INTERNATIONAL PROJECT MANAGEMENT

WITH PARTICULAR REFERENCE TO ANTARCTICA AND THE CAPE ROBERTS PROJECT

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EXECUTIVE SUMMARY

Various economic, social and political considerations have led to an increasing number of international projects being implemented. These projects can provide valuable opportunities to all the participants including an increased resource pool, greater depth of knowledge in all areas and top quality state-of-the-art technology.

This report examines the use of project management techniques and how they can be applied to international scale projects. If scientific research is to grow in the future as it has done in the past, many advances and an increased awareness in project management and international relations is essential.

Antarctica, an ideal laboratory, provides the perfect place for nations to participate in interdisciplinary studies and research. With increased global co-operation and collaboration, the research carried out will continue to be refreshing and new, while providing the increased resources and technology required in today’s society, and in the future.
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INTRODUCTION

Antarctica has in the past and will in the future, prove to be an ideal laboratory for scientific research and investigation. Its climate, location and political environment make it so unique that scientist’s flock to the region to undertake a wide variety of experiments and investigations. Many of these could not be performed in the same conditions anywhere else in the world.

Scientific research in the region is highly valuable, causing a forever increasing demand for the most up to date technology. To undertake worthwhile investigations these days, considerable support is needed in terms of resources, personnel and logistics. More often than not, individual countries can not provide the support and funding necessary. This has led to an increase in international projects being performed in Antarctica and the rest of the world.

An increase in the number of international projects has caused widespread interest in project management techniques. Much is already known about the use of project management on small scale projects within a country, however applying these methods to an international scale project can provide many advantages along with substantial disadvantages.

This report outlines the advantages and techniques of project management on an international scale with particular reference to Antarctica and its environment.

Section one details project management, and management styles while the second section analyses project management for global projects. Advantages and disadvantages are outlined along with brief sections on both risk management and international relations.

Section three of the report looks at Antarctica and its use as an international laboratory. Its uniqueness, its isolation and climate providing ideal conditions for many topics of interest. Due to the political situation of the continent, worldwide opportunities for exploration and research are offered, enhancing the benefits of international collaboration and co-operation.

Finally the last section of the report looks at The Cape Roberts Project as a case study. The advantages, disadvantages, opportunities and problems of this international project are outlined with a brief review of issues that could be avoided in the future for similar projects.
Project Management

Project management is by now a relatively well developed management discipline. Projects are directed at achieving specific results. It is these goals that drive the project, and all planning and implementation efforts are undertaken so as to achieve them. Projects are accomplished according to a common life-cycle. Every project, no matter what kind or for what duration, essentially follows the activity sequence of prefeasibility/feasibility, design and contract negotiation, implementation, handover and in-service support. Project management becomes important when the project itself becomes sufficiently difficult that it warrants the application of specific project management concepts, skills, tools and techniques [1].

Project management is the application of a collection of tools and techniques to direct the use of diverse resources towards the accomplishment of a unique, complex, one-time task within time, cost and quality constraints. Each task requires a particular mix of these tools and techniques structured to fit the task environment and life cycle (from conception to completion) of the task [2].

There are primarily four reasons for the widespread adoption of professional and advanced project management today [3]:

1. Management is recognising that many of its organisation’s activities are projects and that the management of projects is different to the management of its other operations.

2. Market conditions are becoming more demanding and projects are becoming larger, leading to a requirement for more professional project management.

3. The rate of change facing industry is increasing and more undertakings are having to be treated as projects with tight time, cost and performance objectives.

4. The problems of integrating multiple disciplines in multi-company undertakings is making the adoption of project management critical to their success.

Project Management Techniques

In pulling together functional disciplines a number of special techniques are used as the project develops through its life cycle. These could include any or all of the following: design management, scheduling, work breakdown analysis, task-responsibility matrices, performance measurement, project organisation, cost control, contract administration, quality management and team selection and building [1]. Appendix A outlines each of these techniques in more detail. Project management is essentially an understanding of how the implementation of a project can be managed.

Success or Failure

Projects are often completed late or over budget, do not perform in the way expected, involve severe strain on participating institutions or are cancelled prior to their completion after the expenditure of considerable sums of money. The principle reasons for project overrun fall into the following categories: inflation, engineering changes,
underestimating costs, schedule changes, poor project definition, technological uncertainty, late approvals and adverse site conditions [1]. Overruns however are not necessarily the best measure of project success. The project may still be profitable even though it exceeds its original budget or is late. On the other hand a contractor may achieve his project management targets but in doing so suffer severe financial loss [1]. It is 'perceived' success or failure by all parties concerned that is important, and it must be viewed in the light of the circumstances affecting the project.

There are several different perspectives which must be employed when assessing whether or not a project was successful. At least three measures of project success can be identified.

(1) Project Functionality. Does the project perform financially, technically or otherwise in the way expected by the project's sponsors?

(2) Project management. Was the project implemented to budget, on schedule, to technical specifications?

(3) Contractors' commercial performance. Did those who provided a service for the project benefit commercially (in either the short or long term)?

There could also be a fourth measure: in the event that a project needed to be cancelled, was the cancellation made on a reasonable basis and terminated efficiently? For it has been argued by some that the process of termination is sometimes of great importance but is often poorly managed.

Table A2 in Appendix A details the main steps that should be completed while undergoing a project. It outlines good practice techniques in each of the areas, giving a good general summary to successful project management.

**The Project Manager**

The skill of the project manager rests, in many fundamental respects, on an innate appreciation of the requirements of progressing the project through this life cycle. In doing so, many issues arise which are common to all kinds of projects, eg those of leadership and organisation, financing, planning and control, and the contracting of third parties.

There are two fundamental lessons that the effective project manager masters. One is how to identify and avoid some of the common pitfalls encountered in managing projects. With this knowledge, the project manager can avoid the more obvious potholes and obstacles. The second lesson is how to organise and carry out the project for success – how to make things happen. It is not enough simply to avoid problems. The effective project manager must also proactively guide the project forward in the best manner possible [4].

