush design to implementation);
- (2) get design proven before commitment to prototypes (in this business, it is when commitment to prototypes occurs that cost is very large; therefore, design should be proven first). Obviously, without rushing the design phase, this has to be balanced against it involving too much delay as timing is critical too;
- (3) make certain milestones along the project life to include demonstrations of technical capability;
- (4) continuously review assumptions at different phases to see whether initial assumptions still hold;
- (5) get second opinions on difficult technology matters.

- **Social, political and environmental analysis:** These areas are not perceived as being particularly relevant (in terms of risk) for R&D projects. In ICL, according to Mr Arnell, there are always political considerations taken into account at the overall strategy definition - with whom to negotiate, where to invest, etc. - but

these are not taken into individual appraisals. Health and safety considerations are recognised, but they are more or less standard internationally and therefore there are no risks to be taken. In pharmaceutical products, safety is particularly important, but, according to Dr Towler, it is always impossible to have a 100% safe drug. Judgement on whether a drug is safe enough lies with the senior management and will depend on the product. But this is a highly regulated industry and requirements for new drugs are very specific and demanding.

Environmental pollution is also subject to strict rules, both internally and externally. The standards are applied, according to Dr Towler, in whatever country the company is operating. Still according to him, these are issues looked at early on but, in principle, there are no problems as there is sufficient expertise to see a way round any difficulty.

In conclusion, for any of the companies seen, these aspects seem to be an area not particularly relevant in terms of presenting risks to projects.

- **Organisational and managerial analysis:** There are no special features to this area of analysis. Common guidelines as seen in the framework would apply. Good management and skilled personnel are always essential and were referred to by both companies as ways to minimise project risks (delays, performance and overspending). Dr Towler (Glaxo) particularly emphasised the rôle of the project manager and project teams; if there are no good relationships between people in the teams, time can be spent in solving human problems instead of getting on with the project - and time is critical. The project manager has all sorts of little decisions to make that can also be crucial to the success of the project (because of timing). For example, judgement for colour (a colour that stands out against a patient's other drugs); judgement on format (drugs in the form of a round pill are quite common; can a drug handle a different format?); etc. The training and selection of managers to ensure they can overcome problems is important.

Similarly, in ICL, there is a need to make sure the project is well managed so that it arrives on time. Expertise of staff, training, cooperation and contacts with universities are all means by which ICL ensures good quality personnel on its projects.

- **Rôle of the non-financial factors:** In R&D projects, the general principle (as in both ICL and Glaxo) is that money is put aside for research and, given that, all criteria of selection are then non-financial ones - basically strategic, technical and market opportunity. These criteria change across the different stages of the project, starting with more strategical issues and focusing with time on more technical and marketability aspects. ICL's system for external projects has moved from a previous selection based on the financial side of proposals to a new one where long-

term strategic issues (in the 'strategy panel') come alongside the financial elements.

Similarly, in Glaxo, the appraisal criteria are basically non-financial ones. The financial aspects, according to Mr Arnell, are relatively unimportant once the company is committed to develop certain gaps in the market (strategy). The financial issues come only into consideration to decide the amount of money as a whole to spend on R&D. After that, project selection is subject to other criteria as seen: patentability, balance of certainty versus novelty, and market opportunities (for research projects); and, as projects go through development, more technical issues will be added with a continuous revision of strategic reasons and the market situation (timing and getting ahead of competitors is vital).

8.3.5 Summary of findings

R&D projects are characterised by a high degree of complexity (technical and intellectual), timing criticality (due to the very strong pace of research and high competition), and the fact that the immediate purpose for some of the projects is the acquisition of background knowledge, irrespective of an immediate development of the project. These characteristics make the selection and appraisal procedures place the emphasis on:

- (i) the strategic analysis (to identify the areas worth developing, in terms of gaps in the market, that may give the company the lead in the area; to see to what extent investments should be made on new fields - that may lead to the acquisition of background expertise but not to immediate marketable products; to define the overall research strategy that will allow results ready at the start of a market - instead of products being market-driven);
- (ii) the technical analysis (as major risks are due to the high complexity and new technology involved in most projects);
- (iii) the market analysis (given the high competition and the need to get the lead on the market or the right timing for products).

The main reasons for project failure are normally associated with these three areas too. They are:

- (1) Technical risks (wrong assumptions on the technological performance of some components; difficulties in visualising everything at the beginning before the implementation is underway).

- (2) Competitors and markets (wrong assumptions concerning competitors and markets).
- (3) Inconsistency (for example, overlooking the sales force or any interconnection between all the departments until the project reaches the market).
- (4) Overoptimism (for example, on the part of the technical personnel leading to rushed design and to concurrency).
- (5) Time delays (projects that take longer than expected, risking profits or missing the market completely).
- (6) Wrong costs.

The following were the ways identified in ICL's and Glaxo's approaches to minimise these risks and, in their experience, the main aspects of which to be aware during the appraisal in the different areas of analyses:

- In the overall approach analysis:
 - It is very important to review projects at pre-defined stages throughout their lives, as market assumptions (due to high competition) and technical assumptions (due to high technology) may change.
 - It is important that, through phasing and reviewing, minimum risks will occur at the time of maximum exposure in cost.
 - The balance of what is important changes throughout the life of the project. Initially, it concentrates on (i) strategic aspects (balance of risk, projects fitting into the overall strategy of the company, patentability, market opportunity, etc.), and (ii) feasibility of implementation; in subsequent stages, it addresses more technical questions and details market and commercial prospects. Internal projects (ICL) may have a completely different criteria of appraisal: contribution to effectiveness, taking company's own medicine, validation, and learning purposes.
 - Timing is critical; research should be planned to start ahead of the market so that the market envelope (figure 8.2) would be followed completely; managerial ability to get timing under control is important.

- Corporate changes were made in ICL to attend to the needs of an efficient system of appraisal:
 - (i) the Office of Innovation to take care of ideas originated outside the 'official' planning;
 - (ii) the Long-Term Investment Committee to deal with selection of research on a corporate basis.
- In the strategic analysis:
 - Reviews of strategic issues occur throughout the life of the project (Glaxo and ICL); assumptions are checked all the time.
 - It is important to define:
 - (i) priorities of the business;
 - (ii) clarification of strategies;
 - (iii) directions about investments (ICL).
 - Given the above, projects are assessed against the overall strategy in the first place.
 - It is important to coordinate business planning and strategy creation (ICL).
 - It is important to train strategists in business planning procedures (ICL).
 - Synergy with all units is of prime importance (ICL); to ensure it representatives of all units should be present at the assessment.
 - The 'strategy panel' ensures the analysis of synergy and strategical coherence of individual projects (ICL).
 - Risks in new areas are taken, depending on the size of the company and the interdependence of the project (Glaxo).
- In the technical analysis:
 - It is important to review assumptions all the time as technology is complex and new most of the time.
 - It is important to avoid overoptimism and establish design before implementation (in the electronics case, before prototype commitment); balance this against the risk of delaying the project itself and lose market.
 - It is important to make certain milestones along the project life to include demonstrations of technical capability.

- Obtain second opinions on difficult matters.
- In the social, political and environmental analysis:
 - Overall, there are no specific issues concerning these aspects for these types of industries. All guidelines in the framework should be looked at to deal with social acceptability, environmental matters and political factors.
 - It is important not to overlook rules and regulations concerning safety and environmental aspects, so that the company will not lose its market image.
 - Safety is particularly important for pharmaceuticals - it is necessary to be careful in trading off safety aspects, although there is no 100% safe drug.
- In the organisational and managerial analysis:
 - There are also no special features for the industry. All framework guidelines apply.
 - Good management is essential to get products in time for the start of the market, to solve human problems if they occur, to take all sorts of little decisions that may be crucial for the timing of the project if done efficiently (e.g. judgements on colour and formats in drugs), and to make sure milestones are met.
 - *Contacts with other institutions where research is done (e.g. universities) is a way of increasing company expertise.*

8.4 AEROSPACE AND DEFENCE PROJECTS

8.4.1 Introduction

This section is based on information collected in Smiths Industries (SI), concerning the Aerospace and Defence Group, and in British Aerospace (BAe) in the Air Weapons Division.

Smiths Industries is principally engaged in the development and manufacture of a wide range of control systems and instrumentation for the aerospace and marine industries and for general industrial applications. The Aerospace and Defence Group supply high technology systems and equipment for use on both civil and military aircraft, marine electronic equipment and custom micro circuits. The group has been working in collaboration with British Aerospace over the past years, particularly on the design of advanced electronic displays for the flight deck. Each division of SI has its own project support group and, for small projects, local managers have a great amount of authority over them. For large projects, such as new aircraft programmes, decisions are taken at Headquarters. The interviews were held with the Director of Future Projects (Mr Hosegood).

British Aerospace has seven divisions, two of which are primarily concerned with the manufacture of aircraft - the Civil Aircraft Division and the Military Aircraft Division. The five other divisions manufacture tactical weapons, defence systems, space craft and related technological equipment. The interviews were held in one of the latter divisions - the Air Weapons Division (Business Development Unit).

8.4.2 Key Features of the Business and Type of Projects

Companies in the Aerospace and Defence sector are faced with very high technology projects and the need to back-up these technologies with a programme of applied research in the field.

- **Technology:** In most Aerospace and Defence (A&D) projects, there are new and complex technologies involved and this fact was pointed out both by Mr Minion (BAe) and Mr Hosegood (SI) as leading to the major risks - bad project performance, delays and overspending. Delays and overspending are often due to technical changes. In Smiths Industries, the large amount of investments is for bids involving completely new equipment - new aircraft, updated systems, etc. In this field, R&D is very fast and mid-life revisions are always needed. Therefore, getting estimates wrong is very common, Mr Hosegood said. Cost estimates are very difficult to predict because, according to Mr Hosegood, given the long time of the work (new aircraft programmes may take twelve years, for example), there will always be new technical specifications in the middle (defence reactions to offence systems; if these move, clients will want

changes as well). Changes are therefore frequent, he said, as well as new technology not completely understood when the project starts - which adds to overruns and delays. Similarly, Mr Minion of BAe said that technology not established properly at the beginning leads to difficulties in achieving performance, and overspending is therefore common (since once the R&D phase and design is completed, the project will be seldom stopped).

- **Applied research:** Having a steady flow of research going on (technology-based, not product-based) was said by both companies to be extremely important in this business: (i) to keep ahead of the competition, (ii) to serve as an input on the technical risk assessment whenever a new technology is to be used, and (iii) to look at the next generation of requirements and be prepared to address it. It is part of BAe's long-term strategy to have a whole range of technology, looked at in the research programme, waiting to be developed. New technologies are backed by this applied research which is done 2 to 3 years in advance of project development. Similarly, in SI, keeping at least one step in front of current technology is an essential part of the company strategy - to be able to participate in future aircraft development programmes [98]. Over the last five years, the group has spent over £100m to directly-funded and private venture research and development engineering [97].

8.4.3 Application of the Framework - Key aspects and risks

- **Methodological aspects:** Long before the bid proposal is due, the feasibility analysis is supported through:

1. Long-term preparation (assessing possible partners, manufacturers, opportunities to come); (SI)
2. BAe Applied research, developing new technologies that will support the technical risk assessment of proposals; (BAe)
3. prioritisation of projects to bid for, ensuring the company directs its resources to the most beneficial areas in strategic terms; (SI)
4. assessment of business opportunities for each group of products, ensuring the company lead in new fields; (BAe)
5. phasing of the appraisal, starting with a pre-bid stage where all risks (technical) are assessed, before a commitment to take the project is made. (BAe and SI)

- **Strategic analysis:** The importance of placing a project in the context of the overall objectives of the company and in the context of all other activities is reflected in the practices of both SI and BAe.

At the preliminary analysis, strategy is a key issue in SI decisions. According to Mr Hosegood, long before a detailed evaluation is done major projects are taken to the top level and are mostly seen from a strategic viewpoint. Although the financial impact will be looked at, Mr Hosegood said that SI can absorb half the cost of R&D of the project if it is strategically beneficial to take it (for example, by allowing a payback period of 18 years instead of the normal 12 years for this kind of project).

In BAe, although strategy was not emphasised by either Mr Eastwood or Mr Minion as a key area of analysis, its importance is also reflected in:

1. the assessment of business opportunities for each group of products, and placing speculative projects in this context;
2. analysing the project in the context of the company's strengths (technical capability, resource analysis).

- **Technical analysis:** This is a key area of analysis as most risks have technological causes. Delays and overspending were referred to by both companies as mainly due to changes in technical specifications and technology not completely understood at the beginning. Therefore, it is extremely important that a realistic assessment of the technical viability of the project and the capability of the company to do it is made early, and that changes are avoided.

In SI, Mr Hosegood said that quite often bad assessment and control of software occurs. Projects will then start running out of time, an extra team will have to be put on the project, and the price will go up. The main deficiency with the system, he said, is that it relies very much on the judgement of engineers on what needs to be done. A check through a second person is always carried out but, even so, Mr Hosegood said that it is still easy for both to get things wrong. The minimisation of risks, greatly depends on the ability and capacity of the personnel involved.

In BAe, similar difficulties in achieving performance in time and budget were referred to. This is due, according to Mr Minion, mainly to technology not established properly at the beginning. In his opinion, most of the time it would actually be difficult to make predictions accurately due to the complexity involved. Yet he also said that there is a tendency amongst the engineers (who are normally the ones who assess risks) to be very optimistic; they look at the job as easier than normal and tend to underestimate the costs. Past experience is essential for these assessments. The applied research expertise is also a basis for the assessment of technological risks; furthermore, the company tries to introduce technology one step at a time so that risks can be controlled. Quality control is a priority in the company as this is a business with a very high profile in the world's eyes. Every project goes through strict quality

standards, right from the initial concept, and a continuous liaison between the quality control department and the design group is ensured.

- **Political, social and environmental analysis:** There is no a priori analysis of these areas. No particular risks associated with these areas were identified as typically occurring. In SI's case, most of the work at the moment is carried out with North America or Europe and, therefore, there are not many political problems. Previously, Mr Hosegood said, there had been some political risks in work done in South America. This was an aspect considered at Board level at a very early stage. When choosing a partner, there are also political considerations involved to ascertain their relations with their governments, and therefore avoid future problems. In terms of social acceptability of the company work, Mr Hosegood said that this was a negligible aspect for the appraisals as it did not influence their projects. Nevertheless, it is general policy of the company to establish good links with local communities and provide them with support in activities such as education or health [97]. The company's own employees are also asked if they have any reservations when working on some defence projects, and their opinions are respected (very few would actually not wish to be placed on those projects, according to Mr Hosegood).

Similarly, in BAe, there are previously defined general rules of not trading with certain countries, for example. These rules are flexible, Mr Minion pointed out, but if a problem is foreseen, a decision would go to Headquarters for clarification. The Government carries out a regular (every 3 to 4 years) examination on the way the business operates, and standard rules for design and production quality control were introduced ten years ago by the MOD. Clear rules and regulations also exist on the environmental and safety side and there is no room for trade-offs.

- **Organisational and managerial analysis:** Good management, good leadership and well-motivated teams are considered as essential to project success, as in other businesses. Therefore, all guidelines from the framework would apply. In the analysis of the practices of the companies, Mr Minion pointed out that in this business, it is important that the project manager has a basic knowledge of engineering in general and of the product in particular (as risks are mainly technical). Normally, he said, the selection for a project is of someone within the company so that he will understand and know the company procedures.

- **Rôle of the non-financial factors**

The appraisal centres around the financial, strategic and technical factors of the project and the organisational needs (to set up the project management and teams, and to see the availability of personnel and resources). Strategy is examined at the very beginning to ascertain, in the first place, what jobs to bid for or what opportunities to pursue. Factors such as the long-term result of carrying out a project, early spin-offs, technology that might be developed, etc., are all taken into account when a new project opportunity exists (SI). These strategic aspects, according to Mr Hosegood, can be the determinant for the decision to take the project, although the trade-offs have always been to consider the consequences of the project in financial terms (the company will always have to be able to afford it financially). Once the finance is assured, and the project fits in with the strategy of the company, the technical assessment is the prime consideration. Only if the technical risks can be solved will the project go ahead.

8.4.4 Summary of findings

Aerospace and Defence projects are particularly characterised by their advances in technology. The pace of R&D in the field is high and there is a constant use of new technologies. Risks are normally associated with this; overspending and delays are the result of:

- complex technology not established properly at the beginning;
- consequent changes in the middle of design and implementation;
- customer changes of specifications;
- unpredictable mid-life revisions (due to the pace of research during the long-term life of these projects);
- overoptimism in assessing technology and cost;
- difficulties in predicting the foreign exchange rate.

The technical assessment is therefore a vital one in the analysis to overcome these problems. Together with the technical assessment, strategic reasons, financial aspects and organisational needs are the prime areas for appraisal. Other aspects, such as political, social or environmental, are not perceived as relevant in terms of being a cause of project failure. Still, political considerations (in particular when working with international partners), social acceptability and environmental aspects should be checked for possible implications to the project. As ways of dealing with the main sources of risk, the following were identified in the companies' practices:

1. On the technical side:

- ensure technical personnel have the capability to assess risks - use personnel with high expertise and previous experience;
- set up a quality control group right from the initial concept of the project - liaise with the design personnel;
- double-check assessment and estimations;
- back-up expertise by a background of applied research (technologically-based).

2. On the organisational and managerial side:

- in this business, it is important that the project manager will have an engineering background in general and knowledge of the specific type of product in particular; past experience in being able to detect risks earlier and assess them is essential. (BAe considers internally appointed project managers as the best option since they will be familiar with company procedures).

3. On the political, social and environmental side:

- these areas do not have particular relevance in terms of risks to projects:
- political risks are avoided by previously defining the rules as to with which countries to negotiate, and by checking governments and international partners on their relations;
- acceptability of companies' work is ensured by general support of the companies and their local communities (SI);
- environmental rules and safety are not traded off for cheapness.

4. On the strategic side:

- strategy is looked at in the early days of the project (before the bid on a commitment is taken). The project is assessed in terms of its opportunities, short or long-term, its advantages or not in terms of competition, and its compatibility with the company's other activities.

5. In the overall methodology, the appraisal is supported by a long-term preparation:

- assessing beforehand possible partners, manufacturers and opportunities to come;
- developing new technologies on the research side that will be an input to the assessment of the technical risks;

- prioritising the projects to bid for, so that resources would be directed to the most beneficial areas for the company;
- assessing the business opportunities for each group of products.

In terms of decision-making, it is the project's affordability to the company (or its profitability), the project's strategic importance (profitability may be traded off by it) and the technical risks (too great risks should lead to a non-bid decision) that are the main determinants for the final go-ahead.

8.5 ENERGY PROJECTS

8.5.1 Introduction

This section is based on information collected within the Central Electricity Generating Board (CEGB) and British Nuclear Fuels (BNF).

The CEGB was created by the Electricity Act 1937. Under the Act, its main duties are "to develop and maintain an efficient, coordinated and economical system of supply of electricity in bulk for all parts of England and Wales". It operates both conventional and nuclear sources of energy. The interviews were carried out before privatisation within the Strategic Studies Department and the Generation Development and Construction Division.

In British Nuclear Fuels, the basic business is, at present, the reprocessing of fuel and recycling of uranium. A major project - Thorp - is under development. It will reprocess oxide fuel from AGRs (advanced gas-cooled reactors) and LWRs (light water reactors), and is expected to come on line in 1997. The interviews were carried out within the Thorp Project Management Unit.

8.5.2 Types of Project and Key Features of the Business

The following are the critical characteristics of this business and projects in terms of implications for the appraisal:

(1) Long time-scale: New generating plants normally have a construction lead-time of at least seven years and an operating life of decades [101]. The possible trends in electricity, demand, fuel availability and fuel prices must therefore be considered for many years ahead. Given this long-term period of project life, all estimations are difficult (UK economic growth, capital, costs, etc.). Getting estimates wrong was reported by the interviewees as one of the reasons for failure (improving the methodology of forecasting is one of the continuous objectives to deal with this problem). Experience was said to be a way of getting good control of the estimates.

(2) Major construction: All new plants involve major construction work - at least seven years, as referred above. This leads to a great impact on the local physical and social environment and therefore social issues (and environmental ones) have to be carefully considered in the appraisal. Also, because this is a business in the hands of nationalised companies, a public inquiry is demanded most of the time (particularly for nuclear plants).