If project managers want people to take them seriously and to do their bidding, it appears obvious that they have to create and nurture a base of authority. In the project management area, there are five kinds of authority that they should focus on [4]. The first three are organisational: formal, purse-string, and bureaucratic. They are rooted in the specific organisational setting in which project managers find themselves. The two
remaining kinds of authority, technical and charismatic, are personal. They are intrinsically tied to the project manager's personality and achievements.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal Authority</td>
<td>All project managers possess some degree of formal authority to carry out their work. This formal authority is automatically conferred on them as soon as they have been appointed to the project.</td>
</tr>
<tr>
<td>Purse-String Authority</td>
<td>If project managers have some budgetary discretion and use it effectively, they can exercise authority of the purse strings.</td>
</tr>
<tr>
<td>Bureaucratic Authority</td>
<td>History is filled with examples of individuals who attained power in their organisations through the quiet mastery of bureaucratic skills.</td>
</tr>
<tr>
<td>Technical Authority</td>
<td>Technical workers typically have a high degree of respect for technical competence.</td>
</tr>
<tr>
<td>Charismatic Authority</td>
<td>Perhaps the most useful kind of authority is charismatic. The project manager who possesses charismatic authority is able to get others to listen to him and do his bidding through the force of his personality.</td>
</tr>
</tbody>
</table>

Table 1 - Forms of authority in project management

For project management, interdependence, initiative, team work, freedom, responsibility, and self-motivation are highly valued characteristics. Only project management ranges across the organisation to plan, direct, and control resources to get the job done with little or no formal authority. People who work in project management enjoy the challenge and freedom as well as the turbulence of the environment. Typically, individuals who are comfortable in this type of environment have the physiological and psychological characteristics that are needed to thrive in an unstable, unpredictable, high-risk setting.

Management Style

The way managers interact with their staff is very important to successful project management. There are three basic styles that are frequently discussed in the management literature: autocratic, laissez-faire, and democratic. In autocratic management, the bosses make all the decisions. They exercise tight control over their staff. Laissez-faire management lies at the other extreme. With this management, anything goes. Staff can do whatever they want. It might even be argued that laissez-faire management is nonmanagement; nobody's in charge. Democratic management is participative. Managers and staff make decisions jointly.

In actual project situations, it is neither possible nor advisable for project managers to pursue one style 100% of the time. Effective project managers find that their management style reflects the circumstances facing them. A project manager may adopt a laissez-faire manner with her closest staff during the creative design phase of a project and then adopt a democratic approach during the more routine implementation phase. She may determine that the only way she can get good results out of a troublesome supplier is by behaving in an autocratic fashion with him, yet she may take a laissez-faire approach with another supplier who has proved to be very reliable over the years.

Project Planning

A major portion of the planning effort entails determining the relationship of different tasks to each other and then scheduling these tasks in such a way that the project is carried out efficiently and logically. A number of tools have been developed
over the years that make this undertaking rather routine. Three tools in particular are all that is really necessary to schedule any project, from the simplest to the most complex [4]. They are the work-breakdown structure, the Gantt chart, and the schedule network.

*Work-breakdown Structure*

When people begin scheduling a project, the first thing they often do is to generate a list of all the tasks that will be included in the project. First they take a big-picture view of the project and list the major phases that must be addressed. Then they begin adding detail to each phase; they later add detail to the detail.

A work-breakdown structure is nothing more than a top-down formulation of how project tasks fit into the overall project structure. It is an important planning tool because it serves as the basis of the project schedule.

*Gantt Chart*

The Gantt chart allows the project parties to see easily when tasks should begin and when they should end. On a variation of a bar chart with tasks on the vertical axis and the time statistics on the horizontal axis, project staff know the planned start and finish dates for different tasks. The Gantt chart is also useful for project control when actual start and finish times are added. It then enables a visual comparison of the plan with the actuals. This determines the amount of schedule variance on the project.

*PERT/CPM Schedule Network*

Gantt Charts look at tasks as if they were independent activities and do not take into account their interconnected nature. In the late 1950s, two techniques were simultaneously developed that allowed project staff to examine the consequences of changes of task start and finish dates on the overall project schedule. One technique, developed was called the Program Evaluation and Review Technique (PERT) while the other was called the Critical Path Method (CPM). Both approaches are based on flow charts that look similar, but each has a different way of approaching schedule computations [4].

**Benefits of project management**

The main advantages of adopting a project management approach to any project development include the following:

- more effective delivery of changes because they are planned and implemented in an integrated way, taking care not to affect current operations adversely;
- effective response to disparate initiatives from the top down, filling the gap between strategies and projects;
- support to senior management who need to keep activities focused on project objectives;
• improved resource management, project prioritisation and project integration;

• better management of risk because the wider context is understood and explicitly acknowledged;

• help to achieve real project benefits through a formal process of their management and measurement.
INTERNATIONAL PROJECT MANAGEMENT

New and important applications of the discipline of project management are emerging in response to the changing boundaries of the world. Among the most impressive of these is the use of project management to deal with the multi-national opportunities arising in a world altered by political and economic events and technological advances. With changes so encompassing and multilateral, the integrative approach of project management enables companies and nations to work together in an increasingly complex international business community [5].

Borderless Project Management

Reflecting global trends, co-operation with organisations across external boundaries is growing in importance. As the borders of project management are extended, more complex forces come into play. These can either facilitate the role of the project team or make it more complex and challenging. Projects which extend across companies and countries will encounter differences in managerial values and philosophies, organisational and national cultures, and languages and usage.

The growing globalisation of business makes borderless project management even more necessary. As nations work less independently and more co-operatively in ventures to attain common objectives and goals, the philosophy of borderless project management will increase in use, and as a result, greater co-operation will be fostered among nations. As people from different companies and countries work together on project teams, there will be a technology transfer through personal and business interests, which will draw people and countries closer together.

The borderless project team does whatever is necessary wherever necessary and however necessary, without any border constraints, in pulling the project together and managing it during its entire life cycle. The co-operation of many entities – functional, organisational, political, cultural, and national – is needed to make the project successful.

Borderless projects and initiatives are not without their problems. Language and cultural barriers and differences in management philosophy are posing extraordinary challenges for the discipline of project management.

WHAT IS REALLY DIFFERENT

What is different about borderless project management and the more ‘traditional’ project management:

- The management of the borderless project cuts through organisational and national borders, searching out and applying the resources needed to make the project successful.

- Differences in cultures, traditions, values, philosophies, and languages of the project partners pose special challenges and, if not properly accounted for and managed, may contribute significantly to project failure.

- Attitudes of the project team members, the managers, and the professionals in each of the partner organisations take on added importance, particularly in
recognising the potential that the political, social, cultural, legal, and economic forces can have on the project.

- The financial risks and implications of the project, both in the development effort and during the life of the products and processes that are created, can be immense, going far beyond the financial capabilities of any of the partners operating independently.

The logic of the borderless project manager is to undertake activities anywhere in the world that will minimise the cost, accelerate the schedule, and maximise the technical performance of the project.

**Project Management**

Project management for an international project is not drastically different from the project management process which is carried out for small scale projects. It again uses a systems framework, and is the application of a systems approach to a complex task or project whose objectives are explicitly stated in terms of time, costs, and performance parameters.

An international project will progress through a conceptual stage, planning stage, production stage and a shut down stage. During these stages of the project, there are various project management tools that are particularly valuable in developing countries. These include: feasibility studies, objective definition, cost estimates, time-scale estimates, cash flow analysis, work breakdown, work scheduling, quality assurance and postproject evaluation just to mention a few.

The project manager's job is not confined to controlling events within the project organisation. Often as important to the eventual outcome, are the project's linkages with the external environment. This is particularly the case in an environment which is changing rapidly.

**SOURCES OF POWER**

'Exceptional managers understand that true organisational power is based much more on inspirational leadership than on executive rank and status. These managers have achieved their stature by establishing the power bases that are essential to the exercise of leadership.' [6 pp 7-10]

This above quote implies that when the project manager needs to gain influence with an important actor in the environment, he or she may have to use a conscious approach to using the available forms of power. Developing a personal relationship through social interaction is one obvious form of developing influence.

**GLOBAL PROJECT MANAGEMENT**

Understanding cultural issues requires individuals to stretch themselves intellectually and behaviourally. National and ethnic culture is a complex, multidimensional phenomenon with an extensive historical basis. The dual function of culture is to provide internal integration and external adaptation for groups of people. Culture both
constrains and facilitates human behaviour at all levels of activity. Successful project managers possess a high level of personal and professional integrity.

The global project manager must lead the design and implementation of processes, procedures, systems and structures to organise work better, accelerate decision making, and improve communications and intelligence gathering. All are important to create high-performance flexible network organisations. However, the most critical task for the project management is to establish, clarify, and reinforce the values, behaviours, and knowledge to create a new culture. This culture will synthesise the strengths and differences of all the people who will be part of the global team [5].

International project managers must learn to operate in a different environment. New project teams must often be organised to implement parallel multidisciplinary processes. Whether it is a design/build approach, concurrent engineering, or multifunctional team design, the objective is to organise a project team that can simultaneously execute many of the phases. This requires a great deal of cross-functional involvement and co-operation. But it also leads to shorter product or process development cycles and more predictable manufacturability, reliability, and service.

COMPLEXITIES

When initiating and controlling a global project, many additional complexities may arise due to the interaction with multiple countries. There are numerous sources of complexities however the main ones are outlined in Figure 1.

**Figure 1 – Sources of complexity in the corporate environment**

Opportunities and Threats

International projects require exposure to an environment having several features both at the country and industry levels with which the participant is not familiar fully or even partly. These include the local culture, language, political system, economy, laws,
regulations, work force, and skills. Proper understanding and appreciation of the major differences, and appropriateness of the approaches adopted will minimise the risks and maximise the benefits of the project [5].

There are many opportunities and threats which could exist during the life cycle of an international project. While international projects present several opportunities and advantages, they also involve risks and threats beyond those characteristic of domestic projects, and these vary depending on the country or region and nature and duration of the specific project. Some of the benefits and dangers of international projects are listed in Table 2 below.

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>These projects provide protection against domestic recession, stagnation, and competition and assist corporations in optimal utilisation of resources and production capacity.</td>
<td>Political turbulence/warfare</td>
</tr>
<tr>
<td>They provide a hedge against inflation, currency fluctuations, tariffs, quotas, and similar adverse economic factors and widen the basket of risks and rewards to reduce cyclical vulnerability.</td>
<td>Economic downturns</td>
</tr>
<tr>
<td>They provide access to large international markets.</td>
<td>Sudden changes in laws relating to taxation or repatriation</td>
</tr>
<tr>
<td>International projects provide countries or companies access to mineral, natural, and agricultural resources in the host countries.</td>
<td>Delays due to government controls</td>
</tr>
<tr>
<td>Exposure to an international business and project environment can considerably broaden the perceptions and sensitivities of a company's personnel at various levels, thereby contributing to the development of human resources.</td>
<td>Barriers due to cultures or languages</td>
</tr>
<tr>
<td>An optimal mix of local and foreign workers, materials, and equipment and the benefits of fiscal and financial concessions can reduce costs and increase productivity and efficiency.</td>
<td>Protection of intellectual property</td>
</tr>
<tr>
<td>The presence of a corporation in a particular country, even if it is achieved through entry in a small way, can lead to larger and recurring future business opportunities in that region.</td>
<td>Industrial unrest</td>
</tr>
<tr>
<td>Successful implementation of projects in an international environment can enhance the image of a company and elevate its status from the domestic to a transnational level.</td>
<td>Inadequate prior assessment</td>
</tr>
</tbody>
</table>

*Table 2 – Opportunities and threats of global projects*

**CRITICAL SUCCESS FACTORS**

Appendix A, Table A3 outlines ten major critical success factors of good project management. Project managers can make practical use of these factors by the following four-step process:

1. Periodically monitor the 10 factors over time
2. Use consensus to develop a collective picture of the project
3. Pay close attention to low factors
4. Visually emphasise the critical success factors

By doing this, a continual reflection and analytical process is formulated which will give on-going feedback as to the progress and success of the project.
Risk Management

"Everyone in business makes mistakes. If you didn't take risks, you'd never get anything done. The sin would be if you made the same mistake more than once." - Michael Eisner, Chairman and CEO, Disney Corporation (quoted in Henkoff, 1995)

The management of risk is the process by which risks are identified, estimated, evaluated, controlled and monitored. Risks may be related to a wide variety of causes including the management of business change, project or programme change or technical aspects of the project. Management of risk should be an important component of project management, to increase confidence in the overall success of the programme. To ensure that risk is managed effectively, the management of risk needs to be built into the programme's decision-making process [3]. The processes to support this are:

- Risk Analysis: identifying and quantifying threats to the successful completion of the project and identifying possible courses of action to eliminate these threats
- Risk Management: having decided on the appropriate course of action, plans must be detailed, resources scheduled and the whole controlled and monitored so that progress can be assessed and the status of risks updated.

Risk analysis and risk management are not activities to be carried out once only; they are part of the continuous decision-making process. In particular, risk analysis and management should be carried out at the end of each section of work and the outcome should be fed into the planning of future sections. It will provide the project manager with the means of avoiding major problems.

Risk management is a systematic process in which risk factors are identified, evaluated, and planned for. It is a formal approach to sorting through numerous and varied uncertainties in order to identify critical issues and provide contingencies for dealing with any difficulties that may arise.

International Relations

CULTURE

Organisational culture can be defined as the collective set of values, beliefs, assumptions, and symbols that consciously and unconsciously guides the way a firm conducts its business. In the most simplistic sense, culture is collective mental programming.

In the global marketplace the right kind of culture is one that sustains a dynamic flexible organisation, stimulates innovation, and uses the synergy of the team to accomplish its mission. Creating this type of culture is a job that project management is well qualified to carry out.

It is vitally important to be aware of cultural tendencies which may be different than our own and which may exert significant influence on our business transactions. Relevant cultural factors to program management practices include:
• Factors associated with different managerial styles, negotiation tactics, legal systems, financial processes etc present the greatest problems. While it is impossible to completely resolve these differences, it is possible to lessen them with knowledge, understanding, and preparation.