(3) Political dependence: Because these are nationalised companies, there is a great dependence on political instances. For example, the MOD is BNFs first client and all the requirements come from it. Therefore the arguments when considering a new plant are not around whether to build it (this is determined outside the company) but around managerial, environmental, safety and technical issues (e.g. Can it be built on time? Will the Department of the Environment accept it? Will it be safe and authorised?). Similarly, in the CEGB, when a new plant is being considered, the whole of Government and the relevant bodies will be involved in the decision for permission:

- request to the Secretary of State;
- permission to build;
- permission from the Treasury for finance;
- permission from Nuclear Institute (if it is a nuclear plant);
- etc.

(4) Criteria of assessment: The criteria of assessment are different from private companies. The CEGB, as a public company providing a basic service, has to take its investment decisions far beyond the profitability aspects. Its main objective is to provide electricity in order to meet all the demand needs - at the minimum cost possible and as efficiently as possible. Decisions to build new power stations or any major investment are, as mentioned, subject to the approval of all of the Governmental bodies concerned. In these decisions, these bodies take the whole economy into account, and not just the company perspective.

In BNF, like the CEGB, most projects are assessed far beyond a rate of return basis. This rate is set by the Government. According to Mr Halford, projects are mainly assessed on an environmental and technical basis, and not on commercial terms.

(5) Safety and technical reliability: When nuclear plants are concerned, safety and technical reliability are a prime criteria of assessment - as the consequences would be socially unacceptable in the case of failure. Linked to the nuclear plants, some minor projects will be carried out, according to Mr Halford, purely to ensure that environmental and safety standards are met (financially, they are just done on a cost minimisation basis).

8.5.3 Applying the Framework - Key areas and risks

- **Strategic analysis:** The CEGB's strategic studies are behind the initial proposal for new plants: attending to demand forecasts (establishment of needs) and the existing grid of stations (options on types and sites).

Project financial risk is not perceived as relevant, according to the interviewees, given this is a public company (with privatisation, this would probably change). The main aim of the company is to attend to all demand needs without any power cuts (the Government may pick up the bill through lower cash flows).

- **Technical analysis:** This is an area of extreme importance to be looked at in the initial appraisal, and all design and technical definitions should be completed before construction to avoid concurrency. Many of the causes of project failure pointed out in the interviews were linked to this area.

For the CEGB, failures to appreciate technological risk and not making gradual transitions in technological progress were mentioned as the main reasons for failure. Prototypes should be used more often. The use of joint ventures to transfer technology was suggested. Trade-offs should not occur in the area of safety and reliability. Companies should go for safer technology rather than cheapness. (Interview with Mr Williams and Mr Ayton.)

In BNF, it is Mr Halford's experience that the main reasons for failure are technical aspects as well as managerial ones. On the technical side, he referred :

- a lack of or wrong definition of what is trying to be achieved (in his experience, inadequate definition in any particular phase generally gives an optimistic perspective of the work, and leads to an underestimation of its complexity and the time needed to complete it);
- the existence of a great overlap between design and construction;
- changes made at too late a stage (according to Mr Halford, projects do not tolerate too much change, in particular after the feasibility stages);
- problems in the nuclear projects, due to the novelty of the software, leading to delays.

- **Political analysis:** Political dependence was discussed previously as being one of the characteristics of these companies (as long as they remain in public ownership). Political circumstances have the final decision in making the projects viable: for funding, for permission to build, for safety and environmental controls, for public inquiries. They can also have a say on clients (BNF), suppliers, and contractors

(CEGB). The appraisal, therefore, needs to take into account the Government's policies and ensure its commitment (for funding and permission).

- **Social analysis:** At the earlier stages, when deciding on the location for a plant, social aspects come into consideration. This is particularly true for new locations, although in the case of nuclear plants, irrespective of location, the analysis should always be done as there is normally opposition from groups like 'Friends of the Earth', the anti-nuclear lobby, etc.

In BNF, according to Mr Halford, there is not a formal analysis of the social aspects of projects at the feasibility study stage, as all plants are being built in predetermined sites (the existing ones). As most of the local inhabitants are employed by the plants, they get direct benefit from it and therefore are not normally the ones who oppose the plant. All plants are subject to the environmental and safety laws of the country.

In the CEGB, traditionally, all plants have been located in the North, near the coal fields, but problems of transmission have made it necessary to bring them nearer to the consumer - to the South - where social opposition is greater. The initial policy for nuclear plants, determined by the Government in 1955, was to locate the power stations in areas of low population density [101]. In the company's experience, it is known that a station receives a better reception in an area where it already exists. Therefore, the current strategy is to locate new plants in land belonging to the CEGB and where other plants are already in operation (e.g. Sizewell B). It solves:

- compulsory purchasing of land and need for resettlement;
- social opposition risk (nearly all inhabitants live on the work provided by the plants, so a new plant brings job security for the future);
- the risk of scenery being affected.

But this policy of using existing sites has to be balanced against the need to diversify the grid system.

It is also the CEGB's experience, according to Mr Williams, that it is the people outside the site areas that actually complain most, as the local inhabitants actually benefit from the project (jobs) and already know what to expect from it in terms of damages. Assessment of social reactions - to what extent people believe they will benefit from the plant or how they will balance it against the inconveniences - is taken by judgement and experience. For example, it is known that a site in areas of high unemployment will be more easily accepted, and that major construction in the Thames areas are subject to delays due to the tradition of bad industrial relations there.

To minimise any risks of social opposition and trying to avoid delays with public inquiries, CEGB policy is always to develop good relations with the local people and start negotiations with the local authorities several years prior to development. Local inhabitants are kept informed of what is being planned (type of traffic, supplies, routes, etc.) and local liaison committees are established for this purpose.

At a community level, the company tries to persuade people of the benefits by:

- cash injections in the local community to compensate for the inconveniences;
- trying to secure from the Government that a greater amount of taxes will be employed in the area;
- using local resources;
- improving local conditions; and
- on a long-term basis, taking social policies to improve education, transport, medical facilities, etc.

On an individual level, negotiations will also deal with people directly affected by the plant (e.g. resettlements, improvements, etc.).

Impact studies are carried out prior to the negotiations and local views are an integral part of the proposals sent in to the Board.

• **Environmental and safety analyses:** These are a prime area of analysis. An environmental statement has always to be presented to the Government. Environmental impact studies are carried out in the CEGB by both in-house and outside consultants. A team of geologists, for example, will look at the type of land; another team will analyse the environmental damage (for example, for fish, when seawater is used as a resource); another will deal with air pollution, etc. All these are aspects regulated by law that will have to be satisfied. The same applies to safety aspects, which are particularly important for nuclear plants. Standards have been established within the CEGB, and are reviewed regularly in the light of scientific and technical developments. These standards are always within the legislative framework. An environmental monitoring programme will be carried out throughout the life of the project, in particular in the case of nuclear power plants, to "ascertain whether the operation of the station has any detectable effect on the environment" [101]. Such a programme is started before the reactor is commissioned as background data on the natural levels of radioactivity is needed for future reference and assessment of changes. A fundamental factor in the design of the plant is also the control of radiation exposure of staff and the public.

Similar measures are taken by BNF. According to Mr Halford, there are no trade-offs, or room for breaking the law, in environmental and safety matters. All levels (discharges to environment, maximum radioactive dose allowed to workers and the public, etc.) are set. The only decision to be made is whether the cost of the project, meeting all the environmental requirements, is an affordable one.

- **Organisational and managerial analysis:** An analysis of the CEGBs traditional project organisation was carried out earlier in Chapter 5. As examined then, adjustments have been carried out in this structure in order to ensure a greater coordination between all stages of the project and all disciplines. The lack of coordination between disciplines was also pointed out by Mr Halford as a common reason for failure. He suggested that, in particular on very large projects, this could be minimised if the project organisation is separated from the rest of the company's organisation completely (projectised structure), at least when into the main design phase. The organisation structure should always be adapted to the needs of the project (for example, in the case of Thorp, because of its large size, several project managers were appointed to manage fractions of the work). The selection of project managers and their ability to coordinate all areas and in motivating personnel is an important aspect to consider (all general guidelines in the framework related to project personnel, communications, teamwork and motivation are relevant for the sector).

When using contractors, it was pointed out by Mr Halford, it is equally important to ensure that they too place the same emphasis on motivating personnel. This might be one of the aspects to consider in their selection. The project manager responsible for the contracts (in the Thorp case, the head of construction) should, in Mr Halford's opinion, be an expert on strategy rather than on the technical field (in contrast to the other project managers - responsible for design and technical matters - who need a technological background in the area). The contracts strategy was also referred to by the CEGB as extremely important. Inappropriate contract policies have been also pointed out in the literature as a major area of problems in this type of project [57]. This was confirmed by Mr Williams, who referred to the commercial priorities of contracts as among the major causes of failure (industrial relations, and inexperienced management were, in his experience, some other main causes).

- **Rôle of the non-financial aspects:** Non-financial considerations have particular importance on the siting policy (social and environmental factors), on the design and technology (safety and reliability) and on the organisational and managerial aspects (contracts strategy, organisational structure and project personnel). The financial side is set by the Government; funding and the rate of return are dependent on the Government. An assessment of all non-financial aspects is necessary for all

projects. The risk of project delays and extra costs due to public inquiries on the project, make it essential that local issues are taken into account in the decisions. The final go-ahead on projects is dependent on the political instances (both for funding and permissions).

8.5.4 Summary of findings

The distinguishing features of projects in this sector are that:

- these projects have a very long time-scale (which makes all estimations difficult);
- they involve major construction, having therefore a great impact on the social and physical environment;
- they are subject to political bodies for permissions and need Government commitment for funding;
- their appraisal is not in terms of the greatest profit for the company, but takes into account social and political reasons (the need to meet all energy demands; the need to buy from predetermined sources; etc.); the rate of return is set by the Government;
- technology and design (to meet all the necessary safety standards) is complex (in particular in nuclear plants).

The major areas of risks identified were technical and managerial ones:

- failures to appreciate technological risk;
- not making general transitions in technology;
- overlap between design and construction;
- changes at too late a stage;
- lack of coordination between disciplines;
- inexperienced management;
- industrial relations;
- inadequate contracts strategy.

Several suggestions were made and practices were identified in order to minimise these problems (already pointed out in the framework).

The environmental aspects, although a prime part of the analysis (and its fulfilment can be the sole objective of some parallel projects), were not reported as presenting particular risks. There are laws and standards to be met which do not allow for any trade-offs. Impact studies are carried out and an environmental statement is

one of the main documents for decisions. The assessment is carried out in order to ascertain whether the project can be afforded, given the costs to the environment and whether standards can be met technically as well.

The technical aspects related to the environmental standards (safety of design, insurance against earthquakes, etc.) can be difficult to deal with and should be solved before construction begins, to avoid delays then.

The social aspects are also a prime factor in the appraisal, as public inquiries may bring long delays to the projects. To minimise this risk, and gain the acceptability of the people affected by the plants, several policies were suggested by CEGB.

Overall, once the need for a new plant is established, or a requirement from the Government is made, the appraisal has to concentrate on establishing the technology and design, on assessing the whole impact on the environment and meeting all safety and environmental standards, on assessing the social impact and establishing channels of communication with the local inhabitants, and on the setting up of the organisational and managerial needs of the project. The economics of the project has to be established, costs estimated and funding secured, but profitability is not as important for the implementation of a project as it normally is in private companies.

8.6 MINING, PROCESS AND CONSTRUCTION PROJECTS

8.6.1 Introduction

This section is based on the information collected within RTZ and Consolidated Goldfields (mining), Shell (oil and gas), and Bechtel, Foster Wheeler and Humphreys & Glasgow (construction). As the analysis of the Cerro Colorado project will illustrate further the main aspects of appraisal and the risks for projects in these areas, this will be a short section. Although the Cerro Colorado project particularly concerns a mining project, Shell and Consolidated Goldfields have similar approaches and face similar problems in the appraisal (the complexity and size of projects, the political aspects of developments abroad, the great impact of the projects on the environment, and the organisational and managerial demands). Equally, construction companies face the same questions on the appraisal whenever the company is acting not just as contractors for the building but as consultants for the feasibility studies and have to decide on matters such as: best process route, best locations, etc. In these cases, political, environmental and social aspects also have to be considered, along with the financial, technical and organisational needs of the project. Thus these industrial sectors will be considered together as they share the same issues. When the contract is only for construction, the assessment is restricted to financial and commercial aspects, competition, experience of the company in the field and technological capacity, likelihood of the project going ahead and its location. Social and environmental matters are in this case not part of the appraisal as, in principle, they are the owner's responsibility and have been resolved earlier (before the construction begins).

8.6.2 Type of Projects and Key Features of the Business

The separation of these projects from the previous group (energy) derives basically from the fact that these are projects undertaken by private companies. This implies that projects are less dependent on the national political instances and that the perspective of the company is strictly individual, with greater emphasis on the profitability aspects of the projects (rather than having to assess projects in the context of the country's social, political and economic situation). Also, in many cases, the projects in this group are undertaken all over the world. This demands an assessment of the host country in terms of its political and economic situation and an awareness (and knowledge) of the different cultures whenever negotiations take place (for social policies, housing, contracting of workers, etc.).

All other main features are shared with the energy group of projects: i.e.

- long duration;
- complexity (due to size and technology);
- great impact on the environment (social and physical).

8.6.3 Applying the Framework - Key areas and risks

- **Strategic analysis:** This is a determinant factor in undertaking or not, a new project (for example, RTZ' first commitment to the Cerro Colorado was taken mainly because of the company's need for new copper mines).

In Shell, long before a particular project comes to evaluation, the strategy of the company is defined. It is within this strategic analysis that the several options are looked at.

Similar strategic importance was pointed out by Mr Sykes (Consolidated Goldfields) namely, the need of the company to have a clear idea as to the type of risk it wants to take, and the kind of project the company is capable of doing.

- **Technical analysis:** While technological assessment has to play an important rôle in the analysis from the beginning (as these types of projects normally involve high technology being applied to new situations), an important lesson from the Cerro Colorado case was that an overemphasis at the initial stages of the technological studies, without social or political risks being sorted out simultaneously, can be an unnecessary expenditure (social, political and environmental issues have the same power of delaying or stopping the project but cost less in terms of money).

Construction companies, according to Mr Ward (Bechtel), find technical uncertainty to be the main area of failure and the most difficult one to assess. Two other related reasons pointed out in the sector (by Mr Dunlop, Foster Wheeler, and Mr Williams, Humphreys & Glasgow) were the scope of the work not being well defined and changes after the conceptual phase. The guidelines for the assessment are the same as for the previous sectors where technology is uncertain: take time to assess the viability of the project and establish technology; when novelty is involved, do it on a small scale and use prototypes; use experienced and skilled personnel; share the risk, through partnerships or consortiums, if it is too great for the individual company to take. All other guidelines in the framework as to by whom, when and how the assessment should be done, and ways to minimise the risks, are to be considered.

- **Social, political and environmental analysis:** The exploration of oil (on-shore and off-shore), gasfields, mining plants or any other projects involving major construction have an inevitable great impact on the environment: utilisation of land, pollution of air or sea (or both), noise, and likely damage to scenery. Therefore, an environmental and social impact study of the project is an integral part of the appraisal. Because the exploitation of natural resources often takes place in countries where politics are very unstable, changes of régimes occur, and the risk of nationalisation is a real threat, the political risks should not be overlooked. Irrespective of being developed abroad, the large size of these projects also make them dependent upon political bodies (mainly for funding and permission to build, and on several pieces of legislation, on labour, on pollution, on housing, etc.). As discussed earlier, these aspects should be taken into consideration before substantial resources are committed.

Soal, political and environmental problems are recognised to add to an increase in costs, mostly through delays. This opinion was held by all companies: Shell (Mr Galler), RTZ (Mr Lewis), Consolidated Goldfields (Mr Sykes). In their experience, if the project is not welcome and has a bad reputation, the business will suffer. Every year, this seems to become more true, according to Mr Sykes.

Shell's approach to the environmental and social analysis has been illustrated in Chapter 5. The main guidelines for environmental analysis were:

- the use of local knowledge and experience as a vital part of background environmental assessment;
- the use of a positive consultative approach for cooperation and support from a wide range of people;
- the use of alternative contingency plans;
- phasing the project development according to the studies and the analysis of results;
- to establish a managerial position to coordinate the environmental and safety aspects;
- to use the latter aspects (environment and safety) as an input to design.

Concerning the social aspects, Shell's policies were:

- to establish good relations with the government of the host country and local communities;
- to align the company's objectives with the objectives of the country for greater acceptability;
- to staff local companies with local people;

- to support local activities.

Overall, the policy of all the companies interviewed is that unless the project is acceptable to locals, and the political and environmental difficulties can be solved, the project should be rejected.

- **Organisational and managerial aspects:** Given their size and complexity, these projects share the same need for experienced and skilled personnel with all others in the previous groups. When projects are developed abroad (as in several of Shell's, RTZ's and Consolidated Goldfields' projects), partners may be imposed by the foreign governments (so that at least 50% of the project is owned by a national company). These partners may lack the experience and skills needed to develop the project. Therefore, particular attention has to be paid to the sharing of activities. Shell's and RTZ's policy is normally to be the operators to avoid conflicts in the day-to-day running of the project. Shell also tries to second its own staff, in particular for finance and general management positions (which, according to Mr Galler, is not an easy issue to negotiate), and it carries out continuous monitoring and establishes financial guarantees. A typical feature in international projects is that the project organisation is spread through different countries. This might cause difficulties in communications, as it happened in the Cerro Colorado project, and should therefore be avoided as much as possible.

- **Rôle of the non-financial aspects:** It has already been emphasised how important it is that all areas of analysis are taken in parallel from the early days of the project. Decisions should take into account all risks and not just financial or technical ones. This is the practice of all the companies interviewed.

8.6.4 Summary of findings

The features of these types of projects include:

- long duration and large size;
- technical complexity;
- great impact on environment (social and physical);
- political dependence (national and international - when projects are developed abroad).

The major risks occur on the technical feasibility of proposals, on the managerial ability to run the project, on the social acceptability of the project, and on ensuring the political support of the host government. All areas will therefore have to be

considered in the analysis. Initially, the strategic and financial benefits of the project tend to play a determinant rôle in the company's commitment to a project, but all other risks should be considered as well. The analysis should then concentrate on solving all issues with the power of delaying or stopping the project (such as social, political, environmental and legal) before major resources have been committed.

Several ways of dealing with these risks will be examined in the Cerro Colorado project. Some others, coming from the experience of other companies in these sector, were pointed out throughout the framework and summed up in this section. For example:

2. In the strategic analysis:

- projects are firstly looked at in the context of the existing business and how they fit into that;
- it is important to have a clear idea of:
 - the kind of risk the company wants to take;
 - the kind of project the company is capable of doing.

3. In the technical analysis:

- technical uncertainty requires time to establish technology and design before starting implementation;
- changes should be avoided at later stages;
- the scope of the work should be defined early;
- the use of prototypes, the sharing of risks through partnerships, the use of skilled personnel, and the introduction of novelty in small steps are ways of minimising the risks;
- a large amount of resources should not be committed to solve technical difficulties before making sure that social, political and other issues can be solved as well.

4. In the social, political and environmental analysis:

- the nature of these projects (where major construction is involved) leads to a great impact in terms of social and physical environment;
- when projects are developed abroad, the political risks increase, in particular in countries where nationalisation and political instability of régimes are common;
- social, political and environmental risks are recognised by companies to add to delays and to increase the cost of the project;
- if these risks are too high, the project should be rejected;

Several guidelines were suggested for the minimisation of environmental and political risk, and to gain social acceptability.

5. In the organisational and managerial analysis:

- the same demands on high quality of personnel, good communications and flexibility of the organisational structure to meet the needs of the project, which were seen in other groups of projects, apply here;
- when a partnership is imposed by the host country (in international projects), the balance of responsibilities and activities has to be previously defined; work in joint teams as much as possible (Cerro Colorado lesson); have only one company involved in the running of the project;
- when involved in international projects, avoid spreading the organisation through too many locations (this makes communications difficult).

All the above areas, and their risks, should be seen together. They are all important aspects, capable of delaying or stopping the project, and it is therefore the balance of all the risks that it is important to consider.

8.7 OVERALL CONCLUSIONS

The objectives of this chapter were to:

1. examine the relevance, in each group of projects, of all areas of analysis defined in the framework;
2. identify the key issues and risks linked to each specific type of project, and the companies' best practices to minimise those risks.

A summary of the main findings was presented at the end of each group of projects, whilst this section draws those findings together and into some overall conclusions. The framework presented in chapter 7, when applied to a specific type of project, should be modified according to these conclusions.