• The importance of adjusting your international negotiating style according to the culture with which you are dealing. An international negotiator must not only be aware of cultural differences which exist, but also individual differences.

• Personal relationships and their importance in the international arena. It is important to create an atmosphere of trust throughout the entire program. This trust can be built through social contact, honesty, patience, and understanding of different cultures/customs.

• Several management and/or organisational factors have important influences on the success of international transactions. These factors are directly controlled by the program manager and therefore should be considered before venturing into an international program.

INTERNATIONAL ORGANISATIONS

The development of intergovernmental and non-governmental international organisations is one of the most striking features of international relations in the twentieth century. Increased co-operation, co-ordination and harmonisation of policy across state boundaries has resulted in the creation of permanent international organisations. This suggests both the development of some kind of international consciousness and also the inability of elite's to manage either domestic or international relations effectively in the absence of joint action.

The ability of international organisations to affect the international environment depends on the uses made of them by state actors and their competence to perform significant roles over a wide range of international interactions.
WORKING IN ANTARCTICA

Why working in Antarctica is different?

No one who visits Antarctica comes away unchanged. The beauty of its amazing wildlife, its constantly changing light, and the many shapes and colours of its ice, are overwhelming. Isolation, hardship and danger bind people into a special relationship with each other and with the landscape.

Antarctica is a unique laboratory that provides special opportunities for science. The ice and snowcap contains an undisturbed history of global climatic changes that can tell a great deal about the effects of such alterations on the global and regional environments. The study of Antarctic terrestrial and marine ecosystems includes an examination of how life has adapted to extremes of the Antarctic environment. The polar situation itself creates a set of phenomena, such as the convergence of magnetic lines at the South Magnetic Pole, that can be studied only in Antarctica (or the Arctic).

ENVIRONMENT

Antarctica has an extreme environment, and thus is very different to work in than other areas of the world. It is the coldest, the windiest, the driest and the highest continent on earth. It is a continent completely surrounded by the Southern Ocean and due to the isolation, is considerably difficult to get to. A permanent ice sheet covering the continental rock comprises 87% of Antarctica's area while 11% is permanent floating ice shelves. Only 2% of the continent is exposed rock and in winter the ice covered area more than doubles [13]. The constant winds can cause unbearably cold temperatures, and due to the combination of all its characteristics, all essential life support systems for people to survive, must be imported from outside. This includes clothing, food, shelter and energy.

The isolation and climate of Antarctica do not just cause physical problems in humans. Some of the costs experienced by people working in Antarctica include the separation from friends and family, the cold and the lack of light in winter (or lack of darkness in summer), and the stress of living in confined quarters with a small unchanging group of companions all day every day. Also there is a lack of recreation opportunities both indoor and outdoor.

THE POLITICAL SITUATION

Antarctica has a unique system of government. No one owns it, although seven nations claim parts of it. An international treaty gives all countries the right to explore its scientific mysteries, but none the right to exploit its resources. It is defined as a natural reserve devoted to peace and science.

For an international project to take place in Antarctica, the countries need to come to a consensus on many issues related to location of investigations, logistics, environmental issues, funding issues etc. Because of the nature of the political system of Antarctica, there is no set rules for any part of the continent, except those which fall under the Antarctic Treaty System. Thus any differing values due to cultures with regard to the environment must be challenged and conceded upon.
LOGISTICS

Antarctica is a difficult place to live and visit simply due to its climate and location as mentioned above. Getting to the continent by boat is time consuming, or by plane is expensive not to mention the fact that you are never guaranteed to land. Once at Antarctica, the difficulty and cost of keeping people there is significant. Shelter is essential, food consumption is higher due to the climate, clothing is expensive and energy is required for lighting, heating and the running of equipment.

Due to the extreme environment, the technology used in the area must be the most advanced in its field. This in itself is a difficult task, as the extensive knowledge required in many different fields to perform state-of-the-art projects in Antarctica is vast.

Running a project of any scale in Antarctica requires special planning in all these areas to enable the survival of the personnel involved, and the survival of the project. As opposed to projects in other areas of the world, if the planning and preparation is not done properly before the project, changes can not be easily made and extra supplies and personnel can not be obtained without difficulty. All of the logistics involved with project management in Antarctica are costly, and more often than not, the funding can not be provided entirely by one country alone. This is when international projects really become beneficial.

Despite the introduction of modern technology to operations in the Antarctic, the area still remains the most hostile on Earth to human activities. Full possible co-operation in all endeavours remains paramount for the safety of all personnel and for the success of their work. Timely and detailed exchanges of information between all active parties are vital to achieve this high level of co-operation.

There is no exception to project managers in Antarctica. To survive, manage a project, obtain results, collaborate and co-operate with colleagues, project managers need to be tolerant, self-sufficient, co-operative and fairly conformist.

International co-ordination and collaboration

"The significant problems we face cannot be solved at the same level of thinking we were at when we created them." Albert Einstein

International co-ordination is bringing different national scientific research programs and studies in different fields into appropriate or suitable relationships, so that the different parts build on each other. Its objectives may be to reinforce the growth of knowledge, to make best use of logistics, scientific, and financial resources, and/or to give effect to polity priorities. Co-ordination will often need a formal level of institutional recognition and management; it can be achieved by collaborative joint efforts or by direct co-operation, and it can take place on various scales and at various stages of activity. Co-ordination requires communication, and it can be furthered by competition.

International collaboration is scientists from different nations, organisations, and/or disciplines actively working together in a joint enterprise. It may be formally organised or ad hoc, and it may be carried out on a large scale through major international
programs or on a small-scale, scientist-to-scientist basis. It may contribute to coordination, and it may also simply result from direct co-operation.

International co-operation is working together by different groups or different scientists toward the same objective, without necessarily being linked in a joint enterprise.

A CONTINENT FOR COLLABORATION

Results of scientific research in Antarctica and the surrounding ocean are freely available within the international scientific world - not only between scientists of countries themselves active in Antarctic research but to scientists of all other countries as well. The world's scientific community has long recognised the need for scientific research in Antarctica and the surrounding ocean. Few nations, however, have possessed the will as well as the sophisticated technologies and scientific resources necessary to undertake major programmes in the harsh and difficult regions of the Antarctic. Governments with adequate resources have made them available for research, with little material reward for themselves, as a contribution to Man's understanding of his global environment. The results benefit all peoples of the world, and the openly available scientific knowledge gained has provided, and still does provide the only factual basis on which governments can make rational judgements on emerging practical issues.