8.7.1 Conclusions - Relevance of Each Area of Appraisal According to the Type of Project

- **Strategic, Technical, and Organisational and Managerial analysis**
 - The strategic analysis of the project, the technological assessment, and the organisational and managerial needs, are the aspects systematically appraised, whatever the type of project.
- **Strategic analysis**
 - Strategy is defined at the overall level (Board and senior management) and is normally linked with corporate planning (Public Sector, R&D, Aerospace and Defence, Energy, Oil and Gas).
 - In the public sector, individual appraisals assume this analysis (strategic opportunity of the project) has already been carried out. Appraisals look to the compatibility of the project with the other activities in terms of resources and opportunity of skills.
 - The analysis of the effects of the project in terms of overall risk is more pertinent for private businesses. In the public sector and nationalised companies (CEGB, BNF), that analysis is not part of the appraisal process. This is linked to the fact that, in public companies and social programmes, projects are implemented because of society's needs and not because of their profitability (although cost minimisation and best value for money are the guiding principles in all projects).

- In R&D projects, strategic issues are critical due to the high competition in the businesses and the fast pace of research (there is a need to carry out research timed to produce results ready for the appearance of the market; there is a need to be extremely aware of market opportunities and to anticipate competitors; there is a need for an analysis of the holes in the market that may give the company the lead in the area; there is a need for implementing projects to acquire expert background and knowledge, irrespective of their immediate application).
- The strategic analysis of individual projects is carried out in the very early days of the appraisal and plays an important rôle - sometimes overwhelming - in bidding for the project or in taking a commitment (for example, RTZ's commitment to the Cerro Colorado project; SI's policy of allowing a greater payback period, or absorbing part of the R&D costs, for projects that are seen to be desirable for strategic reasons).
- **Technical analysis**
 - This is an integral part of appraisals for all types of project.
 - It is particularly important in projects where novelty is involved or where high and complex technology is a typical feature (Aerospace and Defence, Energy (particularly nuclear), Process, and R&D projects).
 - Technology not established properly at the conceptual and design stages, consequent changes of specifications in the middle of implementation of the project, overoptimism in the assessment, and not making gradual transitions in the use of new technology, are amongst the more common reasons for project overruns and overspending in all sectors (in the public sector, this is true for the MOD, as in Health and Transport projects the designs are relatively standard).
 - Given the above, this is an extremely important area of the feasibility studies and the technical definition should be completed before implementation of the project. Yet heavy spending should be avoided for solving the technical viability of options if other issues that can stop the project, and that in terms of money do not require heavy commitments, have not already been negotiated.

- **Organisational and managerial analysis**
 - This area of analysis is important to all types of projects.
 - All projects should ensure good management and good leadership, skilled and experienced personnel and training when necessary, a good flow of information between teams, motivation of all workers, and a flexible organisational structure to attend to project size, complexity and the different needs throughout the project life.
 - Together with technical aspects, managerial and organisational factors are the most common reasons for the failure of projects. These reasons include: inexperienced management (without experience senior management lacks the ability to identify the risks soon enough), lack of coordination between disciplines, inadequate project structure (not adapted to the project needs in terms of areas to implement, special groups needed and overall structure (matrix versus projectised)), bad communications, and bad industrial relations.
- **Social, environmental and political analysis**
 - Social, political and environmental risks are recognised to add to delays and cost of projects if not taken into account at the appraisal stage.
 - The emphasis that these three areas take in the appraisal varies much more with the type of project than the previous areas of analysis.
- **Social analysis:**
 - Social aspects are not part of individual appraisals for R&D projects. These type of projects seldom have a direct impact on the environment and no particular risks have been experienced by the companies in this area. There is, however, an overall policy of supporting local activities as part of having good acceptability of the company's work.
 - Social aspects are particularly relevant in projects involving major construction or by any other way affecting the normal life of local inhabitants or other people (for example, projects whose installations or access routes go through occupied areas).
 - In the public sector, social views should be taken into account in the appraisal of the different options. Public inquiries often occur and will

delay the project when there is social opposition and when negotiations have not reached any conclusion. Nationalised companies are also subject to public inquiries if opposition exists.

- **Environmental analysis:**
 - Environmental considerations, like social, are important whenever the projects have a great impact in terms of physical environment: air and water pollution, noise, scenic damage, and any damage to the flora and fauna of the region. This covers all sectors, except R&D projects.
 - Rules and regulations on the environment and safety are considered and taken into account by all companies, and they cannot be traded off.
 - Safety is extremely important in nuclear projects and drugs.
- **Political analysis:**
 - Overall political considerations may have to be taken into account whatever the type of project since, given their large size, they might depend on political instances for permissions or funding. However, they are particularly relevant in:
 - social programmes (where there are guidelines and policies based on political views and the last resort for trade-offs are the political instances);
 - projects within nationalised companies (that are dependent on government funding and for the final go-ahead);
 - projects developed abroad or in partnership with foreign companies (risks increase, and major decisions may be dependent on government policies and permissions).

The following tables sum up the above conclusions.

Table 8.1 - Relevance of each area of analysis

RELEVANCE OF EACH AREA OF ANALYSIS	PUBLIC SECTOR	AEROSPACE & DEFENCE	RESEARCH & DEVELOPMENT	ENERGY	PROCESS MINING CONSTRUCTION
STRATEGIC		*			*
Risk	0			0	
Strategy	*			*	
Synergy	*			*	
TECHNICAL	*** (MOD) 0 (others)	***		*** (Nuclear) 0 (others)	*** (Process) 0 (others)
ORGANISATIONAL & MANAGERIAL	*	*	*	*	*
SOCIAL	*** (Roads & Health) 0 (others)	0		*** (a)	*** (a)
POLITICAL	***	0		***	*** (Intern. Proj.)
ENVIRONMENTAL		*			***
Environment	0 (others)		0	*** (b)	(b)
Safety	*** (Roads)		*** (Drugs)	*** (Nuclear)	

- Symbols:
- 0 - Low relevance
 - * - Important
 - *** - Crucial
 - (a) - In projects with direct impact on local inhabitants
 - (b) - In projects with great impact on physical environment

Table 8.2 - Main risks

SECTOR	MAIN RISKS
PUBLIC SECTOR	Linked to the deficiencies in the overall approach and methodology of appraisal and to organisational and managerial aspects.
AEROSPACE AND DEFENCE	Technical (due to the advancement of technology used and the pace of R&D in the field).
RESEARCH AND DEVELOPMENT	Linked to technical and strategic aspects.
ENERGY	Technical factors, and managerial and organisational deficiencies.
PROCESS MINING AND CONSTRUCTION	Related to the technical feasibility of proposals, to the managerial ability to run the project, to the social acceptability of the project and to the political support of the host government.

Table 8.3 - Key issues to be considered

SECTOR	KEY ISSUES
PUBLIC SECTOR	- lack of personal responsibilities - need to appoint project champions - need for incentives, to have better quality management - need for appraisal to be taken more seriously
AEROSPACE AND DEFENCE	- the need for background expertise (applied research) to support the use and assessment of new technologies and in order to compete in the market
RESEARCH AND DEVELOPMENT	- develop technical capability on the research side - awareness of market opportunities - get the timing right
ENERGY	- safety and technology (particularly in nuclear plants) - local issues in siting policy - political interference (projects depend on governmental approval)
PROCESS MINING AND CONSTRUCTION	- all areas are capable of delaying or risking the project, and it is therefore the balance of all the risks that it is important to consider

8.8 THE LITERATURE VERSUS THE FINDINGS OF THIS CHAPTER

As discussed earlier (chapter 2) there has been little work concerning the role and assessment of the non-financial aspects of projects at the appraisal stage. This applies even further to the analysis of those aspects according to types of projects. Nevertheless there are studies, although not concerning the appraisal process in specific, that have examined the main determinants of risk for projects in different sectors. (Morris and Hough [57] is one of the more recent studies, where eight major projects are examined and a review of some of the previous work is provided). A comparison between the findings of these studies and the emphases placed in the appraisal process by the companies interviewed, leads to the following conclusions:

(1) In Aerospace and defence

The principal reasons of overruns, according to the Morris & Hough review, are technical ones: underestimate difficulty and cost, changes, technology advance, technical uncertainty, and poor project definition. Therefore the great emphasis placed by the companies interviewed in this study on the technical assessment seems in line with the literature.

In addition to the technical assessment, it was found in the interviews that strategic reasons, financial aspects and organisational needs were the major areas for appraisal. These later aspects (organizational and managerial) were also found in Morris & Hough' case studies, as leading causes for success and failure.

A recommendation by the authors to "integrate the broader political, community and other such 'systems' factors into the overall project management effort" (page 208) was not noticeably taken into account by the companies' practices.

(2) In Energy projects

Reasons of overruns in the studies reviewed by Morris & Hough were linked with: financial factors (interest charges, inflation); poorly defined contracts; concurrency; and adverse site conditions, manufacturing difficulties, design faults, and labour problems (in CEGB plants). All these aspects were identified by the companies as important aspects considered in their appraisal systems.

Problems of political support, and social acceptability of the plants, were viewed as important in the companies' initial assessments of proposals (cf section 8.5), but were not emphasised by the literature.

(3) In process and construction

In oil plants the principal reasons for overruns, according to the Morris & Hough review, were inappropriate contract policies; late design information and too many

changes; and poor industrial relations management. These were also mentioned by the companies in this study.

Furthermore, social, political and environmental risks are recognised by companies to add to delays and to increase the cost of the project (see section 8.6), and hence were also considered in their appraisal practices. The need to ensure political support, in particular for large civil projects, have also been identified by Morris & Hough [57].

(4) In Social services programmes

Little has been written concerning the analysis of social programmes, such as health, education, transport, etc. In their experience of these programmes worldwide, Baum & Tolbert [8] highlight as necessary changes for a greater efficiency of those programmes better training of personnel and stronger incentives; they also highlight as causes of inefficiency, poor management, inadequate training programmes and in many cases a lack of entrepreneurial spirit and an aversion to competition. These managerial and organisational aspects were also among the strong factors that came out in the analysis of this sector. The lack of ultimate responsibility for decisions which was seen in the analysis was also identified by the authors.

(4) In R&D projects

No specific literature was found concerning the appraisal of non-financial aspects in research projects. The computerization of PAYE (a project studied in [57]) involved the need of new computer technology by ICL, and identified this to be one of the main areas of risk for the project. This was indeed one of the main areas for analysis in the sector, but this research went further in the specific analysis of these projects, and came out with other important elements, namely, time criticality, awareness of market opportunities and need for background research irrespective of immediate development (which required a different criteria for appraisal).

PART IV
CLOSURE

CHAPTER 9

CONCLUSION

9.1 INTRODUCTION

The objective of this chapter is to provide an overview of the work carried out and suggest areas for further research.

9.2 OVERVIEW OF THE WORK AND AREAS FOR FURTHER RESEARCH

The basic purpose of this work was to develop an analytical framework for the appraisal of the non-financial aspects of projects that would (i) identify the main areas of appraisal, (ii) identify the likely risks in each area and the ways to minimise them, and (iii) provide guidelines for the assessment (when to do it, how and by whom) and for the decision-making processes.

A few guidelines concerning (i) and (ii) above were identified in the recent literature, and even fewer relating to point (iii). This thesis adds to the previous work by addressing these gaps, and by analysing the relevance of the different aspects according to the type of project.

The framework was developed in Part II. It incorporates and expands the propositions of the literature collected in Tables 2.1 and 2.2. The relevance of these propositions was highlighted throughout the analysis of the different areas, and the conclusions made at the end (Chapter 7). The framework guidelines were also based on the analysis of several companies' methodology of appraisal (weak and strong points) and are rooted in the rich experience of senior members of those companies. A summary of these guidelines was presented in Chapter 7 (tables 7.1 to 7.9).

Not all areas of the framework apply equally to specific projects. These differences, according to the main types of projects, were pointed out in Chapter 8 (Section 8.7 summarises the likely areas of risks in each type of project and concludes on the relevance of each area of the framework for each type).

The overall conclusions of the research can be summed up in the following points:

- (1) The trend identified in the literature towards the recognition of the importance of including non-financial aspects in the appraisal of projects has been followed by the companies' practices.

The financial return of a project is no longer the only criterion to attend to in the selection of projects. Many companies, especially large ones, are placing

a greater emphasis on non-financial aspects and are including them in their formal appraisal procedures.

- (2) The importance given by companies to the non-financial aspects varies greatly by area of analysis.

Strategic, technical and organisational issues are widely incorporated in the initial appraisal. Social, environmental and political factors are less so, and are normally not subject to a formal analysis (these were also the aspects least covered in the literature). Small companies in particular often engage in social or environmental analysis only to the extent that the company's public image would require it and, in most cases, would ignore it if they could get away with it. This thesis showed, by the analysis of companies' experiences, that all elements should be taken fully and freely into account although the emphasis placed on their analysis may vary with the type of project (see Chapter 8), otherwise short-term gains were likely to be offset by longer-term difficulties.

- (3) The overall conclusion is that all non-financial aspects are as important to the success of the project as the financial ones and should therefore be included in the appraisal procedures, and as early as possible.

This was illustrated by the analysis of several companies' past experience, and the study of the Cerro Colorado project. In particular, the importance of political and social issues (which have been, so far, less researched) and their power to delay (at the minimum) the project was highly evident in the later case.

From the three points above, it seems logical to conclude that the importance of this work is to contribute to a greater awareness of all the likely risks to projects and the ways of assessing those risks at the appraisal stage.

The limitations of the work had already been pointed out, namely, the number of companies and people interviewed, and the time spent on each. The sector analysis would obviously benefit if a greater number of companies per sector had been interviewed and their experiences taken into account. Even for the ones seen, there was a limitation on the time spent for each interview (limited by the availability of the people interviewed) and the information made available.

Therefore, the research looked at the major issues in each area of analysis, but it was not possible to trace the importance of all the issues in terms of their consequences and implications on past projects. (The Cerro Colorado project is the only one studied in detail where these implications are examined.) Given more time, further

work could pursue the investigation of the relevance of the critical issues identified by this research. This could be done by the study of specific projects within each of the sectors analysed which would certainly provide more depth to the conclusions (as done for the mining sector).

A further area of work would be to expand the typology analysed in Chapter 8 to other types of project and not just to the ones considered here. (For example, the transport sector, which was initially planned to be part of the typology, was not included because it was only possible to interview one company in the sector (British Rail) and it was felt that conclusions drawn from that interview could not be generalised with respect to the whole sector.)

APPENDIX A

CASE-STUDY - THE CERRO COLORADO PROJECT

1 INTRODUCTION

- **General**

This appendix concerns the work done within the RTZ Group, on one of the company's copper projects - the Cerro Colorado, in Panama. This was a selective study, according to the objectives of this thesis, and not a study of all the project aspects. The same objectives were also the basis for the emphasis placed on the analysis of the different aspects. Hence, it is possible that major aspects in terms of the project may only be briefly mentioned here, for example, financial and marketing aspects (that in terms of a project are certainly among the major aspects to be considered).

A draft of this chapter was reviewed, before finalisation, by the RTZ people interviewed and minor amendments were introduced according to the review.

- **Objectives and Outline of the study**

The study aims to identify and to analyse, in the light of the framework developed, the approach taken by RTZ in the appraisal of the Cerro Colorado project, concentrating on the organisational, social, environmental, political and managerial aspects, and on the role played by all the elements in the appraisal process.

Section 2 gives the necessary background information to place the project in perspective, in terms of the country and in terms of its past history and scope. Section 3 presents the typical approach used by RTZ in the evaluation of projects and how it was used in the Cerro Colorado case and its development. Section 4 is a detailed analysis on the important aspects as far as this thesis is concerned: managerial and organisation, political aspects, environmental and sociological impact, legal aspects, and major areas of concern. Finally, section 5 discusses the overall conclusions of the study and presents a summary of findings on the different areas of the project examined.

- **Approach**

The approach taken has already been discussed in chapter 3. Briefly, the analysis was carried out through the following methods:

- 1 - Use of RTZ internal and external reports, produced during the two year evaluation period and RTZ internal files on the non-financial aspects.
- 2 - Interviews with some of the people involved in:

- (1) the different areas of analysis of the project (the political and economic assessment, the general preliminary analysis, the legal and environmental aspects and the technical areas in relation to organisational aspects and environmental links).
- (2) the project overall coordination (project directors and project coordinator).

- **Limitations**

The main limitation of this study is the fact that it looked at a project that stopped at a very early stage of its development (after the prefeasibility studies had been completed). This fact makes the assessment of the implications of the different policies taken very difficult, if at all possible. To what extent an area of analysis should have been given more or less emphasis, to what extent the various issues could have been solved within a reasonable time, what would be the precise trade-offs involved in those solutions, are all questions in which uncertainty is present. Because of that, throughout this chapter many issues are treated in terms of what was likely to happen.

Another limitation has to do with the fact of not knowing the Panamanian views on the project, when in fact most of its non-financial aspects had a direct bearing on the country and its population. It is therefore possible for some bias and incompleteness to be present in this study on that account.

Finally, a third element that might have added to some incompleteness of the study is the fact that it was not possible to talk with some key figures (in terms of our purposes) of the project:

- the project manager;
- the RTZ person involved in the social studies (notwithstanding most social work having been done by Codemin, which highlights the importance of the previous limitation).

2 BACKGROUND INFORMATION

2.1 The country¹

- **General**

Panama is a very small Central American country with a population of approximately two million, heavily concentrated in the capital, Panama City. The population is mainly composed of Latinos - the Spanish descendants, with a small percentage of several pre-Colombian groups, among whom the Guaymies - the predominant population in the project area [11].

¹ as at the time of the project.

- **Political situation**

Panama had been ruled by the military since 1968 as a result of a bloodless coup, in which General Torrijos, the charismatic and much respected leader of the country, took a prominent part and ascended into power. According to the RTZ people, he was the ultimate person, and in practical terms the only one with power to make decisions for the country [21, 23, 29].

The Government was composed of members of the Partido Revolucionario Democrático (PRD), a centre-left party which combines marxists, social democrats and some businessmen. The first democratic elections were to have taken place in 1984. The major opposition, composed of rich right-wing land-owners, was located in the Province of Chiriqui where the mine was to be built [11].

Panama had several links with the USA, a major one being the Canal. Treaties had been renegotiated (in 1977) stipulating a gradual transference of the Canal zone to Panama, an old Panamanian expectation, although according to Mr Crowson there still was some opposition and resentment to the way some aspects were negotiated [25].

- **Economy**

Panama's economy is mostly dependent on the services sector (60% of the GDP) with the most important roles played by the Canal, the free-trade zone of Colon (the leading one in Latin America) and the Banking industry (Panama City had developed as a kind of international finance centre, especially since 1970 when several changes in the banking law established very liberal conditions such as no foreign currency controls).

The agriculture sector represents 1/3 of the country's exports, mainly sugar, coffee and bananas. There is a small fishing industry of which shrimp is very important - it accounts for 16% of the total exports, being the third main export commodity. There was no important industrial tradition.

The Cerro Colorado was seen as a way of balancing this great dependency on the services sector, and of diversifying the economy [11].

Some macro-economic indices [11, 30]:

GDP (Gross Domestic Product) - \$3.5 billion

External debt - \$2.5 billion

Debt Service - \$435 million (interest + capital)

Unemployment - high, reaching 30% in particular areas.

Currency - Balboa (official currency but linked to the USA dollar by a standard parity of 1B=\$1. Circulation: coins - dollars+balboas
notes - dollars only.)

2.2 The Project

• General

The Cerro Colorado is a very large copper deposit. It has an estimated inventory of 114 billion tonnes of ore at an average copper grade of 0.78%, based on a cut-off grade of 0.4%. It is located in the Province of Chiriqui, 250 kilometres west of Panama City. The area is mountainous with steep-sided valleys and torrential streams. Rainfall is very high - it has an 8 months rainy season with brief intensive storms (the other 4 months are dry and subject to periods of strong wind gusts). There has been moderate seismic activity in the past [9, 11].

• RTZ Investment

When RTZ became involved in the project (June 1980) several studies on the deposit had already been done [1, 2].

The deposit was discovered during the 30's by the Sinclair Oil Co., and it was subject to preliminary assessments by the geologists of the Panama Canal Co. in the 50's and by the government in the middle 60's. In 1970, the mineral concession was sold to Canadian Javelin Ltd. This was the time when RTZ first looked at the deposit. RTZ did not have any specific interest then, mainly because of Javelin's involvement. Following some disagreements between Panama and Javelin, the Government recovered the concession and in 1975 asked Texasgulf to assess the deposit [2].

Texasgulf and Codemin - the Panamanian Government agency - established a company, EMPRESA DE COBRE CERRO COLORADO (CCSA), owned 20% by Texasgulf and 80% by Codemin, with the purpose of developing a mine. Between July 1976 and March 1978, a detailed feasibility study was undertaken. Following its completion in August 1978, Codemin and Texasgulf agreed that the project should not proceed because of unfavorable economics [2]. A low level of activity continued in 1978 and 1979 including some environmental work.

At the same time, under advice from IMF, Panama decided to reduce its share in the project in order to reduce its financial risk. Texasgulf was not interested in augmenting its share and decided to withdraw. Panama therefore sought a new partner.

RTZ was one of the companies invited to visit the property and examine the feasibility reports with a view to participation. RTZ took an interest in the project, and after a very preliminary assessment, decided to submit a proposal for the acquisition of Texasgulf share in January 1980 [2]. In March 1980, the first agreements with Codemin were signed and in June 1980, RTZ acquired its interests as shareholder and project administrator from Texasgulf. Texasgulf maintained an option on the project for 15% of RTZ's 49% share, to be exercised at the end of the first work programme (about 8 months after). The option was not exercised [2].

Codemin has the option to buy RTZ's equity after a period of 20 years (from the delivery of the Texasgulf feasibility study). The present arrangements gives Codemin 51% interest share and RTZ, 49% [5].

- **Project scope**

The project included the construction and operation of an open-cast mine, a mill and concentrator and all the associated facilities and necessary infrastructures such as road access, water supply, power lines, construction camps, and so on. The construction of a town site for permanent housing would have been a Panamanian affair outside the project scope. It was highly possible that the project would construct and operate its own power scheme. The mine size had not yet been defined - studies were done for different scales of operation (between 8 million and 40 million tonnes of ore a year) but it would be likely to be around 15 to 20 million tonnes. The cost of the mining operations alone was estimated at \$2 billion (January 1981), including interest cost during construction and inflation [10].

3. EVALUATION OF PROJECTS - GENERAL METHODOLOGY

3.1 RTZ Methodology²

Although each major project is unique and may present different aspects for evaluation, there is a general framework for analysis within which main principles and stages can be identified.

- **Principles**

1. Spending in steps

The analysis of a project is done in successive and separate stages, each one containing a particular and increasing level of information. At the end of each stage, a deliberate decision whether to proceed to the next one or not has to be taken. This reduces the risk of people continuing the work for reasons (not always conscious) that have nothing to do with the project viability. In fact, according to Mr Lewis people become less objective, as time and effort goes on, and would be reluctant to see their work canceled. There is a sense of commitment to the project already. There is also a sense of failure if the project stops. The main benefit of this policy of spending in steps, however, is that it avoids unnecessary costs. For example, no money would be spent on assessing the environmental impact of a project until its economic feasibility has been established in the first place.

² section based on interviews with Mr Lewis and Mr Presgrave.

2. Flexibility

Although evaluation stages can be identified as being fairly standard procedures (areas to be covered, checklists for the collection of new data, etc.), this does not simply mean a strict list of things to go through. The need for flexibility in order to adapt to changes and particular situations, and the importance of the human element in all of this must be emphasised. The people involved, according to Mr Presgrave, are the ones who decide when and what emphasis to place in each one of the factors.

- **Evaluation stages**

Given the policy of spending in steps, the evaluation process follows a sequence of stages throughout which there is an increase in the accuracy of estimates, the amount of information collected and the money spent. The main stages are the following:

1. Preliminary analysis

A very preliminary analysis to assess the technical and economic viability of the project and its general desirability. This stage gives priority attention to the technical and financial side of the project; it is the classical type of project evaluation (geology, mining costs, prices, view for improvements, etc.). The first question to be answered is whether it is possible to mine and to extract and whether this is worthwhile (in terms of the quantity and the quality of the ore). Subsequently, given the resources are worthwhile and there are ways to extract the mineral, the economic and financial prospects of the project are examined. This point, the economic and financial potential, may be seen as the most important aspect of the project. According to Mr Presgrave, all technical problems, by and large, can be solved as long as the economics of the project allows more money to be put into them; the same would be true for practically any other aspect. But if the economics themselves are bad, there is nothing that can be done. This assessment is based on rough estimates. There would be a general look on all the other dimensions of the project, in particular the political stability and situation of the host country. But on the whole, unless there is a particularly grave and self-evident condition, they would be assumed normal (i.e. presenting the average problems of any other project). Naturally, an issue first thought of as inoffensive may become a major problem later on, and would eventually cause the project to stop if not solved. But this does not justify spending money in the first stage to survey all areas in the search for possible problems [19].

2. Prefeasibility stage

This stage corresponds to a medium detailed study, in which the estimates would possess an approximate 20% accuracy, and the range of the areas covered would be greater. The emphasis is still on the technical and the economic side but all other aspects may now start to be analysed in greater detail (environmental impacts, political aspects, social problems, infrastructures and all necessary inputs - labour, power, materials, etc.). The extent of the analyses would be in accordance with their importance. The ability to judge this importance and to balance the right amount of work to be done in each dimension relies on the human element and is a key factor. At the end of these studies a decision of proceeding or not to the full feasibility stage would be taken. This is an important step as the full feasibility studies involve a great sum of money and, according to Mr Presgrave, it is not usual to start them unless there is a fairly great degree of certainty that the project will go ahead. This stage can take up to one year.

3. Feasibility stage

It consists of the final set of studies on the project before construction starts. It deepens the analysis in all areas, it increases accuracy, it solves all the major issues that have been identified. It can take up to two years to complete and in general it includes the construction of a pilot plant. At the end of these studies a "bankable" document is produced covering all aspects of the project. This document would be used to raise finance. During this stage a large number of talks with possible financiers and customers will take place. At the end, contracts are to be signed and the final decision to be made (in principle, a "yes" decision, otherwise the project would have probably stopped earlier [20]).

Given the flexibility principle there are no structures to follow. These stages might be more or less detailed and prolonged according to the particular conditions and constraints at the time of the project (for example, the need to get into a market in time may rush any of them). The areas covered in each one very much depend on the personalities involved in the evaluation and their capacity to foresee the problems before they happen - so that they can be brought in earlier into the analysis and be dealt with. The final decision also depends to a great extent on the people involved. In the limit, according to Mr Presgrave, irrespective of much detailed work, "a project will go if a person wants it" (naturally this person has to be someone with experience, reputation and in the position to implement the decision).

3.2 The Cerro Colorado case

The analysis of the Cerro Colorado followed the same sort of principles and stages mentioned above. There was a first preliminary analysis to decide on the spending of RTZ to buy Texasgulf's share; a prefeasibility stage that had cost around \$25 million to work on technical improvements, economic assessment and on the solutions of some of the existing problems; and a planned full feasibility stage that would have cost another \$75 million to detail the studies in all areas, and solve or minimise all remaining relevant problems. In this case the project stopped at the end of the prefeasibility study.

• Preliminary analysis

The work on the Cerro Colorado commenced in late 1979. The first decision to be made was whether RTZ would submit a proposal to buy Texasgulf's share. During November and December 1979, background information on Panama and on the Cerro Colorado started to be collected and analysed.

The work included [33]:

- review of all available information in Toronto (mainly Texasgulf's 24 volume feasibility study);
- review of all known legal and contractual arrangements;
- review of the feasibility studies with the firm responsible for it (Brown & Root): a 2/3 day description of the project, strong and weak points, etc. as a quick means of assessment of the project and its problems;
- discussions with Texasgulf to see why they dropped the project and their assessment of the Brown & Root feasibility study;
- visit to Panama for talks with the Government and to the site.

The work was planned to be taken in steps. After any one of them, it could have been decided that RTZ had no interest in participating in the project. If however, the feeling was that it was worth proceeding there would follow in the first weeks of January a deeper technical and financial review and the preparation of the proposal for submission to the Panamanian Government. The impressions from this first work were positive. It was thought that there was enough room for technical improvements to make the project more profitable [3]. Visits by the technical and commercial experts were also favourable. At the same time a comparative analysis of the Cerro Colorado potential competitors was being done: analysis of ore bodies, infrastructures available, and political stability of the host countries (discussions with the Foreign and Commercial offices of Zaire, Panama, Argentina, Papua New Guinea, etc, where the alternatives were located, took place). In terms of the alternatives available, Panama

looked the most attractive with a large revenue, a reasonable grade ore body, reasonable economic prospects and a fairly stable country.

Other elements were a source of concern though [22]:

- Panama's location in Latin America where all its neighbours were having political problems (fear the same in Panama).
- Panama's previous experience with the USA (suspicious of foreigners).
- Panama's dependency on the project (it makes the project less attractive as it can easily be a target for political instability; it would also put a lot of pressure on Panama's economy. This was not new for RTZ though; it was the same in Bougainville).
- Panama's inexperience in large industry, and in mining in particular.
- RTZ inexperience in Latin America (this was a new territory, RTZ had experience of handling people elsewhere).

The balance of opinion, according to Mr Adams (RTZ director involved in the preliminary analysis), was that although the above aspects were negative to the project, they were not so terrible that it could not be handled, and given the relative optimum on the economic side, and the underlying sense of urgency in finding new mines (the old ones would be expired by the end of the century), it would be worthwhile to take an option on the project. Therefore, in January 1980 RTZ submitted its proposal to the Panamanian Government and in March RTZ and Codemin agreed on Principles and Memorandum of Special Agreements, Option Agreement and amended Articles of Incorporation (all drafts). A letter was signed in which RTZ proposed to undertake a Work Programme of 6 to 8 months costing \$6-7.5 million, to be started in June 1980. A preliminary evaluation commenced in Toronto with the assistance from Bechtel Engineering Group in order to assess the desirability of commencing the 8 month programme. This evaluation covered the technical aspects, infrastructure, manning, commercial and financial, costs and some related environmental aspects [2]. Major changes in relation to the previous Texasgulf approach were introduced in the technical side in order to get better economic results. Even so, the economics of the project were not that favourable. The base case, with a copper price of \$1.10 per pound presented a negative NPV. Only for a price of 1.26 (an optimistic view) was the NPV greater than zero. But it was felt, according to the report done [2], that there was a good probability of improving the economic returns based on further technical improvements and reduction of costs (freight, power, etc.) during the 8 month period of work. However, there was also a fear of increasing costs due to (currently unspecified) changes in Panama environmental laws, and to failure in achieving the assumed labour productivity because of pressures from the workforce to increase salaries once the mining started. On a meeting held towards the end of this

phase to review the Cerro Colorado, it was the RTZ chief executive opinion that the most difficult issues were the local ones (townsite, environment, salaries, etc.) [16-A]. The decision was to finalise the proposed option agreements and proceed with the agreed programme of work.

• **Prefeasibility stage**

In June 1980, RTZ acquired its interest as shareholders and the programme of work commenced.

The purposes of the programme were [3]:

- to give RTZ more information with which to decide on exercising the proposed option and spend a further 2 years and \$75 million on a full-feasibility study;
- to augment its knowledge of Cerro Colorado;
- to attempt to solve some selected technical and non-technical aspects.

Its major emphasis were:

- technical aspects;
- assessment of market and financial potential;
- economic analysis.

Other areas included were:

- training (development of programmes);
- environment (baseline data collection, establishment of criteria);
- operational visits to other mines to collect data on labour productivity, housing standards, etc.

This work, fully reported in January 1981 [5], indicates a marginally viable project with some technical, commercial and financial risks that would need to be examined before commencing the next stage. The report focussed on the technical side (volume I and II) and the financial, commercial and economic analysis of the project (volume III and IV). On the environmental side, the deposit of solid waste was identified as the major issue and some baseline studies were completed. The study was based on a likely scale of 120,000 MTPD (smaller sizes were also analysed but the returns were below 10%).

After January 1981, Codemin and RTZ agreed on a period of 6 months to undertake some more detailed studies in order to minimize the risks identified and take decisions on several impending matters (power, townsite, labour code, environmental laws, social aspects, etc.). The plans for the pilot plant and feasibility stage were initiated. As time progressed, due to the successive decreases in the copper price, the project started to show very little chance of reaching economic viability, and

consequently all problematic areas were looking gloomier and becoming a lot more difficult to solve [29].

During this period some other reports on the project development were produced [6, 7, 8]. The areas covered included:

- technical aspects;
- housing and power schemes;
- marketing, financial and economic analysis;
- risk and potential analysis / analysis of alternatives;
- environmental and social studies;
- legal issues;
- labour, training.

A detailed analysis of some of these reports is done in the next sections.

Meanwhile, some changes had taken place since the January report. Among them [7]:

- the smelting facilities were not to be included in the project;
- the scale of the operation would be reduced. A 50,000 MTPD study was to be started in the early summer of 1981.

The economies of scale in the larger mine concept were not very substantial relative to the much greater risks involved. It would also be easier to sell, it would require less capital cost (therefore being easier to finance) and could be expanded later if necessary. This was a change in philosophy from "the bigger the better" approach of 1980 [16-B]. Despite attempts to optimise the project economics, falling copper prices were making it increasingly unlikely that the feasibility study would be started [19].

In December 1981, the Board of Directors and shareholders of CCSA approved a cost reduction programme to place the project on care and maintenance status by mid 1982. Meanwhile, and for future fast release of the project, it was agreed that the following would be completed:

- 1 - the 50,000 MTPD study and its possible expansion;
- 2 - all the documents and the Pilot Plant Overall Work Programme necessary for the future next stage;
- 3 - if possible, a solution to the major outstanding matters should be found (in the end, when the project stopped no visible agreements had been reached yet).

In June 1982, the 50,000 MTPD study was completed and reported. This report, including all major areas of analysis, indicated a deterioration of the overall project economics making it unattractive for further investment [10].

4. THE CERRO COLORADO - DETAILED ANALYSIS

4.1 Organisational and Managerial aspects

4.1.1 CCSA Organisation

The CCSA company has ownership of the deposit. The shareholders are: Codemin (51%) and RTZ (49%). CCSA is controlled by a Board of Directors (from Codemin and RTZ) that makes the decisions on all the major aspects of the project. It appointed RTZ-DE (a wholly subsidiary of RTZ) as project administrators. RTZ-DE reports to the owners through the CCSA executive committee (see Fig Ap.1). In principle, when the project reached the construction and operation phases, CCSA would have had a more complex organisation (having its own employees, etc.). The interconnection between the different levels is high. People belonged to more than one level at the same time. For example, RTZ chief executive and RTZ project director belonged to RTZ Board, CCSA Board, Executive Committee and RTZ-DE Board and the project manager was on CCSA Board, Executive Committee and RTZ-DE Board. The same would happen on the Panamanian side.

The function of RTZ-DE as Administrators was to manage, to supervise and to direct, all the activities and businesses connected with the exploration, evaluation, design, construction and operation of the project. They ran the project on a day-to-day basis but needed the Board's permission to [31]:

- select general contractors for design, engineering and cost;
- select suppliers of material and equipment greater than a certain limit;
- personnel and remuneration policy;
- suspend, interrupt or diminish the operations of the project.

They would also submit recommendations to the Board of CCSA on issues such as [31]:

- budgets, annual capital and operating expenditures;
- sales policies;
- annual mining programme.

These interaction would be through the Executive Committee of CCSA and through the managing directors. The Executive Committee would meet at least once a month and would approve the monthly economic and financial report, and the monthly

metallurgical programme based on the annual one approved by the Board of Directors [31].

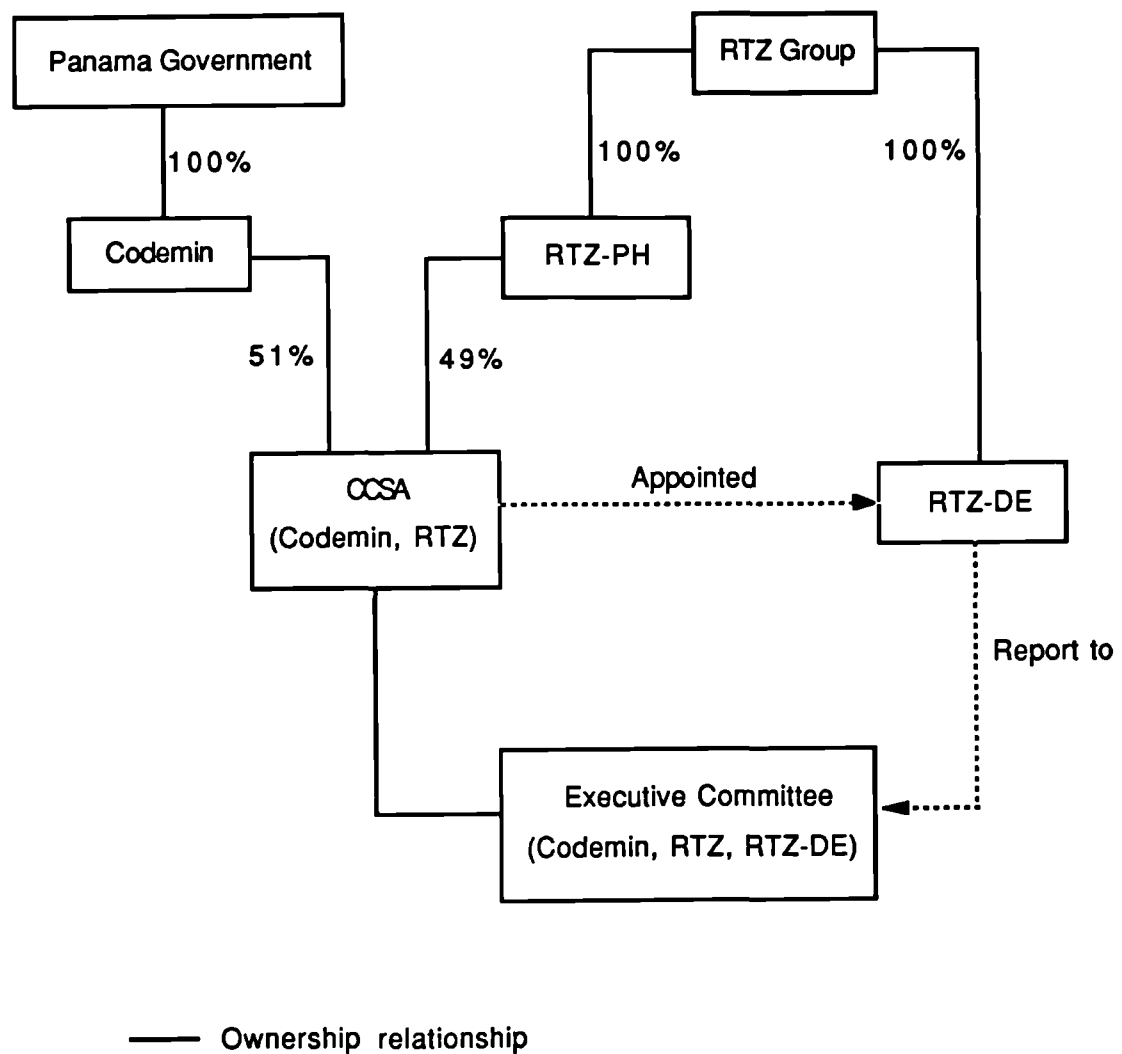


Fig. Ap.1 - Structure of Shareholdings.

4.1.2 RTZ-DE

4.1.2.1 General principles

- **(1) Project organisational structure**

According to Mr Lewis, a project organisational structure (for RTZ projects), will move and change according to its development. Initially, the structure would be a very flat type of organisation coordinated by a small group of people without rigid lines of command or report. In RTZ' s experience, this allows greater initiative and cooperation and better communication between the people involved. At this early stage, when the work to be done is not strictly defined but under study, this freedom is of great importance. In time the structure will move to a more rigid organisation - in principle, after construction began when the work is more defined, and the number of people involved is greater, needing a lot more control [19].

- **(2) People involved**

Initially a project would not directly employ many people. On one hand it is not necessary (these are preliminary studies), on the other hand, Mr Lewis referred, people would not want to be employed without knowing if there is a future (it is not yet known if the project will go ahead or not - "in-house" people will be brought in at these stages). A lot of work will be done through outside consultants and contractors; these also provide necessary expertise and/or independence of work in some areas.

The level of participation will also vary according to the development of the project. Initially many people would be working on a part-time basis, later moving to a full-time job (in particular, at high levels). It is not uncommon, Mr Lewis said, to see that at critical stages (when the major decisions are to be done, or when there is a sensitive project to implement), the higher levels of management would be involved (even only on a small percentage of their time). When the project starts to run more smoothly they would give way to middle or lower level management (it is better to have the right senior people in part-time than a lower level managing ones full-time).

It is Mr Lewis experience that one of the most decisive factors for the success of the project is the quality of people involved [20]. Ultimately, he said, all structures can only work if in accordance with the people, for example, the same scheme may be good for one project manager and bad for another. Some people in particular (senior management) have a great responsibility for the success of the project. In the end, said Mr Presgrave, it is up to them to manage the work in such a way that all areas will run within the appropriate timetable without causing unnecessary delays (costing money and time). These people should have the capacity to foresee the likely problems before they happen. A great part of their success lies, in his opinion, on this "ability".