The number of countries contributing to Antarctic research has grown in recent years and it is expected that this trend will continue. The unique nature of the Antarctic Treaty actively promotes the concept of freedom of scientific investigations and freedom for scientists to work anywhere they wish. This provides a sound governmental basis for scientists of different nations to work together. The scientists themselves are anxious to do this because of the magnitude of many of the problems needing to be studied, some of which are beyond the capability of any one nation to tackle alone. Also, in many instances, the pooling of resources by two or more nations for a particular study enables more effective use to be made of these resources. Great benefit is derived from multinational teams of scientists on a research project.

It is important to all mankind to ensure that the existing goodwill and international collaboration among Antarctic scientists continue to be encouraged so as to permit the scientific research to advance in the future as it has since the conception of the International Geophysical Year [11].

International Research in Antarctica

"The demand of science, that no part of the globe shall remain untouched by the hand of investigation, was the force that drew our little band to the land of the farthest south." Otto Nordenskjold – Antarctica (Flurst and Blackett, London, 1905)

The Antarctic is proof that great things can be achieved through co-operation. What has been achieved in the name of science in the Antarctic region has been, and is being, achieved largely through international co-operation, between scientists and scientists and governments and governments.

The opportunities of Antarctica's developing role in global, interdisciplinary science lie in deriving the most benefit for the most people through greater scientific understanding and utilisation of its results.
The internationalisation of Antarctic science also means that international organisations can play an increasingly important role in communicating opportunities for and organising co-ordinated and/or collaborative activities. Not only are they in touch with a larger and more diverse membership than is presently represented in Antarctic political forums, they also tend to serve as a fulcrum for developing programs of global scope [12].

The nature of scientific research in Antarctica has changed significantly since the first explorer/scientists took off to chart the unknown in the early 1800s. The 30 years since the IGY have moved Antarctica to centre stage in a number of large-scale, interdisciplinary investigations into global phenomena [12]. Yet as research opportunities multiply, restricted growth in national budgets for Antarctic research, combined with the high costs of carrying out today’s more sophisticated research activities using satellite and computer system, are making it more difficult and expensive to establish individual national ‘state-of-the-art’ programs and to upgrade existing ones.

Four potential values of increased international co-ordination of scientific research in Antarctica may include:

- Cost-effectiveness and efficiency in an era of rising costs and restricted budgets;
- Attainment of improved scientific results due to wider collaboration in the planning and execution of scientific programs;
- A potential reduction in adverse environmental impacts, to the extent that research and logistics facilities can be shared among different national program, diminishing the area impacted and the intensity of impact; and
- Providing additional opportunities for scientists from more countries to take part in Antarctic scientific research, in order to help accommodate increasing international interest in Antarctica.

SCAR AND THE ANTARCTIC TREATY

SCAR and the Treaty have functioned independently side by side since both came into existence after the IGY. Without their mutually supportive relationship, it is doubtful that Antarctic science would have reached its present level of sophistication. The continuation of SCAR and the Treaty are fundamental to the continuation of further scientific discoveries in the Antarctic.

The greatest challenge to SCAR lies in its ability to deal with other international bodies and to address non-scientific issues without compromising the distinction between science and politics. As an organisation, SCAR is an advocate only of the continuation of high-quality scientific research programmes in the Antarctic. So long as SCAR can keep this mission in the forefront of its activities, and so long as its scientists can maintain strong programmes of high scientific merit, SCAR will continue to flourish as the only international body dedicated solely to the advancement of knowledge on this unique area of the planet [11].
CASE STUDY – THE CAPE ROBERTS PROJECT

Background Theory

The Cape Roberts Project is a joint venture by scientists and the national Antarctic programmes of Australia, Germany, Italy, New Zealand, the United Kingdom and the United States of America. The aim is to recover and analyse cores from the sedimentary strata beneath the sea floor off Cape Roberts in the Ross Sea, Antarctica. The strata are over 1500m thick and represent parts of the time period between 15 and more than 100 million years ago.

The uniqueness of this project uses international co-operation and collaboration to ensure all resources and funds are used to their maximum benefit while the variety of participants and the interdisciplinary nature of knowledge provides wide range of expertise in many fields.

Managing The Cape Roberts Project

PROJECT INITIATION

The Ross Sea Region has a previous history of drilling projects at several different sites. Additional interest from New Zealand to drill deeper in time provided the incentive to plan another large scale drilling program. It was apparent from early in the planning stage that the scale of the project would need to be large to obtain the information of greatest scientific interest, and thus the cost of solely performing a project of this size was out of New Zealand’s capabilities.

New Zealand’s approach to other countries for their support created a nation wide interest in the project, and through various academic links around the world, New Zealand quickly had the financial and scientific support of four other countries. Planning of the project was begun, and collaborative meetings were held between all participants in the project. It was evident at an early stage that a project extension would exceed the initial budget, and additional funding was necessary to finish the project. This lead to Australia becoming the sixth participant in the Cape Roberts Project.

The initiation of the Cape Roberts Project was largely due to networking throughout the world. Each contact that demonstrated an initial interest in the project, was able to approach and influence their respective Antarctic programmes to create a national interest while gaining the financial support for their role in the project.

MANAGEMENT STRUCTURE

The management structure of the Cape Roberts Project was discussed and a consensus made at the initial international meetings. Two committees were determined and were called the International Steering Committee (ISC) and the Operations/Logistics Management Group (OMG).
Overall supervision of the project is to be the responsibility of the ISC while the logistics support for the project is the responsibility of the OMG. Decision making is by consensus and the committees comprises representatives of the Parties Contributors.

The other important figures in the management structure of the project include the Project Science Co-ordinator, the Project Manager and the Project Science Operations Manager. These three people deal with the science programme, the resources of the project and the organising the equipment and personnel at the drill site respectively.

The running of each country's Antarctic Programme including the scientists involved with the project is completely up to the country itself in the way it is managed and budgeted. This eliminates problems with differences in management strategies, culture and finance arrangements. Communication problems due to language and differences for the project was not seen as a potential problem. This was because the official language for the Antarctic Treaty is English, and therefore was the common language for all project meetings and documentation.

RESOURCES AND FUNDING

An estimated overall cost for the project was determined over a period of five years. It was decided that any projected increase of more than 5% of the estimated cost would require negotiation while the budget would be reviewed and refined by the OMG after each completed season's work.

It was also decided that contributions to the project shall be through the commitment by the national programme of Parties Contributors of both operational and financial resources. The contribution of Parties Contributors was determined on a percentage basis for each country, and each Party Contributor would be entitled to a degree of scientific involvement in the project that is in general proportion to its contribution to the logistic support of the project. Each Party will bear the cost of its own scientific work and of the attendance of its representatives at meetings connected with the Project.

DOCUMENTATION

Several documents have been released outlining procedures, plans, safety precautions, diagrams, management structures and budgets. The combination of these reports provide the basis for the project and outline all aspects of the project from start to finish including post-project documentation.