When selecting the teams, two main factors should be taken into account [20]:

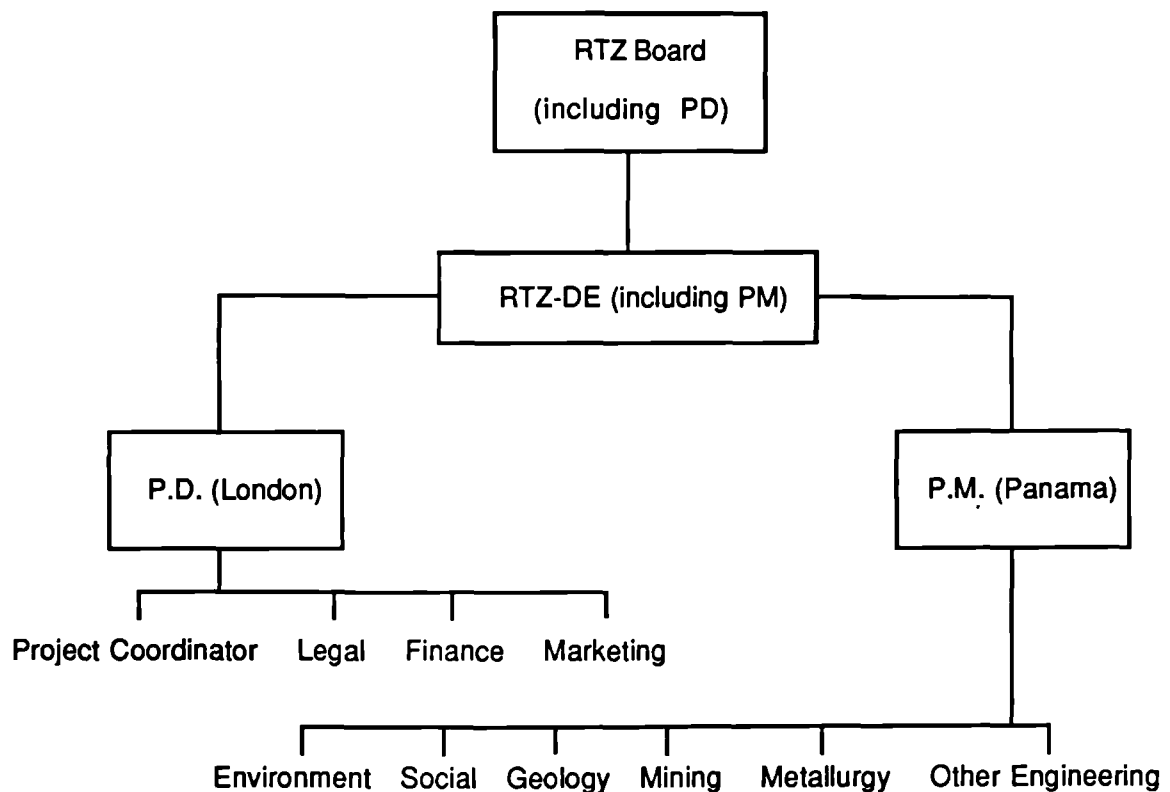
1. How well they will perform the job - should be people with knowledge, experience and initiative/creativity.
2. How well they will get on together - so that communications will flow easily.

4.1.2.2 The Cerro Colorado Structure

• General

All the studies progressed under the type of flat organisation described earlier. Initially, during the pre-option period, a very small number of people was involved (principally from the Technical Services Group, the Financial and Legal areas, and the Business Evaluation Group). They were all based in London (with some work reviewed in Toronto). Afterwards and still during the pre-option period, a small team (including the project manager) moved into Toronto for the preliminary analysis.

During the prefeasibility stage the project was under the following structure [19]:



P.D. - Project Director

P.M. - Project Manager

Fig. Ap.2 - Project organisational structure (at the prefeasibility stage)

- **Start of Activities and Location**

Activities were spread through three different places :

- London
- Panama (site and Panama City)
- North America (Toronto/S.Francisco)

The London office mainly handled the legal, financial and marketing areas, Panama mainly the activities at site and North America the technical services. The legal, the financial and the technical areas were the first ones to start. The legal team was first based in London, moving to Panama in January 1981 when the bulk of the discussions started. The financial and marketing areas were always based in London. These are Head Offices' functions during the whole feasibility period until necessary finance is agreed and contracts signed. Only later on, during the construction and operation activities, would they be Project and Operational functions moving to Panama [20].

The technical groups were spread through three different locations:

- a group in Toronto (technical services and engineering group), working with Bechtel;
- a group at Panama City (the project manager and the administrative staff);
- a group at the mine site (mining engineering, drilling team, geology, etc. and all people data gathering on the infrastructure work).

In early 1981, because a different contractor was involved, Fluor, a team moved to San Francisco to work with them. The social team, a Codemin department, was located in Panama (an RTZ person became involved towards the end of 1980). The environmental team was also located in Panama (mainly an environmental officer from Texasgulf, plus outside consultants and Panamanian contractors). (An RTZ expert became involved by the end of 1980 and was based in London). The project coordinator became involved also at the end of 1980 and was based in Toronto. The project director was based in London throughout the whole period.

According to Mr Presgrave, there were economic and efficiency reasons behind the spread over several locations. People would have to be located where the expertise was (case of technical teams in Toronto or S. Francisco), or where the money was (Marketing, Finance) or where the work was (for the Panamanian issues and the site work) [20].

- **Participation levels / Number of people involved**

At the project stage there was not a full-time involvement of all people concerned. The people based in London were mostly in part-time work, those based in Toronto and Panama were mostly full-time people. According to the programme of work estimates, there would be a total of 27 RTZ people from which 19 are on a full-time basis. The total manpower would be 117 (78 full-time and 39 part-time) including the contractors group, Codemin and several others.

Once the full-feasibility stage started, said the project coordinator, all this would have changed. More people would be in Panama (at the pre-feasibility there would be about one fourth of the total; this would increase to about a third during the feasibility studies and to nearly 100% for the construction and operation phase). The time of their involvement would increase as well - for example, the project director in this case would probably be a full-time director (at that moment it would be about 20-30% of his time).

- **Communications & Report System**

Communications and reporting followed very informalised systems, as described below (based on interviews with Mr Lewis [19], and Mr Presgrave [20]).

All Panamanian issues and technical aspects were reporting regularly to the project manager in Panama informally. Formal monthly reports were being issued during the programme of work on the major aspects. These were reports going to the CCSA Board and to London (project director). The social and environmental areas, although Panamanian issues, reported both to project manager and project director (some outside consultants reported directly to project director, people in Panama reported to project manager). On a regular basis (weekly or according to the issues), the project manager would report back to the project director in London (mainly through phone calls, etc.). The project director had also reporting to him the project coordinator, the legal team and the financial and marketing areas. Only the latter two submitted formal monthly reports. The others were reported on an informal basis (memos, letters, phone calls,...) according to their development.

This informalised system is a key element for the good management of a project as it brings the issues immediately to the knowledge of project manager/project director, i.e. not having to wait for written reports which are always out of dates. People within each team had a direct access to anyone in another area - if a problem arose and needed to be solved quickly, they did not have to go up and down a chain [19].

The main problems, according to Mr Presgrave, were related to the great dispersion of places. In itself, he referred, distance is not a problem (it can be overcome by frequent travel, adequate phone systems, etc.) but in this particular case the telephone links, especially the ones between Panama City and the site, were very

bad. Added to this there were very short periods for communicating (only 5 hours between Panama or New York and London).

- **Assessment**

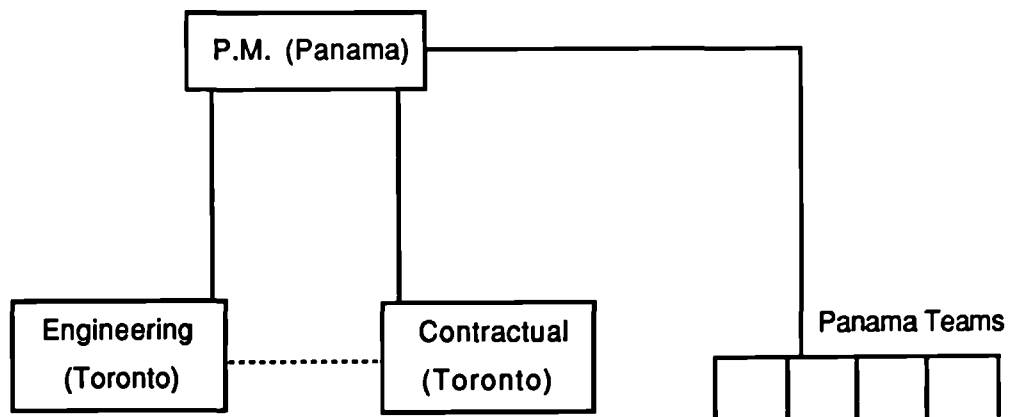
On the whole this was felt as an adequate system to work in, by both Mr Presgrave and Mr Lewis. At this stage of the project, it benefits from all the advantages of a flat structure. People had been carefully selected (with great expertise) and they worked well together.

Still, in Mr Presgrave's opinion, there was room for improvements in some aspects. His suggestions were that:

(1.) On the Organisational Side

Given the three different locations in which the various teams were operating, there was a need for the project manager having in each centre a unique person whom he trusted to control the work and report back to him.

By this time there were two groups in Toronto, one person leading the engineering side and the other the contractual side, both reporting independently to the project manager (Fig. below).



..... No communication

P.M. - Project Manager

Fig. Ap.3 -A - Project organisational structure (the engineering area).

Mr Presgrave feel that the work would have benefited if there had been a person in the overall coordination in Toronto, below the project manager and reporting back to him (Fig. Ap.3-B).

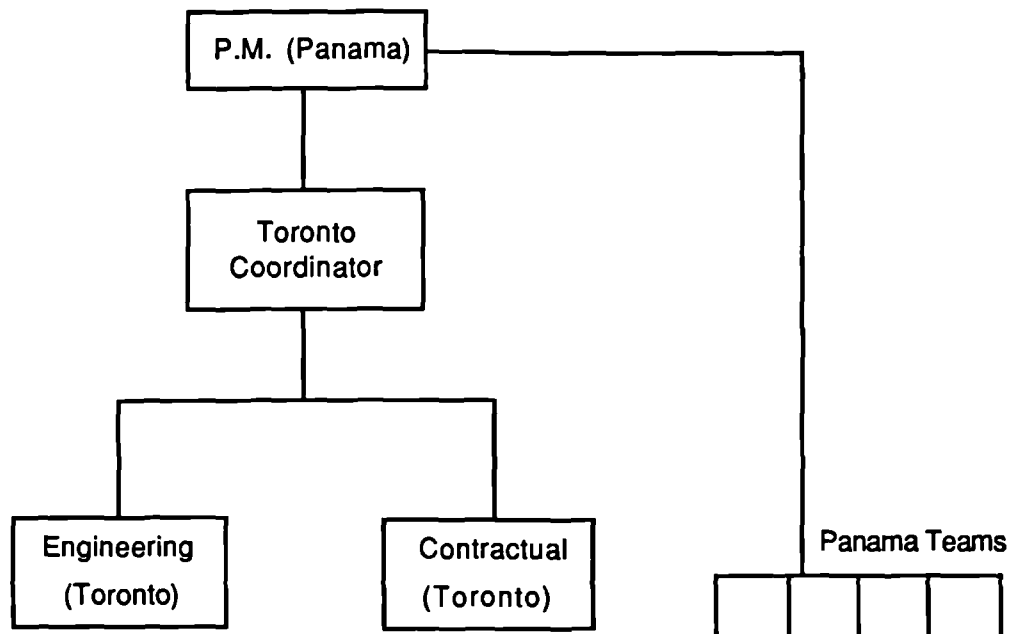
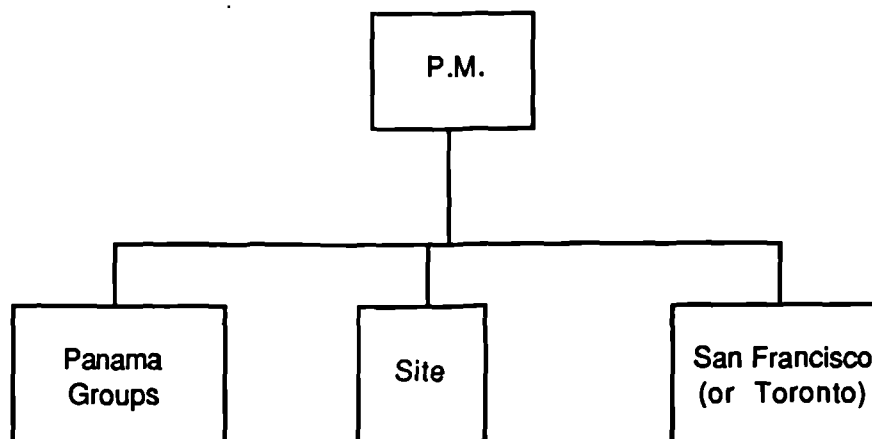
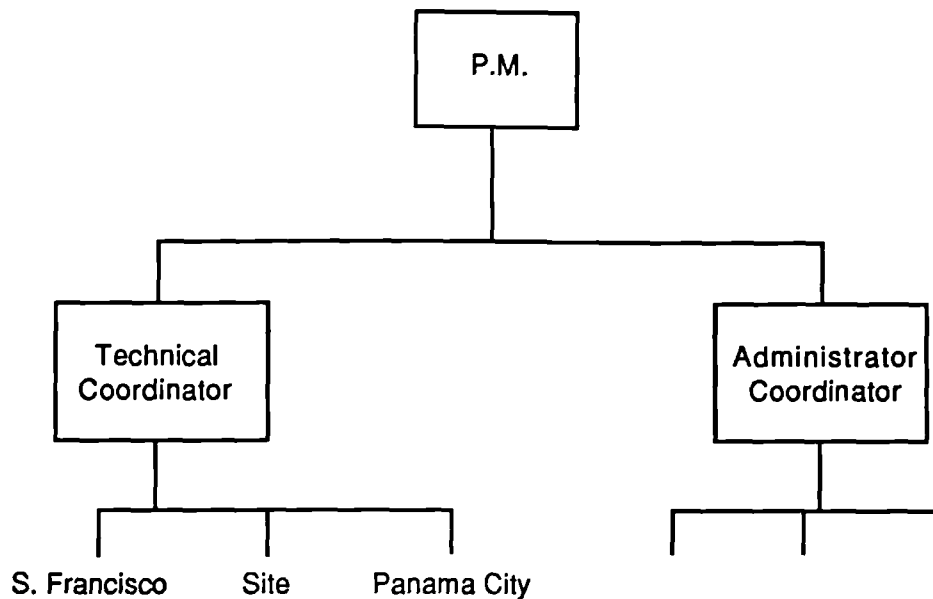


Fig. Ap.3-B - Project organisational structure - proposal (engineering side).

At the same time there should be a separate coordinator for all technical aspects on the engineering side, irrespective of their location, that would know about and coordinate all the work. Similarly there should be another overall coordinator for the administrative side. They would then separately report back to the project manager. Namely, at this stage the structure was:



and Mr Presgrave's suggestion was to move to:



(2.) On the Managerial Side

Mr Presgrave referred that although the project director was responsible for the overall technical side there was a feeling among the technical people that he was interfering in a too detailed way (not on the organisational side of the work, but on matters like design, location, alterations for technical reasons, etc.). This was also referred by Mr Lawton [23]. In a way this belonged to the particular personality involved - according to some of the interviewees [19, 23] someone very creative, very impulsive, with plenty of unique and brilliant ideas but also poor at delegation.

Also according to Mr Presgrave, the work during the 8 months programme was rushed to a deadline. It would have been better, in his opinion, to have detailed some of the aspects further irrespective of the time. If done, this would have followed a suggestion from an earlier meeting when the RTZ chief executive proposed that the Work Programme should be defined by Work completion rather than just by time [16-A].

• RTZ/Codemin

A sound relationship with the partner, was referred by Mr Adams (actual Cerro Colorado project director), as a key factor for success. In the present case, Codemin, the partner, had the advantage of being extremely committed to the project which provide an incentive to find solutions if problems arise. But there were a few aspects that had to be very carefully managed.

- (1.) According to Mr Adams, there was almost always a suspicious feeling from Codemin that RTZ was trying to withhold information from them [29]. This feeling was reinforced because of Codemin's unfamiliarity with the mining aspects and their past history with the USA (fears of another Canal problem).
- (2.) There were different perspectives of the project and the way the work should run.

Panama (Codemin) was very committed to the project, as it was the only one for them and had a great importance to the country. According to Mr Lawton, they saw RTZ's pessimist views of the economic estimates, in comparison with their own, as RTZ wanting to extract more out of them. For RTZ this was one project amongst a number and which, like any other, would need to be profitable in the first place.

RTZ was careful to be trusted by Codemin. This was RTZ's first experience in Latin American countries.

Codemin and RTZ also had a different perspective about the scope of their respective work. Codemin thought at first that RTZ would only run the technical matters. All Panamanian issues (Guaymi, environment, housing, etc.) were to be their own problem. In general, this was in fact the case but RTZ wanted to agree on the basic decisions. Roughly the level of participation of each one in the different areas was [19]:

	RTZ (%)	Codemin (%)
Technical	95	5
Environmental	70	30
Social	20	80
Marketing & Finance	70	30
Legal	60	40
Tax	70	30
Townsite: Start	10	90
End	60	40

There were some issues like the townsite, said Mr Lewis, in principle a Panamanian affair, that "had changed hands" when problems were getting worst, and RTZ felt they needed to control them.

(3.) Communications were at times extremely difficult [23].

Codemin people were said to be difficult to reach although having offices in the same building ("they were always talking to themselves or to the Government" [23]). According to Mr Lawton decisions were very difficult to get made at meetings. There was not a clear hierarchical structure among the Panamanians and officials would change frequently. The only person with decisional authority was the General (not an easy person to be reached). Codemin on its part, said Mr Adams [22] was facing a dilemma; on the one hand they wanted to become a mining company and act like one, with its own objectives, etc. and on the other hand being a Government agency they were defending the policies of the Panamanian Government. There also appeared to be a lack of communication between Codemin and some of the ministries involved, Mr Lawton added (this is confirmed in [15-B]). All the above aspects were improving with time.

4.2 Political Aspects

4.2.1 General

This is an extremely difficult area. Almost any issue (labour, environment, social aspects, etc.) had a political dimension. This section will just describe the way in which the political assessment of the country as a whole was done. This description is mainly based on the interview held with Mr Crowson, who was RTZ political expert for the project.

Day to day decisions that involved political dimensions are not referred to here. This does not mean that there was not always a political awareness of situations, which will be pointed out in the report where relevant.

4.2.2 Development

The formal work in which an RTZ expert in this field was involved started in late 1980 and went on during early 1981. Previously there had been a very crude analysis of these aspects at the end of 1979, on which to base the initial commitment.

The project was located in a world region of general political concern but at that time it was considered that the strategic importance of finding a new mine to replace the old ones would bear a high degree of risk. For this reason, said Mr Crowson, the decision to take an option on the project came before a careful economic and political analysis, even knowing from the start that there was a fair amount of instability and risk involved. In any event, he added, the initial analysis did not look bad enough to prevent taking up the option on the project without a more thorough study. The World Bank reports on the country had given a favourable impression; the dictatorship

seemed more or less firm; canal treaties were settled; several USA links existed; there was no foreign exchange risk; Panama had a strong commitment to the project, etc. These were all factors that contributed to that view. The involvement of international institutions on the financial side and the participation of the Government also acted as safeguards against political instability and possible total or partial nationalisation or other pressures. On the other hand it was known that many other motives had a negative influence: the great size of the project; Panama's inexperience in industry and in mining; lack of diversification of economy; great external debt; nationalist feelings against other "canals"; etc.

Later in 1981 a deeper analysis was carried out. The economic structure of the country was studied with greater accuracy, the political problems examined more closely - visits and talks to the local people, tours around the country - local companies were contacted (and foreign ones to know their problems, if any, of operating in Panama), etc. From these studies formally reported to RTZ Directors, the same overall conclusion was reached. Although with potential for some problems (the ones mentioned), they were all seen as manageable. To reinforce this feeling there was the strong commitment of the General to the project (and most senior management in Codemin were the General's friends), and its importance to Panama.

It could always be argued to what extent some of the problems were fully appreciated. Question marks according to Mr Crowson, were being raised in relation to any aspect. For example:

1. Size

- project would be very visible, highly exposed in case of instability,
- could raise similar emotions as the Canal (although in this case it was also a domestic project),
- domestic influence on economy (it would impose a tremendous strain in terms of labour supplies, import procedures, debt, etc. Would Panama cope?).