Key documents for the project are:

- The Record of Understanding between Parties Contributors. The document established the project by setting up terms of reference and the two main bodies, the ISC and the OMG.

- The Operations Plan - was drafted in New Zealand and is the authoritative source for all practical aspects of the Antarctic phase of the project.
• The Science Plan – provides an overview of the scientific work to be carried out and how it is to be managed. Includes information on scientific practise by participating scientists and science groups.

• A report published by the Royal Society of New Zealand on the 1992 workshop to plan the Cape Roberts Project. This outlines the scientific rationale, the drilling programme, logistic requirements and a plan for Comprehensive Environmental Evaluation (CEE).

• The Drilling Manual – documents drilling equipment and practise for the project.

• The Comprehensive Environmental Evaluation – circulated and approved by the Antarctic Treaty System, and is the project’s guide to sound environmental practice.

• Other scientific reports including post-project documentation will also be produced including daily progress reports from the field.

CRITICAL SUCCESS ANALYSIS

The following section outlines a brief critical success analysis for the Cape Roberts Project.

As shown in Appendix A, Table A3, there are 10 major success factors of good project management. By periodically monitoring the factors over time, developing a collective picture of the project, looking closely at low factors and visually emphasise the critical success factors, a continual reflection and analytical process is formulated which will give on-going feedback as the progress and success of the project.

The third column in the table below shows a brief review of the Cape Roberts Project in how it has been initiated and its success of each goal.

<table>
<thead>
<tr>
<th>Success Factors</th>
<th>Aspiring Goal</th>
<th>The Cape Roberts Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mission</td>
<td>Initial clarity of goals and general directions</td>
<td>Initial goals were clearly defined, specifically set out in the Record of Understanding.</td>
</tr>
<tr>
<td>Top management</td>
<td>Willingness of top management to provide the</td>
<td>New Zealand’s top management provided the incentive for the project, while top management in</td>
</tr>
<tr>
<td>support</td>
<td>necessary resources and authority/power for project success</td>
<td>each party provided the resources and funding.</td>
</tr>
<tr>
<td>Project schedule/plans</td>
<td>A detailed specification of the individual action steps required for project implementation</td>
<td>A detailed plan was constructed and is outlined clearly in the Operations Plan. This includes Gantt charts and a detailed programme of all project phases.</td>
</tr>
<tr>
<td>Client consultation</td>
<td>Communication, consultation, and active listening to all affected parties</td>
<td>Communication and consultation was performed at the ISC and OMG meetings with all representatives from parties present.</td>
</tr>
<tr>
<td>Personnel</td>
<td>Selection, recruitment, and training of the necessary personnel for the project team</td>
<td>Training workshops were planned and run for all parties involved with the practical side of the project. Careful selection and recruitment of major project figures was performed.</td>
</tr>
<tr>
<td>Technical tasks</td>
<td>Availability of the required technology and expertise to accomplish the specific technical actions</td>
<td>All technology was available by the time of the project commencement including personnel and expertise to successfully complete the first drilling season at Cape Roberts to date.</td>
</tr>
<tr>
<td>Client acceptance</td>
<td>The effect of “selling” the final project to its ultimate intended users</td>
<td>Pamphlets and publicising was performed to make the public aware of the project, its mission and its progress. Thus gaining support in the public and scientific communities.</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Monitoring and feedback</td>
<td>Timely provision of comprehensive control information at each stage in the implementation process</td>
<td>Daily, weekly and monthly monitoring has been performed to date while seasonal feedback has lead to the completion of progress reports including results, problems and changes.</td>
</tr>
<tr>
<td>Communication</td>
<td>The provisions of an appropriate network and necessary data to all key actors in the project implementation</td>
<td>Communication networks are apparent to allow information to flow to all major parties in the project. No major problems have been outlined to date.</td>
</tr>
<tr>
<td>Troubleshooting</td>
<td>The ability to handle unexpected crises and deviations from plan</td>
<td>Safety, search and rescue and contingency planning has been performed and is outlined in the Operations Plan.</td>
</tr>
</tbody>
</table>

**Table 3 - Critical success analysis for The Cape Roberts Project**

**PROBLEMS FOUND AND OVERCOME**

As with all projects in history, there are always problems which are found, and situations which could have been handled in a better, more constructive or more efficient manner. The following points outline a few problems involved with The Cape Roberts Project which could have been dealt with in another way, or could have been planned for a little differently.

- A considerable amount of time was spend on providing the foundations of the project, however it has since been felt that additional time was perhaps necessary to set guidelines, procedures and general fundamentals of the project.

- Significant problems with funding and funding bodies was apparent. Due to some parties contributing straight money, while others contributed a proportion of resources and money, differences in opinion resulted when trying to put a price on resources. This is a difficult task at the best of times and was emphasised in the project, due to its multi-national nature.

- It was noted that an important initial task for a large scale project such as this, was that key decision makers must be taken on site as early in the project development as possible. This will enable important decisions to be made correctly and efficiently with a realistic frame of mind and the essential required background knowledge.

- Another point noted by management was that for a collaborative project such as this, it is important that nothing is to be taken for granted. With differences in policies, culture, morals and methods for performing tasks, considerable hurdles can be met which could prove to be a great deal more crippling than necessary.

- It is important that collaborative projects are seen by everyone as being a collaborative project. All parties involved in the project must be made to feel equal in terms of contribution, validity in opinion and publicity. This has to date been performed well, with all publicity including all parties names, and all findings being of a collaborative nature. It is a collaborative project where no one scientist or no one country gets the rewards. Thus care must be taken that
the project is promoted as an international collaborative project, and that results are collaborative as well.

- Another problem outlined in the progression of the project so far involved an environmental analysis. The Antarctic Treaty has environmental guidelines, however each country has their own guidelines which they are to work by. Again, due to differences in opinion, these guidelines can and will never be identical. This has already proven to be a problem when tasks at the site are being performed, and to what extent the environment is being disturbed.

- Another significant problem facing management in the future involves the resources and equipment and what to do with them upon completion of the project. Does the equipment get left down on the continent for possible future drilling projects or does it get handed over to another country who may use it under less strict environmental guidelines, thus presenting the opportunity for public disapproval in other parties country's.

- Unusually thin ice one season with the addition of a storm caused a major delay in the project. Drilling for the season was ceased and was postponed until the following year causing a years extension for the final completion date of the project. The major problem with this delay was the personnel on site who were initially preparing for a season of work, then finding out the project had been halted for a year. This left some personnel with no work, and no backup schemes. Due to this situation, a contingency was set up, so that if this situation happened again during a following season, all personnel would receive a portion of wages for their inconvenience.