2. "Panamanian factor"

- methods of making day-to-day decisions (would they be quick enough?).

3. Panamanian's far too great expectations on the project

- the economic benefits for Panama were not linear: profits uncertain, debts, etc. and Panama had some recent contested megaprojects (building of an outstanding airport, expansion of sugar market that became a redundant failure).

All these, among others, could cause, in Mr Crowson's opinion, future problems but at the time it was felt that so long as the economics of the project were good, the problems would be solved.

Still according to Mr Crowson, a more detailed analysis should have been made earlier, before the decision to take an option on the project. In general, it is at this early stage that on political grounds the project could be stopped. Therefore the assessment should be made then. But in practice, he also said, this is idealistic. There are other people in the business and a judgement has to be made quickly. The risks taken are the cost of that judgement.

4.3 Environmental Aspects

4.3.1 Organisational and development of work

The first formal and systematic environmental studies dated from 1976 under the direction of the Colorado School of Mines and Research Institute (CMRI) [15-C].

The work, commissioned by CCSA at the time of Texasgulf involvement, led to the production of a reconnaissance report, pointing out the major environmentally sensitive aspects of the project and giving a description of the Cerro Colorado environment [13-A]. After that work and in order to keep spending to a minimum, it was decided that no further environmental work would be done, at least until knowing if the project was to go ahead. However, in 1979, when it became evident that the World Bank - the possible Panamanian financiers - were concerned about the environmental impact of the project, the CSMRI was authorized to proceed with further studies. An environmental officer was appointed to the project (Mr Barbour), and new programmes started, covering the collection of background data on meteorology, oceanography, marine biology and S. Felix river, and some analytical laboratory work. Most of this work was produced throughout 1980 and 1981.

When RTZ became involved its work programme envisaged the continuation of the CSMRI studies, scheduled to be completed by October 1980 [3].

The environmental plan covered [3] :

- (1). Minimum of one year's baseline data to generate information on air quality, water quality, hydrology, aquatic ecology, wild life, vegetation, and archeology. This would cover the areas most likely to be affected by the project and about which there was some concern (Lower S. Felix, Gulf of Chiriqui, Escopeta and its environments).

- (2). Establishment of environmental design criteria. (There were no legal requirements in Panama to have a complete environmental impact statement before project initiation. However, RTZ early on intended to make a clear statement on the environmental effects as a record of their position, and to prepare a 5 year environmental programme to the Government and other interested parties defining the safeguards and attitudes to be adopted [2, 16-A]. Some general criteria were defined but a lot more would have to be established.)
- (3). Environmental inputs to be provided for consideration in tailings disposal site selection.

(1) above included experimental work such as vegetation trials on the proposed tailings disposal site, and tailings characterisation.

The aim of the work, was to obtain a reliable basis to assess the real effects of the mine over the environment and decide if they could be acceptable, once minimised, to allow the proceeding of the project [3]. Equally, it intended to identify the main points of sensitivity which might required special attention in future exploration within the concession area [13-B].

The Texasgulf environmental officer continued his work within CCSA and Panamanian sub-contractors and international consultants were engaged in parts of the programme [15-C]. Towards the end of the initial programme of work, RTZ's own environmental expert was called for a review of the studies and the assessment and suggestions on the major issues [24]. He was also engaged in the preparation of a draft environmental code.

After the end of the programme of work, some environmental baseline data collection continued and emphasis was given to the analysis of possible solutions for the major problematic areas, and to the preparation of the environmental criteria. A lot more work on these areas needed to be done.

The full feasibility studies stage would have included a detailed environmental programme on [6]:

- collection of baseline data on current conditions in the affected areas.
- experimental studies
- establishment of standards for:
 - environmental control
 - construction control
 - industrial hygiene
 - gaseous and dust emissions to atmosphere
 - aqueous effluents, noise levels, etc.

- assessment of project impact
- monitoring and management of the above activities.

The goals of this programme were [13-D]:

- (1) - to produce a report analysing the project's likely environmental effects which would be included among the project's "bankable documents".
- (2) - to provide information to project manager so that environmental considerations could be included in the decision-making process.
- (3) - to produce baseline data for standard comparison during the project operations.
- (4) - to design an environmental management programme which could be used during construction and operations phase.

4.3.2 Main Issues and Trade-offs Involved

There is no possibility of mining on such a large scale without having negative environmental impacts. In the Cerro Colorado case, the two main environmental issues were very early identified as the safe disposal of tailings and the effect of waste-rock erosion on the quality of the nearby river system [4, 13-G].

• Waste Rock/Overburden

This presented a source for concern as it seemed impossible to remove all the waste and deposit it without affecting the local river system (90m tonnes overburden were to be removed before mining, and ore/waste rock during the mining process) [12]. The main river (S. Felix) was largely used during the dry season for bathing, as a drinking source for domestic, agriculture and cattle use, and as a source of fish. During the winter time, natural erosion due to the heavy rainfall covers the river flow with coloured suspended solids making it impossible to be used [16-D].

From the studies done it seemed very unlikely that during the summer the river quality and its uses could be preserved [10]. Further studies were to be done. The nature of the overburden - very fine grey material (clay minerals) that, once disturbed, becomes fluid very easily - with the rain washing it out, would cause the river to become very muddy. Discolouration appeared inevitable [16-D]. According to Mr Savage this material is so fine that it could not be stabilized chemically [26]. Some alternative ways to prevent the damages to the S.Felix, were considered [13-G]:

- 1 - to use some form of dredging to keep the river clear during the dry season (only a conceptual scheme, needing more study);

2 - straighten the flow of the river (in the limit, by artificial channels) to prevent the coastal accumulation of solids spreading (this would be less acceptable environmentally);

3 - to lagoon and to coagulate the suspended solids from the river flow and hence recycle the waste (which according to RTZ environmental expert was very expensive and doubtful practicable).

If none of the above options proved sufficiently efficient and practicable to implement, the supply of an alternative drinking system along the river was also considered as a minimum way of limiting the damage [15-C]. Provisions to keep the S. Felix base level at the same height to prevent it from flooding (as has happened in previous mines) were also to be taken.

At this time the effects of erosion on the ability of the river to maintain its existing uses could not be quantified without further experimental work that needed to be done [13-G].

• Tailings Disposal

Several options were considered for the tailings. They were assessed under economic reasons, technical feasibility and environmental impact [24].

The optimum solution would be to store all tailings near the plant, but the cost of constructing significant tailings storage areas there would be prohibitive. Because of concerns over possible erosion into the natural flow of the river, or dam failure in case of seismic activity, it was decided to rule out any high-level sites [13-A] (tailings are a very fine divided material, particularly prone to slumping). Disposal on a major drainage system like S. Felix, was also ruled out - limited storage capacity, risk of flooding and unacceptable environmentally.

On the low-level areas, two alternatives were under consideration [16-C]:

(1) - A mangrove coastal area.

(2) - Sea water disposal.

(1). In this first alternative, there would be a considerable impact, as the mangrove area is vitally important for the ecological equilibrium of the zone [13-G]. The mangroves are very high trees that prevent erosion and stream run-off, and provide vital nursery and breeding grounds for fish. (This, according to Texasgulf environmental officer, would be an important concern for the commercial fishing and prawning industry of the zone [13-J]). At the same time, the mangroves were already under stress by small scale timber cutting. In addition, mangrove trees were being stripped of their bark by locals who sell it to the leather tanning industry. This was the alternative assumed in

the last report - June 1982 [10] but studies on the possibility of pumping the tailings into the sea were still being done.

- (2). The hypothesis of submarine deposition was the one with less environmental problems but more technical ones [16-C]. For an efficient method and to avoid effects on the shrimp industry, tailings would have to be disposed in a deep hole, ideally 40 km distant from the shoreline (ruled out as too expensive).

A re-examination of this system for a 10-15 km distance from the shoreline was to be done - since tailings are non-toxic elements the impacts on oceanic fishing would be small. This was to be subject to further analysis.

A final decision as to which alternative would be used had not yet been taken [12].

- **Other considerations**

Any land areas used for waste and tailings disposal would be subject to revegetation afterwards. Considerations as to the existing archeological sites, and environmental impacts on the selection of routes or any other site selection were to be taken into account [13-F].

Any other typical effects related to the mining industry such as gaseous and dust emissions to the atmosphere, noise levels, etc. were to be properly controlled and monitored. They did not present any special problems though.

4.3.3 Principles

Environmental concerns are an essential part of RTZ assessment of a project [10]. According to Dr Barbour [24], there is no set of fixed international standards to be followed. The standards vary according to the country in which the company operates. This variation is brought about in the first instance, by the country's own laws. In principle, RTZ will abide by them if, Dr Barbour said, they seemed both environmentally and economically acceptable. There are however minimum standards that cannot be traded off for lower costs or simply to obey Government regulations. In case of prohibitive conditions due to those factors, it is more likely that the project will be abandoned, he added. This position reflects the consciousness that RTZ has acquired over the past years, and the realisation that it is better to have a safe and welcome mine allowing a normal course of operations than a cheaper one causing future worries.

In the Cerro Colorado case, as already mentioned, there were no environmental laws previously defined by the Government. They were still being discussed and elaborated. This created a vacuum in which to operate and, according to Dr Barbour, to a certain extent put less pressure on the preparation of an environmental impact statement. However, certain major operating related decisions as to minimise the effects into the river Felix, to safely dispose of tailings and waste, to protect the local

archaeological heritage and forests, to the maximum practicable extent, had to be taken. It was emphasised that, rather than accept quantitative targets (that might not be achievable) or zero deviations from the baseline data, they should only undertake the above decisions publicly, as a principle [13-G]. Guidelines for the establishment of the environmental regulations were defined by RTZ in Sept. 81. They included [13-C]:

- (1) The use of best practicable means to be adopted on the various issues, taking into account [13-C]:
 - (a) best proven available relevant technology
 - (b) nature and gravity of the situation
 - (c) operating and capital cost

This is the same philosophy of assuming only "best practicable means" and not for example "best means available". It would also be considered that, as there were no universally accepted numerical standards as far as some of the issues are concerned (emissions to atmosphere, water pollution, solids dumping, etc.), under the scope of the studies, a library of existing standards in various countries should be investigated, catalogued and created [13-E]. This would include the policies of the United Nations [13-F]. As a result recommendations that would be acceptable and applicable in Panama would be made.

- (2) The submission of the plans for environmental matters to the Panamanian Government [13-C, 4].

(As there was no mining experience in Panama, it was felt that the CCSA should be involved in the review process leading to approval).

Satisfactory environmental performance is not merely considered by RTZ as a matter of legalistic and regulatory criteria. It visibly depends on first class operating performance "from top to bottom". This should be particularly ensured on a continuous basis [13-G].

The highest priority would be placed on safety and protection of the health of the work-force. CCSA would establish a permanent "safety and health" office that would include medical and paramedical personnel among the staff [13-F].

The entire environmental programme would be designed, planned, managed, administered and implemented by a contract organisation which would report directly to the project environmental manager [13-D]. The first idea was to assemble an in-house environmental team to produce the necessary work. However it was then decided that a major internationally accepted contractor, who could be directed to use the maximum of local skills, would be selected to give the necessary independent judgement

and acceptable experience so as to satisfy all parties concerned: Government, leaders, local people, shareholders and the general public [13-E].

4.3.4 Assessment

Inevitably the mining operations would have some negative impacts but no major issue was envisaged by RTZ as prohibitive to the development of the project [19]. Considerable amount of damage to the ecological systems in the area (caused by natural erosion, widespread deforestation and "slash and burn" practices) was already going on without the project, and should be looked at [13-H]. Only a small part of the project area, less than 5%, remained in its natural state. RTZ felt that most national and international environmental activists were trying to create an aura of bad reputation for the project by continuously talking about "environmental non-problems" allegedly attributable to the mine, while they had never addressed that problem of natural erosion. RTZ said the river contamination, for example, was being used as a major part of the campaign against the project while it would be little worse after the first few years of the project than it was then [13-L]. Some of the opposition groups to the project, derived from farmers and landowners, were also in RTZ's view, using alleged environmental concerns as a pretext to fend off economic fears - fears of labour being attracted away from farming by the higher wage rates offered by the mine. Their protests were based on the predictable pollution of the river during the dry season that would prevent cattle from using it and on the allocation of some areas to the project that were at the time being used for ranching.

Some positive aspects from the environmental work to be done, as seen by the panamanians, covered: a greater knowledge on the local flora and fauna, a better use of land (that was facing erosion or was having low productivity problems), and reforestation programme [13-H].

The World Bank as a possible Panamanian financier would carefully look at the environmental policies set by CCSA. They were consulted on all environmental matters of the project and they are reported, by RTZ people, to have expressed a similar assessment of the project impacts in one of their visits to Panama [13-L]. They were pleased with RTZ participation in the project, which allowed them to assume 'top to bottom' first quality performance (given its great experience of running elsewhere) and the application of all normal safety regulations. The World Bank, according to the report on the visit, agreed that there was likely to be no insoluble environment issues concerning the project, and that 'natural' erosion was the main problem of Chiriqui. They failed to reach a defined quantitative position in relation to river quality, but RTZ felt that the World Bank was unlikely to insist upon some of the irrelevant fixed standards for effluent which appear in their publications and that "the Environmental Quality Objectives Approach outlined in RTZ regulatory drafts might well have been

acceptable" [13-L]. It was also perceived that "the World Bank would be realistic and practical on all issues, facing the importance of the project for the development of Panama; they - the Bank - had diffused the environmental aspects".

In a letter to Codemin (Oct. 1981), Dr Tixhon, World Bank environmental officer, expressed the opinion that, if the project was to be decided, the environmental resolution drafts were a good beginning, but were couched in too general terms containing too many loopholes advantageous to the mining company. A technical annex should be added, he suggested, given standards to be implemented.

4.4 Sociological Aspects

4.4.1 Organisational Matters

As it has been stated this area was the main domain of Codemin. Codemin ran a social department at two locations:

- one in Panama City - essentially a policy making group;
- the other, at site - essentially an implementary group.

RTZ viewed this as a natural area in which Codemin could take a more active role on the project, as some of the matters would reflect national policy which had to be determined by the Panamanian Government as part of a wider Panamanian political context [14-I]. At the same time, RTZ believes that, as a multinational company, trying to ensure good relations with the local inhabitants and minimising all adverse effects that the project might bring them, will benefit all parties [19]. Hence RTZ felt that they too should have a say, and was making this clear to Codemin [14-N]. Codemin was somewhat surprised as, according to RTZ, they had assumed that CCSA would be responsible only for the mining and the related operations and that the relevant Panamanian Government ministries /agencies would handle the other issues [14-C].

This was a sensitive point that came out again at a later stage (mid 82) when Panama expressed the intention of creating a special Government commission to deal with the local communities problem. The commission was aimed at creating an inquiry body for mediation between Indians and all the different companies operating in the area [14-T]. Through this mechanism, it was intended to orchestrate the development of the projects into an harmonious policy on Guyami integral development. It would include officials of Codemin, IRHE (Panama's state-owned power company), Government, Justice and the National Guard. Its functions would include [14-T]:

- the definition, administration and execution of the outline policies of the social-economic development of the Guaymí (or other indigenous people);
- the supervision of the commitments given to the projects;

- the recommendation to each project of the budget necessary to guarantee that all programmed actions could be achieved.

The subject of disagreement was the level of responsibilities of such a commission and the type of participation of CCSA on it [14-O]. In theory RTZ agreed that all social matters should probably be dealt with by the Government but there were practical grounds for concern if that were the case. According to Mrs Nadine Jeanne (RTZ person involved with the social aspects), those reasons were [14-O]:

(1) - It might be thought that the company (RTZ/CCSA) was shirking its responsibilities to the local people (people from the church and others were pleasantly surprised that the company was taking an interest and share of responsibility and intending to take an active role on the social side of the project).

At the same time, it provided the opportunity for the company to be blamed for anything that went wrong although they had had no control over what actually happened. In the past, Panamanian social policies tended to be far below the level of requirement needed. RTZ did not think Codemin was equipped to elaborate social policies on their own ("they lack little feel for the project " it was the project director's view [14-D]). The same would happen with a commission in which only Panamanians were to participate. Fears of endless delays if RTZ had to wait for Government programmes instead of settling their own was a further concern.

(2) - In terms of cost, if programmes were to be financed by the project, but outside of their control, there was the risk of the company's resources being wasted or misdirected.

(3) - In terms of organisation there could be a risk of operating with such a system, because Government workers (the social workers) were believed to be very obviously linked with the Government party's political objectives, which could involve difficulties in communication with the local people.

(4) - Communications and reporting between the social groups (commission) and site (or project management) could be very difficult. According to Mrs Jeanne there had already been a chronic problem in getting the site management and Codemin social groups to tell each other what they were up to. This had only been getting better when there was the perception

that the two groups were to be integrated into one organisation, with a proper reporting system, meetings, cost control, budget, etc. (CCSA would absorb the Codemin Social Department). The problems were mainly because the site social department reported directly to the Codemin Social Department in Panama and not to Site Management.

It was felt that a lot more could be achieved if the Site Management could be involved in the day-to-day organisation of the social work, in the same way as for other activities, and if continuous communication and co-ordination with project engineering and management was initiated. An impact study conducted in isolation from the rest of the project and simply published at the end of the next phase would be of little value.

Furthermore, the Site Social Department received little guidance on resources from Codemin Social Department in Panama, thus working largely in a vacuum.

In a letter from the project manager to Codemin [14-U], RTZ suggested that:

- CCSA would be represented in the Commission as an observer (and hopefully there would be some Guaymi participation too).
- CCSA would submit to the Commission its own work programmes and budgets relating to the Guaymi, to be approved by it in advance of CCSA carrying out any major programme.
- CCSA would implement and administrate such work programmes.
- In order to ensure consistency between policies and programmes, independent consultants should also act for the projects.

RTZ decided to make the formation of this Commission and the definition of its role a condition under which the work programme would be stopped if the Commission's role and functions were not to their satisfaction [14-U].

RTZ's own organisation does not have a social department or a permanent full-time "expert". In the Cerro Colorado case, an RTZ person was ensuring the liaison between Codemin Social Work and RTZ policies. The possibility of someone becoming involved full-time in sociological work for all RTZ projects (as has happened with the environmental aspects) arose during the course of the project (April 82). The project director asked Mrs Jeanne to make a proposal on how such a job could be structured [14-J]. Up to then, this role had been essentially fulfilled, during the development of a project, by members of a project team or by Government departments, and in the head quarters, by the Group Public Affairs (to defend the social image of the company). According to Mrs Jeanne's proposal, the idea was that such a "sociological person" would coordinate, plan and make policies on matter related to housing, education, health

etc., with indigenous people. Such work should be as early in the development of the project as possible and should include a very early assessment of sociological factors when examining the viability of a project; something not normally done. In general it was assumed, and might be true in most cases, that the social considerations were only secondary in an initial evaluation, unless they were quite horrific and would involve substantial additional investment. A long-term sociological expert would be able to identify fully whether or not these social factors, if not dealt with properly at an early stage, would involve a cost for the project (financial, political or in terms of operations efficiency). Naturally, this work would also be useful for the later stages, to accompany the "evaluation team", to assist in selecting the international consultants for policy making, etc.

The above that arose as a proposition within RTZ, has never been implemented.

4.4.2 Work Development

Until the entry of RTZ according to Chris Gjording at the Guaymi Forum [14-L] no serious work was done on the social impact of Cerro Colorado, only vague estimates. With RTZ there was a more active promotion of some preliminary impact studies.

- 1 - A study of 13 indigenous communities was completed, including preliminary data on the number of people in these communities, and socio-economic and agricultural aspects [7]. (These studies were already used in the selection of some of the alternative locations for the project installations.)
- 2 - Studies to find alternative relocation or compensation land outside the project area were done [7].
- 3 - Community development programmes were being implemented in the following areas [14-Q]:
 - health;
 - agriculture;
 - information programmes (meetings with local representatives);
 - social assistance (materials and services for local development of activities).

(The efficiency of some of the programmes in Mr Lewis opinion was questionable. RTZ planned to redefine these activities at a later stage, when all social matters were to assume a greater importance. So far, he said, without knowing whether the project was to proceed, RTZ did not wish to assume the responsibility of initiating such programmes).

- 4 - Training policies had started to be implemented.
- 5 - A scheme for re-settlement and compensation of people lands effected was studied.

- 6 - Some general policies and attitudes towards the main issues were taken.

Most of this work took place, or was initiated towards the end of 1980 and during 1981.

A comprehensive sociological study to assess the impact of the project on the culture, economy and welfare of the local people was planned for the next stage. It would include [6]:

(1) Collection of baseline data:

- the Guaymi in the Cerro Colorado area;
- the Guaymi as a total group;
- the Latino of Eastern Chiriqui;
- the people in Panama;
- the people in the smelter plant area.

For all groups data would be collected on: culture and traditions, demography, health level, education level, land use/property ownership, family and social structure, housing standards, land availability, work aptitude, personal life objectives, etc. Much of this data would be obtained by discussion with the people, government officials, local religious and industrial leaders, and outside knowledgeable groups.

(2) Establishment of standards for the most critical aspects of the social impact, such as:

- relocation and compensation of people who must be moved;
- integration and training of essentially agrarian people into an industrial environment;
- establishment and management of a long term benefit scheme to the Guaymi people, for example, "Guaymi Foundation";
- public health facilities;
- compensation levels for damages to crops, fences etc;
- house and community schemes for the Guaymi area;
- employment selection.

(3) Assessment of project impact on:

- health;
- family customs;
- social organisation;
- religious customs;
- education;

- spending patterns;
- income distribution;
- land rights;

and also upon effects caused by:

- single worker construction camps;
- bus transport of workers;
- influx to the area of people seeking employment.

(4) Monitoring and Management

- ultimately leading to long-term planning of personnel and community development activities.

These studies were to be coordinated with the environmental work and were to be coordinated by international experts in the relevant areas (using Panamanian assistance whenever possible). Until this stage started, it was decided to continue with minimum costs, the activities already initiated (such as agriculture, health, assistance) and keeping current the socio-economic data that had already been gathered [6].

4.4.3 The Guaymi

The main social issue was the effect of the project over the local community - the Guaymi. The Guaymi are an indigenous community that have maintained their way of living for hundreds of years. They descend from indigenous Indians prior to the Spanish conquest. A summary description of the Guaymies is provided by several papers [13-J, 14-A, 14-H]. The following, according to those documents, are the main characteristics of their culture.

The numbers directly affected by the project would be around 1500 living in 11 communities. The communities are grouped in small settlements of 5 - 8 houses in which the occupants are normally all family related. Between the settlements there can be around a kilometre distance. This pattern suits their agricultural system - slash and burn - that needs several hectares of land to feed a family. Therefore although the land is sparsely populated it is vital to the people. The increase in the number of groups - Latinos, cattle ranchers - was exerting a pressure over their agricultural life cycles. These should last at least 12 years to be efficient but had been reduced to eight or less.

Land belongs to all the family collectively and it is very important to the Guaymi as they get from it their sense of security. The family is the economic and social backbone of the Guaymi. There is a mutual cooperation in the fields and

production is equally distributed. The Cerro Colorado is located in an area reserved to the Guaymi called the "Comarca", the legal status needed to be defined.

Guaymi society does not traditionally depend on a monetary economy but this is rapidly becoming obsolete as they become more and more dependent on Panamanian economic system. The soil erosion and low productivity of land leading to poor crops made it necessary to seek unskilled jobs in coffee and banana plantations or as cow-hands where salaries were very low in comparison with the length of time they work. Due to this necessity some interaction with Latinos had already taken place.

Religion is mainly Catholic but they still maintain some of their traditional beliefs. The Catholic Church has been their main force of support in the attempt to safeguard their values and culture against the Cerro Colorado impact on them.

At present the general authority for each region is the Chief, elected by the people at the Regional Congress to ensure that the Guaymi were treated fairly by the Government. The Regional Chief has a representative in each Community who is the intermediate Chief. These chiefs have no legal (formal) recognition from Panama Government. Frequently there is a duality between the Chiefs of Guaymi and the official Mayors, often creating divisions and fights for power.

The movement towards a tentative centralised power is very recent (started two decades ago) and is very slowly progressing in order to safeguard the group's survival. This, according to Codemin, makes it rather difficult to secure basic services for the Guaymi ethnic group as a whole, and communications to coordinate any type of activity must be made with each community independently [14-P]. Strong attempts are being made by the Guaymi to unite themselves.

A Panamanian census on the area in 1980 reported:

- high poverty, malnutrition, chronic respiratory diseases and high illiteracy rate;
- high infant mortality;
- very poor medical assistance.

Historically, they have received little attention and care from the Panama Government. This has changed since the Cerro Colorado started. The project, in Codemin's view (note dated 14/7/81), could be seen as an opportunity to improve their standards of living by providing education, health, welfare facilities and permanent jobs. Up to Cerro Colorado they had been abandoned to their positions and, according to RTZ people, treated like a bit of an oddity among the Panamanians.

Some saw a huge project like Cerro Colorado as one more factor that would contributed to a rapid unstructuring of their cultures, taking their ethnic group towards a serious cultural crises situation [12].

4.4.4 Main Issues and Related Attitudes

Concerning the Guaymi there were several issues facing the Project. The following five issues were considered by the project director as the most important ones [14-D, 14-B].

(1) Evolution of Guaymi

- Should Guaymi be preserved as a people or should they be integrated in the Latinos culture?

This seemed, according to the project director, to be the main issue on an international basis supported by the local Catholic Church [14-D].

Insofar as possible, according to Mrs Jeanne [14-B], preservation of Guaymi values and culture would be the aim but an absolutist approach demanding total preservation was seen as idealistic [14-B]. Such an approach, she says, would also stop most, if not all, development including medical assistance and a great deal of other technological development which most people now accepts as necessary and environmentally vital. So in these respects they would try to integrate Guaymi into the reality of Cerro Colorado - by using flexible policies if necessary on employment practices, housing standards, etc. so that Guaymi could adapt more easily - while at the same time they would try to preserve and respect their own values and culture to the extent possible.

Social activists, says RTZ people [19, 20, 29], always argue and might continue to argue as Indian cultures are not preserved, but the people themselves end up better off with all the aids they get from the project than if they were to be left alone.

(2) Resettlement and Relocation of 10 - 15 Communities

(who could not physically remain where they were due to project installations).

- were they to be relocated all together or would the shortage of land involve a breaking up of the community?
- could enough land be found to compensate them?
- criteria for relocation?

Almost any development work on the project would result in the displacement of people from land they either occupied or used for agricultural purposes. The situation was exacerbated within the Comarca where the occupants had been granted exclusive rights by law [13-J].

The relocation would be seen in respect of the following principles [14-H]:

- (1) collective property rights granted to Guaymi
- (2) no individual legal title being held by Guaymi over their land
- (3) the right of the state to expropriate against compensation for the economic development of the country.

In relation to (2), Codemin was firstly intending not to compensate for the lands (since Guaymi did not own it) but just for the crops. RTZ lawyers did not agree [14-E]. They then jointly agreed for alternative land to be found for those displaced and adequate compensation for loss of crops, etc. to be given. This might not have been easy, in RTZ's view, since land was scarce [14-H].

In relation to (3), and according to Mr Lawton [14-E], although Guaymi would be consulted, it would be inappropriate and inconsistent to negotiate any claim that "full approval from the Guaymi be obtained for all land to be taken away" - it would be inconsistent with all other Panamanian groups.

The relocation would be for better installations and in accordance with local feelings.

(3) Compensation Schemes

- levels to be established.

The bases for compensations were being reviewed. The then present levels were inadequate and RTZ, according to Mr Lawton, would insist on them being increased prior to the project release [14-E]. Panama did not enjoy a high reputation on this. In the past, some compensation done by Codemin caused disatisfactions among Guaymi [14-E]. They were then working on a new scheme [14-F] that would be fairer to the Guaymi :

- taking into account the value Guaymi attributed to some of their belongings, previously ignored by the project;
- taking into account the loss of future revenue and not only the crops of the year;
- agreeing the tables for the above compensation.

The measure of compensation remained to be determined. Insofar as profits were concerned, once the compensations had been paid, there would not be any legal recourse to CCSA for further money [14-E].

Privately the concept of a Guaymi Foundation, funded by a percentage of the dividends, was being raised [19]. This foundation would be aimed at the promotion of the economic and cultural well-being of the Guaymi [14-I].

(4) Guaymi Employment and Training

- special policies might create friction and segregation.
- need special training.
- flexibility so that Guaymi could adapt more easily.

A basic policy, socially and economically justifiable, would be to encourage Guaymi to work in the mine if they wish to do so [14-G]. This would ease the requirement for housing outside the Guaymi Comarca and the consequent transportation problem. Furthermore, it would contribute to the economic development of Guaymi. The priority order for employment purposes would be the following:

- 1st. - local Guaymi
- 2nd. - Chiriqui zone
- 3rd. - Panama
- 4th. - Others.

Preliminary pilot training programmes were already under way and some Guaymi were already working in the exploration area [14-R]. Employment and training of Guaymi would require deliberate steps to gradually increase the number of workers and to facilitate their adaptation to the specific work involved [9]. Flexible work schedules to allow for a gradual transition from agricultural and seasonal work to permanent employment were being considered [19]. These concepts of flexibility were not fully developed and would require further evaluation as project personnel gained an understanding of Guaymi attitudes towards work. Guaymi training would require some language flexibility on the part of the trainers for effective communications. Proper training, according to Mr Lewis, is considered an aspect of high priority within the development of a project. It was assumed that initially Guaymi would be trained to operate mining and milling equipment and the Latinos group would provide the bulk of maintenance workers. The technical and supervisory staff would be non-Panamanian since Panama did not have a significant domestic mining industry, but within four years they would be replaced by Panamanian personnel. Later, acquired skills and aptitudes would be the criteria for placement in all cases.

(5) Definition of a Comarca

Legally the Comarca, an area preserved for "the Guaymi exclusive use and ownership", was created in 1952 [13-J]. However the law is vague and of a generalistic type, according to Mr Lawton [14-E]. The boundaries were poorly defined and the Guaymi were demanding substantially greater areas to be included in the redefinition of the reserve areas presently occupied by Guaymi and Latinos (which aggravated the situation). A proposed new law prepared by a Guaymi Congress with suggestions on the Comarca had been discussed with Guaymi Chiefs [14-M]. The Guaymi were to be consulted on matters dealing with the Comarca but the legal expert said, there was no need to have their full approval before land could be taken over (the Government had already granted exclusive rights for mineral exploration in the area to the Cerro Colorado) [14-I]. The negotiations were being monitored by RTZ, that could only assume a supportive role due to the much wider implications of this issue [14-I]. RTZ had expressed the need to have it solved before construction [19] so that operations would run smoothly and activities could be organised to keep penetration of the Comarca to a minimum.

This was not an easy problem to solve - it has to be seen in the context of a small country, with very limited availability of land, trying to develop its economy for the future good of all Panamanians [14-M].

(6) Townsite

- location in Indian reservation?
- type of housing?
- relocation or integration into an existing townsite?
- separate Indian townsite, if non-Indians were to live outside Comarca.

Several controversies, according to Mr Lawton, revolve around the construction of a townsite on Indian territory - it would be cheaper (no need to transport the workers by bus), it would decrease the journey of work by the traveling time, but might have generated problems as the interface between Latinos and Guaymi was not good. Hence the later plans were to place the townsite away from the Comarca. This would be purely a Panamanian affair but principles on quality of construction, timing of construction and standards of housing should be agreed with RTZ [3]. These standards, as referred by Mr Lewis [19], were a serious argument between RTZ and Codemin. The Panamanian Government thought RTZ's view on the standards of housing was far too high. But it was RTZ's opinion, he said, that good housing would produce better employees, feeling happier and therefore greater

productivity for the future of the mine. Codemin was not so much concerned because of the cost, he added, but because of the implications of setting a precedent for the houses to be provided for the rest of the population. They were also concerned about the Cerro Colorado corporation becoming an "elite" which is what happened in the Canal zone. Another area of disagreement was related to the different standards to be adopted to each group: management, skilled personnel, unskilled, etc. so that personnel could be attracted and retained for the project [6]. Mr Lewis referred, that Codemin saw this as undemocratic - a lot of the Civil servants were left wing ideologists. These issues had yet to be agreed.

A special corporation TOWNCO - wholly owned by Codemin - was to be set up to plan and construct the townsite, and to be in close contact with project management so that delays in construction could be avoided [6]. Guaymi's standards of housing would have to be developed to adapt to their own circumstances [6].

RTZ intended to depend on heads of agreements on TOWNCO, on the lines proposed above, or on the provision of similar assurances, for the continuation of the project [6]. Construction camps would be included in the project, therefore to be provided by CCSA.

(7) Participation of Guaymi - in decisions regarding 1 to 6

- problem of leadership - who represented Guaymi?
- aspirations and expectations might differ.

RTZ principle is that Guaymi would be informed and involved but their leadership and representation was fragmented and sometimes conflicting, and it was difficult to establish good communications with and participation of "all Guaymi" [14-G].

4.4.5 Social Opposition

Several groups had a negative attitude towards the project [19, 20, 29]. Among them:

- (1) - Political opposition to the Government (wealthy families), which was particularly important because of forthcoming elections.**
- (2) - Chiriqui opposition**
 - landowners worried about labour and wages.
 - agriculturally based population (there was a certain element of Chiriqui nationalism which mistrusted the Government and its centrally planned approach as well as its silence on the project).

4.5.5 Environmental Code

Panama had no environmental regulations defined. RTZ's view was that the code to be defined should be acceptable by them as a pre-condition in order to proceed [23]. For this reason, they were working together on the establishment of these regulations, and negotiations were taking place. The discussions would have been roughly around the level of standards to set for the Cerro Colorado. Panama, according to Mr Lewis, wanted to strictly set the World Bank requirements. Those, in RTZ's view, were too expensive and/or seemed impracticable in Panama - given the specific environmental characteristics. The Panamanians then disagreed with most of RTZ's proposals [21]. Eventually a draft had been agreed and signed by a Panamanian official, but was then rejected on the grounds of a lack of authority by that official [23].

A mining safety code needed to be defined too. While the previous issue was emphasised, it seemed that no particular attention was paid by Codemin to this other aspect [23].

4.5.6 Power

In any project, according to the project coordinator, it is one of the first priorities to ensure the availability of power in time and at a reasonable price. In the Cerro Colorado case, the project would consume more than 20% of the total national consumption, and would require the allocation and building of a new station (at a later stage the possibility of buying from Costa Rica was also considered) [19].

At that time, IRHE, the Panama state-owned power generation company, was engaged in a programme of developing new power sources to cover all Panama's present and predicted future needs. It was originally envisaged that IRHE would build a new station to cover the project needs and CCSA would buy the power from them. However, Mr Lewis said, the price asked by the IRHE was far too high and unacceptable by RTZ and Codemin. Naturally, with the steady decline of the copper price, this became more critical. The negotiations, initially scheduled to occur before the option period ended, were extremely difficult and never came to any conclusions. Underlying the discussion, he added, there were political frictions between IRHE and Codemin. IRHE feared the competition of Codemin. So far, Codemin was a very small firm, but if Cerro Colorado developed, it probably would become dominant in Panama, taking IRHE's place. It is Mr Lawton's opinion that "both being Government agencies, they would have sorted out between them the tensions". IRHE were not used to having a customer with such a powerful voice and naturally there were concerns about this too [23]. IRHE, according to him, were treating Codemin (CCSA) as a typical customer. This meant that IRHE wanted to charge them their usual price rate, the one they applied to the other companies, and were not prepared to lower it despite the Cerro Colorado demand being far greater than any other one. They were claiming that the price level was necessary

to reach the level of return required from them by the World Bank, who were the major source of their finance. From RTZ's point of view this was like paying additional taxes to the Government. The return IRHE wanted to make on the power to the project, would be greater than the return on the Cerro Colorado itself, was pointed by Mr Lewis [19].

There were also concerns that the dam would not be constructed on time: the timing given by IRHE would always overrun the mine [19]. To overcome this RTZ was prepared to finance the dam themselves and build it. By doing this, it would increase the capital cost of the project leading to a decrease in the taxes to be paid to Panama. Panama's response was that this was the real reason for the RTZ's proposal. In any case, this presented other difficulties, as IRHE, being a supply monopoly, wanted a large sum for their permission for another entity to build the station. "It would be like paying the higher price of the original scheme" [19].

During the course of negotiations a different scheme, which in Mr Lewis opinion, seemed very likely to occur, came out: the establishment of a separate company, DAMCO, jointly owned by CCSA, IRHE, RTZ and Codemin, to undertake the development of the dam. Related to it, there were still several arguments going on such as: who would finance it, what guarantees would be established (such as an 80% take-or-pay power supply contract with CCSA, a "mutual help" agreement between IRHE and DAMCO, etc.). In RTZ's opinion, this would have been a tough contract to make, but one definitely needed to be established before the next stage started or it would not [19, 23].

4.6 Present Status

The project has been placed in "care and maintenance" since June 1982. One year later the same issues were reported, in a letter sent to Codemin by the project director [32], to be still awaiting political definition, without which, given the high costs of the project and inherent risks, no eventual decision to proceed could be taken. This will still continue to be for some time theoretical as the copper market is not yet favourable.

It is now thought that the project has little chance to go ahead, at least during the present century, and RTZ would like to stop it all together [29]. This is a current controversy. Codemin would like to maintain fully the facilities (roads etc.) that are of use to the local inhabitants. Moreover, because RTZ has not caught up yet with the 49/51% total expenditure rule, it is up to them to finance the "care and maintenance" [19]. There are some other legal issues building up, as no specific legislation was made in case the project did not go ahead. For example Mr Lawton referred that the level of "care and maintenance" required is not specified, nor the rights or obligations each part would have if a stop decision is made.

The issues listed as still uncertain, include [32]:

- 1 - The governmental laws.
- 2 - Mining chapter on labour code.
- 3 - Compensation to Guaymi.
- 4 - Restrictions in operating within Comarca. Acceptance of Cerro Colorado by the Guaymi.
- 5 - Welfare provisions to be made for the Guaymi.
- 6 - Housing:
 - location for mine employees;
 - standards;
 - funding.
- 7 - Power source and cost.
- 8 - Tax regime.

5. Overall conclusions and Summary of Findings

5.1 Overall conclusions

The Cerro Colorado case study illustrates the relevance of the non-financial aspects of projects discussed in this thesis and the need to take these aspects into account early in the appraisal. At the time the project was placed in care and maintenance, all the difficult issues to solve were non-financial ones: the environmental laws and regulations; the mining labour code; tax and power schemes; the housing standards; and the Comarca definition. Had the project not been stopped because of unexpected falling copper prices, these aspects were very likely to have delayed it. One year later these were still matters needing agreement and definition.

The Cerro Colorado confirms the need to take into account two of the less researched areas of non-financial aspects: the social and the political ones. The great visibility of the project and its impact on Panama economy (due to its size), the capability of Panama to handle all the project needs (due to the country inexperience of any large size industrial projects and of the mining business itself), and the risks of nationalization or extra demands on the projects revenue, were all RTZ factors of concern for the future. Political reasons were behind many of the difficulties in the negotiations: for definition of standards in housing, in the environmental and the labour codes, and also in solving the Guaymi matters. It seems that all these aspects were optimistically assessed at the initial analysis. Yet the abandonment of the project if those matters were not agreed was considered later on. In the end, social, political and environmental aspects, could be more crucial to the project than the technical or the financial ones. The power of people and politics in delaying the project is hugely evident in the negotiations. The role of the Government in supporting the project is also visible (when General Torrijos died the lack of someone with authority to take decisions was a source of consequent delays and indefiniton on the Panama's part).

A lesson from the Cerro Colorado is to start the appraisal with the cheapest difficult areas. The technical aspects would end up not being a problem in the project, and still there was a lot of money being spent into them since the earliest stages. However, other issues (and less costly to research) should have been defined first (or agreed in principle). Power and tax schemes, housing standards, the Comarca definition, and the environmental and labour codes, were all non-financial and non-technical aspects likely to delay the project (as they were difficult issues to negotiate). If these aspects were not agreeable there would have been no reason for spending money in the technical studies. Therefore they should be examined earlier.

On the organisational side two other lessons can be taken. One, is that there should have been a tighter geographical control on the project structure (for example, trying to locate all teams as much as possible in two centres only: possibly, London and Panama). This, would improve communications and would facilitate control. The second

lesson to be taken is that joint teams, Codemin and RTZ, would have worked better than separate ones. Communications between the two groups of teams were being difficult, even though they were all working in the same building. If, instead of having two offices and two teams, there was only a joint team (as part of the same structure), this would improve communications and would be likely to have led to a greater trust between RTZ and Codemin.

5.2 Summary of Findings

The following is a summary of the main aspects examined in each area of analysis.