OUTCOME OF THE CAPE ROBERTS PROJECT

The project is still only half complete and post project evaluations have not been carried out. It is difficult to determine the problems and successes of various aspects of the project management however it would appear that a comprehensive preproject planning stage was undertaken with all relevant and important documents completed and distributed to the necessary parties. Collaboration between countries appeared to be successful, while the co-operation of all parties has enabled the first two stages of the project to be carried out without any major problems.
CONCLUSION

Project management is a procedure essential to the success of projects, both small and large. No two projects are the same and therefore the project management of every project will be individual and unique to that project. It is the project managers job to analyse the situation and decide on the most effective and most efficient method of organising, running and evaluating the project.

International project management requires some additional techniques with respect to planning, communicating, co-operating, collaborating and running the project. International projects provide the opportunity for greater and more advanced resources and technology while also providing a larger range of expertise in specific fields.

With the increase of global projects occurring around the world and in Antarctica, collaboration and co-operation have proven to be essential qualities required to lead a project to success. If scientific knowledge and research is to expand in society today, an increased awareness of these qualities is required. The advantages will allow countries to work together, to enforce the growth of knowledge and to make the best use of logistics, scientific and financial resources.

Antarctica’s unique environment can and has in the past, provided special opportunities for science. The continent has identified global problems, increased the wealth of knowledge in the world today, and has brought countries together on neutral ground to work as a team to achieve a common goal. This sort of involvement in Antarctica has been guided by the Antarctic Treaty System.

Despite the introduction of modern technology to operations in the Antarctic, the region still remains the most hostile on earth to human activities. Its climate, isolation, and political environment make the continent unlike anything else in the world.

The combination of these attributes requires a precautionary approach to logistics and operations of projects in Antarctica. This includes working towards the opportunities and recognising the threats by planning, evaluating and reporting thoroughly, at all stages of the project. Clear communication between all parties and personnel is paramount to ensure the maximum benefit of the situation, parties and the environment is achieved.

To ensure a high quality of future projects in Antarctica producing state-of-the-art results, the benefits of international projects and their management need to be emphasised and promoted to both the public sector and the scientific communities around the world. This increased awareness can be done by increasing global communication and collaboration, and promoting interdisciplinary studies and research not just in Antarctica.

An increased awareness of working in Antarctica must be developed, clearly outlining all benefits, opportunities, difficulties and risks involved. This will lead to a greater knowledge of project management in the region. The co-operation and collaboration of international scientific communities must strive to maximise the benefits of guidelines in the Antarctic Treaty System, allowing scientific research to advance in the future as it has done in the past.
**APPENDIX A**

<table>
<thead>
<tr>
<th>Specifications</th>
<th>A traditional engineering tool, specifications play a fundamental part in establishing the project baseline. Specifications can be very detailed or merely performance.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work breakdown structures</td>
<td>A work breakdown structure is a family tree division of all the products, services and other work tasks which organise, define and graphically display the project to be completed. The top 2-4 hierarchic levels define the functional basis of the project, the bottom 1-2 define the project’s activities.</td>
</tr>
<tr>
<td>Configuration Management</td>
<td>The technique of defining and monitoring the project’s engineering configuration and, when used with change control, ensuring all parties are using the same appropriate, up-to-date configuration information.</td>
</tr>
<tr>
<td>Bar Charts</td>
<td>Developed by Gantt in the early 1900’s. The bar charts show activities as horizontal bars displayed against a horizontal time scale. Bar charts do not show activity interrelationships.</td>
</tr>
<tr>
<td>Network scheduling</td>
<td>Developed in the late 1950’s, networks show activity interrelationships. Essentially, no activity can leave a node until all those entering it are completed. Precedence techniques have greater communicative power, and avoid dummies which are often necessary for purely logic reasons. The critical path is the longest path through the network (zero slack).</td>
</tr>
<tr>
<td>Task-responsibility matrices</td>
<td>Task-responsibility matrices range organisational unit against work breakdown structure elements so that responsibilities are clear. This is particularly valuable on large, complex projects.</td>
</tr>
<tr>
<td>Performance measurement</td>
<td>Project control requires knowing accurately the actual progress achieved. This necessitates that progress be measured physically. Measurement based on invoices is too imprecise. Combining physical and financial reporting is difficult.</td>
</tr>
<tr>
<td>Matrix organisation</td>
<td>There are essentially three kinds of organisation found on projects: functional, project and matrix. In functional organisations, responsibility and authority lie with functional managers, in projects with the project manager. In a matrix, they are shared. A team member thus has two bosses. The three forms are not mutually exclusive.</td>
</tr>
<tr>
<td>Cost Control</td>
<td>As with performance measurement, cost control necessitates knowing actual costs. There are four basic classes of cost data: budgeted, committed, incurred and forecast.</td>
</tr>
<tr>
<td>Contract administration</td>
<td>At the contract management level, project management often becomes the skill of negotiating and administering the contract, its risks, contingencies and clauses – particularly when variations are introduced.</td>
</tr>
<tr>
<td>Quality Assurance</td>
<td>Quality control is the checking that quality is satisfactory. Quality assurance is ‘all activities and functions concerned with the attainment of quality’, it is a whole philosophy of management geared to this end.</td>
</tr>
<tr>
<td>Team building</td>
<td>Selecting the group of people who will work on the project, and welding them into a team by providing leadership and motivation and by properly handling conflict, is a prerequisite of effective project management. Specific tools exist to facilitate this task.</td>
</tr>
</tbody>
</table>