- **Methodology**

- **Basic principles**

- (1) Spending in steps

- increasing the information collected, cost and accuracy of estimates;
 - positive decision to be taken at the end of each step whether to proceed or not;
 - prevents follow-on work for "outside the project" reasons such as: sense of commitment to the job already; sense of failure if project stops; etc.
 - major benefit: avoid unnecessary costs, for example, not spend money in the environmental assessment of a project that is not economically feasible in the first place.

- (2) Flexibility

- in the evaluation procedure to adapt to changes and particular situations;
 - it is up to the people involved to determine any particular area of analysis (outside the standard ones, or any aspect outside the check-list), and to decide where the analysis should be started and what emphasis to be placed on each aspect.

- **Evaluation stages**

- (1) Preliminary analysis (before commitment)

- its aim is to assess the technical and economic viability of a project and its general dimensions;
 - it covers the classical type of project evaluation (geology, mining, prices) and looks at the alternatives available;

- general political stability of the country is looked at; social or environmental aspects are assumed as normal unless a particular grave condition stands out;
- takes about 2/3 months.

(2) Prefeasibility stage

- medium detailed level of study;
- emphasises still on the technical and financial side of project;
- all other dimensions started to be looked at, in particularly environmental aspects related to technical design, training and housing;
- takes up to one year;
- a "yes" decision at the end of this stage, has to be the result of fairly high confidence on the implementation of the project - as the next stage will involve a considerable amount of money (\$75 Million in \$2 Billion on the Cerro Colorado case).

(3) Feasibility stage

- final set of studies before construction starts;
- deepens the analysis in all areas; all major problems or issues of the project (social, housing, environmental and political included) will have to be solved;
- takes up to 2 years to complete, and may include a pilot plant.

All 3 stages are flexible: more or less detailed and prolonged according to the people involved.

- **Organisational and Managerial aspects**

- **Organisational structure:**

- organisational structure is dynamic, moving and changing according to the project's own development.

- at the feasibility stage, there is a very flat structure with a small coordinating team (this allows greater initiative and cooperation, and better communications - seen as essential in a phase where work to do is not strictly defined yet);
 - it would become more rigid after construction when a great number of people are involved needing greater control;

- activities were spread geographically according to efficiency and economic reasons (this requires a special attention to the communications system);
- organisations should match the people involved.
 - people come first than organisation especially at the earlier stages; at the construction level, organisation becomes more important than initially;
- a good selection of project personnel is seen as essential, in particular for key positions. At the early stages, when critical decisions have to be done, it is better to have senior management (even only on a part-time basis) that may later on give way to lower and middle management;
- people were involved at different levels of participation: initial stages had a considerable percentage of part-time personnel, that later on would move to a full-time basis (for example, project director and financial areas); use of consultants is common for independence and expertise and also for economic reasons (no need to staff-up organisation with every area of work);
- teams are selected according to:
 - how people will perform the job (very high expertise was involved);
 - how well they will get on together (so that communications will flow).
- **Managerial aspects:**
- **Key people**
- key people (project director, project manager) have an essential role:
 - need to see project as a whole, in all its aspects so that trade-offs can be done carefully;
 - importance of ensuring the coordination of all policies (social, environmental, technical) so that they will run in parallel and not cause delays;
 - importance of foreseeing the major issues;
 - importance of delegation for example, technical matters should be delegated to the technical people - too much interference can be bad for the project;
 - work programmes should be defined both by content and timing, so that people will not rush to a deadline.

- Communications and Report:

- at this early stage of the project no rigid basis of communications and reporting was established because:
 - short lines of communication make it easier at this stage to reach compromises on all dimensions;
 - people from each team would have direct access to other team, for quickly solving any problem that arose;
 - 'dotted lines' relationships were seen as important as 'solid lines' relationships.
- emphasis was on horizontal and informal communications and in a simple and flexible structure:
 - formal reports only existed for financial and marketing areas; all other areas followed a very informalised system;
 - the importance of the informal systems was to give immediate and up-to-date information for decision-making.

- Partnership relationship:

- a sound relationship with the partner was tried to be established all the way - gaining Codemin trust and confidence was essential to solve problems and reach solutions;
- commitment of both parties to the project is essential to decision-making;
- lack of trust arose between Codemin and RTZ because of Panamanian's unfamiliarity with the mining industry and the inexistence of fundamental laws (environmental, safety, labour). Schemes were being 'shelved' all the time and new alternatives produced once a problem arose, and this only contributed to the sense of Panamanian suspicion;
- decision making was made difficult because of Panamanian lack of delegation; frequent change of personnel (Panamanian side); dilemmas between Codemin and Panamanian Government objectives; and Panamanian Government bureaucracy;
- different perspectives of the project may also have added to problems in good communications;
- initial 'conflicts' were due to a different perspective of the scope of their mutual work - especially on the social side (who is responsible for what? etc.).

- **Political aspects**

- this was one of the first areas looked at (to examine the stability of the country) but in a very crude way (general knowledge on the country; some talks with Government; etc.);
- a comprehensive assessment - including economic and political situation of the country (economic structure; political stability; foreign exchange rate; industrial experience; etc.) - was done towards the end of the prefeasibility stage by an internal expert;
- the assessment was done through visits to the country, talks with Government bodies, talks with foreign industries operating in the area to find out their experience, and economic reports on the country;
- some factors identified as risky included:
 - large size of the project (compared to country);
 - Panamanian inexperience in industry and mining;
 - lack of diversification of economy;
 - high external debt;
 - nationalistic feelings;
 - 'Panamanian' factor: bureaucracy; unclear lines of decision-making;
 - Panama's expectations on the project as too great.
- it was felt this assessment should have been done much earlier in the process to be effective (to be an input in the decision to take up the option on the project); but the need to get into a market may have prevented this; the issues listed above were a major source of concern;
- one way to avoid political risk is to recognise the reasonable requirements and aspirations of the host government, by:
 - involve their nationals in management at all levels;
 - participation of nationals in the profits;
 - assurance, through participation of nationals on the board.
- on a day-to-day basis, there was always the awareness of the possible political implications of any issue (to be taken into account).

- **Environmental aspects**

- Principles:

- Environmental concerns are an essential part of RTZ assessment of a project.
 - There is no set of fixed international standards to be followed; the standards vary according to the country in which the company is operating - first rule is to abide by that country's law, if economically and environmentally acceptable.
- Trade-off policy involves:
 - economic reasons
 - technical feasibility
 - environmental impact acceptability
- Minimum standards cannot be traded-off by cheaper costs; the project could stop if environmental considerations so demanded (lessons had already been learned in past projects that overlooking environmental aspects may cause increasing costs in the future and a bad environment to work in).
- Environmental performance is not merely a matter of legalistic and regulatory criteria - depends on first class operating and performance "from top to bottom" (a high priority would be placed on the safety and protection of the health of the work force during the project life).
- Environmental matters were considered from the very early stages - in particular technically related aspects so that trade-offs and design selection could be made using them as an input for the decision. (Some of the alternatives concerning tailings and overburden disposal were ruled out on environmental grounds.)
- The work done covered:
 - collection of baseline data (air and water purity, etc.);
 - experimental work;
 - establishment of environmental design criteria (as no code existed in Panama);
 - assessment of project impact.

All these needed to be done during the early stages to be effective.

- Aims:

- identify points of ecological sensitivity to minimise damage;
- produce baseline data for standard comparison during project operations.

- People involved:
 - environmental officer (appointed to the project at an early stage);
 - Panamanian subcontractors;
 - RTZ environmental expert (appointed towards the end of prefeasibility stage);
 - the entire programme (planned for the feasibility stage) would be designed, planned, managed and implemented by an international contract organisation to give independent judgement and acceptable experience and hence (hopefully) to satisfy all parties (locals, shareholders, Government);
 - local skills should be used as much as possible.
- Reporting was both to project manager (people on site) and to project director (consultants).
- The preparation of an Environmental Code was the subject of many discussions and disagreements between both partners as they wanted different levels of standards to be adopted. (Panama wanted best available World Bank standards; RTZ best practicable standards and perceived some of the World Bank criteria as impracticable on technical or economic grounds for the Cerro Colorado.)
- RTZ guidelines to establish the environmental criteria were:
 - use of best practicable means taken into account:
 - best proven available relevant technology;
 - nature and gravity of the situation;
 - operating and capital cost.
- **Social aspects**
 - **Principles/attitudes**
 - it was perceived as a company's duty to be fully involved and share responsibilities in the formation and implementation of social policies;
 - need to ensure good communications with the local people and build up their trust. For that, it is necessary to listen to them and build a feeling of communication and interest (essential for long-term stability);
 - inform Guaymi on the development of the project, consult them as to the related decisions and encourage their participation in the project as workers in the mine. (A representation group of local interest was planned to be formed to receive and consider information.)
 - attend to social partners' positions: Church, Academics, etc. (Discussions with these groups took place to clarify RTZ's position towards social issues and to hear their views.)
 - give priority to Guaymi as to the benefits of the project:

- employment policy would give priority to Guaymi workers; training was given special attention and was planned to take into account Guaymi's work habits. Flexible employment policies, at least in the initial stages, would be taken into account for seasonal work, etc.
 - a long-term plan was to initiate a 'Guaymi Foundation' to improve social conditions, and that this would be supported by a percentage of Cerro Colorado dividends. The role of such foundation would include the promotion of: agricultural projects; health; social assistance; training skills; scholarships; etc. This would be a culmination of the policy of viewing the social aspects in a larger framework than merely that of the project itself;
 - compensate for the damage so that people would not be at least worse off after the project. Criteria for compensations and resettlement policies should take into account Guaymi values and traditions; compensate for loss of future revenues and for things that are valued by ethnic traditions although meaningless to others;
 - learn the country - the more that is known about it the better. To know about people it is essential to live with them, for a real investigation (role of 'participant observer'); look at people as they are, not as we see them. (For example, some social activities started by Codemin social department were not adapted to Guaymi values. They would have had to have been restructured when the social policies were started to be implemented. RTZ did not want the responsibility of initiating activities before knowing if the project was going ahead or not.)
- Development of work**
- initially, social considerations played a very secondary role (RTZ's past experience was that as long as a project is profitable, to allow money to be put into social issues - and solve problems - and that partners are committed to implement it, social problems cannot stop a project, although they may delay it). Social issues are assumed as normal, unless they are quite horrific or would obviously involve substantial additional investment;
 - some work done included the study of 13 communities, and was used as an input in the selection of alternative locations to the project installations. This was done by Codemin's social department with the collaboration of international experts;
 - a liaison person guaranteed communication between the social and the management sides of the project;

- a greater involvement of RTZ started in the later stages of the prefeasibility studies when issues started to look gloomier;
- their short-term emphasis was for the training needs of the project and for the level of housing standards - both these aspects should be strictly coordinated with the rest of the project to avoid delays. Training policies had started to be implemented;
- good housing conditions - an issue of disagreement between RTZ and Panama - were seen as essential to create a happy and therefore more productive workforce;
- studies to find alternative relocation or suitable compensation outside the project area were done;
- community development programmes (health, agriculture, social assistance) had started (Codemin's responsibility). Their efficiency was questioned by RTZ;
- site management wanted to be involved with the organisation of the social work, as for any other activities, to coordinate it with the project engineering and management;
- for the next stage, a comprehensive sociological study covering the following was planned:
 - collection of baseline data (culture, demography, health, land use, property ownership, family structure, housing standards, work aptitudes, beliefs, etc.). Much of this to be obtained by discussions with locals and experts;
 - establishment of standards for the most critical aspects of the social impact such as compensation, training, employment selection, housing;
 - assessment of project impact on: health, housing, education, land rights, social organisation.
- work to be done through outside consultants for expertise and independent judgement, in coordination with the environmental work and in parallel with the technical evolution of the project so that it could affect decisions;
- the appointment of a full-time social expert arose as a suggestion. The aim was to have long-term general policies on matters such as housing, employment, education, health, etc. and to quickly identify the relevance of an early social assessment;
- all issues to be solved before construction;
- a Bougainville lesson: take good care of people at the design stage.

- **Relative importance of each area/Trade-offs/Decision-making**

- The relative importance of each aspect varies according to the project and the strategy of the company at the time of evaluation. For example, in the Cerro Colorado, the strategic need for new mines was the overriding factor to take up the option on the project. All other aspects were taken as risks (economics of project not too good; RTZ Latin America inexperience, Panama inexperience, stability of the country, etc.).
- Generally, the technical and economic sides of the project are the prime areas to be looked at and the ones in which work concentrates during the initial stages. They also follow a more standard procedure. Social, environmental or political risk assessment is more difficult to do and analysis tend to be very much dependent on the perception of the people involved as to their importance. In the Cerro Colorado case, social, political and a lot of environmental work was initiated towards the end of the prefeasibility work programme, and the attention to some of the aspects developed according to the development of problems (as the project got difficult in economic terms, problems became gloomier in other areas, and attention was then put on those aspects: for example, the Guaymi problem, the housing policy, the Environmental Code, the social opposition).
- In principle, non-financial analysis should start as early as possible, and in parallel with the technical aspects, so that they can provide inputs to technical decisions. It is also expected that all major problems should be solved (or guidelines defined) before construction.
- In order to solve problems, it is essential that:
 - the project is financially sound
 - there is a good relationship with the partners
 - common sense is used.

If these 3 conditions prevail, social or environmental aspects have a secondary importance (not in the sense that they will not be taken into account but in the sense that they are not a cause of concern to rush into their analysis).

- Trade-offs are also very dependent on the people and on the particular situation. There are maximum limits for social or environmental decisions ("go as far as the economics of the project allow") and minimum limits (minimum standards - environment, social, etc.) that can not be traded-off for cheaper costs - it is more likely that the project would not be continued. The country in which the company operates will be another factor to balance.

- There is an awareness of the importance of establishing a good relationship with the local people and the host government, and that money should go into this. There is a trend towards a greater recognition of the importance of assessing these aspects and to take them into account in decision-making.
- Decisions are based on:
 - knowledge of experiences elsewhere
 - perceptions and quality of people involved
 - expert advice
 - personal judgement.

There is not a weighting system, there is a balance of all factors based on the above elements.

APPENDIX B

SUMMARY LIST OF THE INTERVIEWS

Company	People Interviewed	Position/Department
• County Bank	Mr C. Bloomfield	Director
• British Rail	Mr G. Cooper	Deputy Rail Investor Analyst
• Aquascutum	Mr Hullander	Managing Director
• Logica	Mr I. Campel (plus other staff)	Personnel Department
• Delta	Mr M. Gill	Headquarters/Planning
• Smiths Industries	Mr C. Hosegood	Director of Future Projects (Aerospace and Defence Systems)
• W.S. Atkins & Partners	Mr R. Thomas (plus other staff)	Technical Development Manager/ Project Management Division
• CEEB	Mr B. Williams Mr N. Ayton (plus other staff)	Generation Development and Construction Division Strategic Studies Department
• BNFL	Mr P. Halford	Project Manager/Thorp Management Group
• Shell	Mr G. Galler	Senior Consultant/Group Planning/Consultancy Division
• Foster Wheeler	Mr N.W. Dunlop	Division Director
• Bechtel	Mr G. Ward	Project Manager
• ICL	Mr B. O'Riordan	Manager/Systems Strategy Centre/Marketing and Technical Strategy
	Mr E. Babb	Manager/Logic Engineering Group/Systems Strategy Centre
	Mr H. McDonald	Marketing and Technical Strategy
	Mr J. Arnell	Business Strategy Group/ Marketing and Technical Strategy
	Mr D. Horth	Manager/Innovation Products
• Glaxo	Dr C. Towler	Director/Development Planning
• BAe	Mr R. Minion	Divisional Executive/Air

	Mr D. Eastwell (plus other staff)	Weapons Division Business Development Executive/ Air Weapons Division
• Humphreys & Glasgow	Mr L. Williams	Marketing Services Manager
• Consolidated Goldfields	Mr A. Sykes	Managing Director
• Public Sector	Mr Parsonage Mr Sharp (plus other staff)	Treasury Ministry of Defence Economic Advice Division
	Mr J. Henderson	Economic Advisers Office (Health Department)
	Mr Knowles	Department of Transport
• RTZ (Cerro Colorado project)	Mr T.H. Lewis	Project Coordinator
	Mr D.K. Presgrave	Chief Engineer
	Mr R. Wilson	Project Director (former)
	Mr R. Adams	Director (first assessment)
	Mr C. Lawton	Head of Legal Department
	Dr J. Barbour	Environmental Scientist
	Mr P. Crowson	Political Analyst
	Mr C. Savage	Mining Engineer
	Mr J. Dherse	Project Director (during the prefeasibility studies)
	Mr B.S. Adams	Project Director (actual)

QUESTIONNAIRE

1 - General Methodological Questions

- What are the key issues and main features of your business and types of projects?
- Is there a formalised system in your company for the evaluation of projects? (brief description and stages of that process). Does this procedure vary according to different types of project? In what way?
- What criteria do you use in assessing a project? (financial, strategic, etc.)
- Do you use a quantitative approach to all the criteria mentioned above? (If not, why not and specify the type of assessment).

2 - Interaction between project and company

- Is each project evaluated on its own or within the context of all other projects?
- How is the interdependence of a project taken into account?
- Is the way in which the project fits in with the strategy of the company analysed? How? When?
- Are there any synergistic aspects considered? How? When?
- Is the risk of the project evaluated in relation to the risk of the company?
- Do you find any value in diversifying the type of projects that are implemented by your company? How do you assess these advantages?

3 - Non-financial evaluation of projects

- Do you assess projects on any of the following factors listed? (Which ones and how?)
 - Technical risk
 - Managerial and Organisational aspects
 - Societal acceptability
 - Environmental aspects
 - Competitor's options
 - Legal aspects
 - Political implications
 - Others (specify)
- What are the main aspects to be looked at?
- Penalties of overlooking these aspects?
- Relevance to the success or failure in past projects? (examples)
- Is the assessment systematic? Structured? Done by whom? When?

4 - Decision-making and final considerations

- Are any of the above factors, eventually sufficient to accept a project that would be rejected on financial grounds? (and vice-versa)

- How do you weight the above aspects to reach the final decision?
- Relative importance of each element and trade-offs?
- Is there a role played by the managerial judgement? Which areas of the project does this judgement cover and what is it based in? Does this judgement allow for common criteria in all projects?
- In your experience what have been the main causes for project failure? And for project success? What have been the main areas of risk? (practices of the company in minimising the risks)
- Which are, within the components of risk discussed, the ones you have found most difficult to assess?
- What are the main deficiencies felt with your present evaluation system?

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- [13 - H]** "Cerro Colorado-ecological aspects ", Codemin notes, 25/6/81.
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[14] Social

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- [14 - D]** 'Discussion paper on Guaymi problems'.
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- [14 - E]** Letter from C. Lawton (RTZ) to F.M. Vale (Codemin), 1/4/81.
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- [14 - G]** Wang transmission, from Mrs Nadine Jeanne to Mr Chesworth ,
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- [14 - H]** Draft paper on Guyami Comarca and the Cerro Colorado.
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- [14 - M]** Draft paper on Guaymi Comarca, 2/11/81.
- [14 - N]** Letter to be send to Codemin on Guaymi issues, 13/11/80.
- [14 - O]** Comments by Nadine Jeanne on the proposals for the formation of
a commission on Guaymi matters, July 1981.
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[14 - S] 'The Bishops talk on the Cerro Colorado' Pastoral letter, 11/5/79.

[14 - T] 'Government Proposals on the Guaymi Commission', 1981, notes taken by RTZ.

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[15 - B] Notes on Public Relations Policies, by Nadine Jeanne, 23/10/80.

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[16 - A] Notes on meeting held to review the Cerro Colorado, 26/27 April, 1980.

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- Direct quotes from interviews

• Interview with:

[19]	Mr T.H. Lewis	Project Coordinator
[20]	Mr D.K. Presgrave	Chief Engineer
[21]	Mr R. Wilson	Project Director (former)
[22]	Mr R. Adams	Director (first assessment)
[23]	Mr C. Lawton	Head of Legal Department
[24]	Dr J. Barbour	Environmental Scientist
[25]	Mr P. Crowson	Political Analyst
[26]	Mr C. Savage	Mining Engineer
[27]	Mr A. Ismail	Financial Evaluation
[28]	Mr J. Dherse	Project Director (during the prefeasibility studies)
[29]	Mr B. S. Adams	Project Director (actual)

- Other sources:

- [3 0]** Financial Times : 8/9/82; 9/6/81; 3/4/79; 11/3/75.
- [3 1]** Project Agreements and related documents, 1980.
- [3 2]** Letter to Codemin, sent by RTZ project director (23/6/1983).
- [3 3]** Programme of work, before submission to RTZ Board in Feb. 1980, file CC MP30.