*Table A1 – Commonly used Project Management procedures*
<table>
<thead>
<tr>
<th><strong>Factors for Project Success</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project definition</strong></td>
</tr>
<tr>
<td>Define comprehensively.</td>
</tr>
<tr>
<td>Communicate clearly.</td>
</tr>
<tr>
<td>Phase as appropriate.</td>
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<tr>
<td>Identify, assess and</td>
</tr>
<tr>
<td>develop sub-objectives clearly.</td>
</tr>
<tr>
<td>Relate objectives to</td>
</tr>
<tr>
<td>participants.</td>
</tr>
<tr>
<td>Do not force clarity until</td>
</tr>
<tr>
<td>appropriate.</td>
</tr>
<tr>
<td>Beware of progressive change.</td>
</tr>
<tr>
<td>Avoid too early a</td>
</tr>
<tr>
<td>commitment.</td>
</tr>
<tr>
<td>**Planning, design</td>
</tr>
<tr>
<td>and technology management**</td>
</tr>
<tr>
<td>Attend to broader, systems</td>
</tr>
<tr>
<td>aspects of projects.</td>
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<tr>
<td>Relate to phasing, logistics,</td>
</tr>
<tr>
<td>geophysical</td>
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<tr>
<td>uncertainties, and the</td>
</tr>
<tr>
<td>design and production</td>
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<tr>
<td>relation.</td>
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<tr>
<td>Have back-up strategies for</td>
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<tr>
<td>high risk areas.</td>
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<tr>
<td>Develop the accuracy of</td>
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<tr>
<td>estimates to an extent</td>
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<tr>
<td>consistent with the</td>
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<tr>
<td>uncertainties present (eg</td>
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<tr>
<td>technology, methods).</td>
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<tr>
<td>Avoid concurrency.</td>
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<tr>
<td>Test design adequately before</td>
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<tr>
<td>final project</td>
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<tr>
<td>commitment is made.</td>
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<tr>
<td>Recognise the extent to which</td>
</tr>
<tr>
<td>research and development</td>
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<tr>
<td>is completed will</td>
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<tr>
<td>affect accuracy of estimate.</td>
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<tr>
<td>Use flexible design</td>
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<tr>
<td>philosophies.</td>
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<tr>
<td>Recognise that good design</td>
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<tr>
<td>management is essential,</td>
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<tr>
<td>especially where there is</td>
</tr>
<tr>
<td>technical uncertainty or</td>
</tr>
<tr>
<td>complexity.</td>
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<tr>
<td>Recognise that interface</td>
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<tr>
<td>management is important where</td>
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<tr>
<td>there are significant</td>
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<tr>
<td>interdependencies.</td>
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<tr>
<td>‘Freeze’ design once agreed.</td>
</tr>
<tr>
<td>Beware of switching design</td>
</tr>
<tr>
<td>authority during different</td>
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<tr>
<td>phases of project.</td>
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<tr>
<td>Pay attention to detail since</td>
</tr>
<tr>
<td>mistakes can prove costly.</td>
</tr>
<tr>
<td>Encourage replication where</td>
</tr>
<tr>
<td>appropriate.</td>
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<tr>
<td><strong>Politics/Social factors</strong></td>
</tr>
<tr>
<td>Ensure effective sponsorship.</td>
</tr>
<tr>
<td>Recognise fiscal, safety,</td>
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<tr>
<td>employment, etc., constraints.</td>
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<tr>
<td>Ensure support for such</td>
</tr>
<tr>
<td>management actions as may be</td>
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<tr>
<td>necessary.</td>
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<tr>
<td>Constrain nationalistic</td>
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<tr>
<td>aspirations on international</td>
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<tr>
<td>projects.</td>
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<tr>
<td>Manage community factors</td>
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<tr>
<td>effectively.</td>
</tr>
<tr>
<td><strong>Schedule duration</strong></td>
</tr>
<tr>
<td>Recognise the major impact</td>
</tr>
<tr>
<td>that output, price, regulation,</td>
</tr>
<tr>
<td>technical developments,</td>
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<tr>
<td>government or corporate changes</td>
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<tr>
<td>can have on definition of</td>
</tr>
<tr>
<td>success.</td>
</tr>
<tr>
<td>Phase projects where possible</td>
</tr>
<tr>
<td>to avoid unnecessary</td>
</tr>
<tr>
<td>over-commitment.</td>
</tr>
<tr>
<td><strong>Schedule urgency</strong></td>
</tr>
<tr>
<td>Avoid rushing. Note possible</td>
</tr>
<tr>
<td>disruptive effect on</td>
</tr>
<tr>
<td>working sequencing. Beware of</td>
</tr>
<tr>
<td>impact on full</td>
</tr>
<tr>
<td>discussion by all parties.</td>
</tr>
<tr>
<td>Beware of when urgency and</td>
</tr>
<tr>
<td>technical uncertainty</td>
</tr>
<tr>
<td>go together (concurrency).</td>
</tr>
<tr>
<td><strong>Finance</strong></td>
</tr>
<tr>
<td>Undertake full financial</td>
</tr>
<tr>
<td>analysis of all project risks:</td>
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<tr>
<td>support, owner's commitment,</td>
</tr>
<tr>
<td>etc., including inflation,</td>
</tr>
<tr>
<td>and possible currency</td>
</tr>
<tr>
<td>variations.</td>
</tr>
<tr>
<td>Be cautious over availability</td>
</tr>
<tr>
<td>of funds.</td>
</tr>
<tr>
<td>Be prepared to stop funding</td>
</tr>
<tr>
<td>where necessary. Seek sponsors</td>
</tr>
<tr>
<td>interested in success of</td>
</tr>
<tr>
<td>project, not just a good return.</td>
</tr>
<tr>
<td>Beware of exchange rate</td>
</tr>
<tr>
<td>movements.</td>
</tr>
<tr>
<td>Check definition of project</td>
</tr>
<tr>
<td>success if business base of</td>
</tr>
<tr>
<td>project changes.</td>
</tr>
<tr>
<td><strong>Legal agreements</strong></td>
</tr>
<tr>
<td>Ensure break clauses are</td>
</tr>
<tr>
<td>adequate. Beware of 50-50</td>
</tr>
<tr>
<td>partnerships. Beware of mixed</td>
</tr>
<tr>
<td>public-private funding.</td>
</tr>
<tr>
<td>Seek commitment to making</td>
</tr>
<tr>
<td>contract work.</td>
</tr>
<tr>
<td><strong>Contracting</strong></td>
</tr>
<tr>
<td>Consider whether more</td>
</tr>
<tr>
<td>innovative contractual</td>
</tr>
<tr>
<td>arrangements may not be</td>
</tr>
<tr>
<td>required. Consider incentive</td>
</tr>
<tr>
<td>contracts valuable where it</td>
</tr>
<tr>
<td>is difficult to get competition,</td>
</tr>
<tr>
<td>though beware of too high a</td>
</tr>
<tr>
<td>level of technical uncertainty.</td>
</tr>
<tr>
<td>Ensure contractors are</td>
</tr>
<tr>
<td>sufficiently experienced to</td>
</tr>
<tr>
<td>perform the work. Consider</td>
</tr>
<tr>
<td>extent to which competitive</td>
</tr>
<tr>
<td>bidding is appropriate.</td>
</tr>
<tr>
<td>Beware of same organisation</td>
</tr>
<tr>
<td>acting as contractor and</td>
</tr>
<tr>
<td>owner. Provide adequate bid</td>
</tr>
<tr>
<td>preparation time. Beware of</td>
</tr>
<tr>
<td>the cheapest bid. Beware of</td>
</tr>
<tr>
<td>having to manage a large</td>
</tr>
<tr>
<td>number of contracts. Define</td>
</tr>
<tr>
<td>contractor’s responsibilities</td>
</tr>
<tr>
<td>clearly. Make contractors</td>
</tr>
<tr>
<td>financially responsible for</td>
</tr>
<tr>
<td>their performance as far as</td>
</tr>
<tr>
<td>possible. Beware of contract</td>
</tr>
<tr>
<td>forms which unfairly penalise</td>
</tr>
<tr>
<td>contractor, particularly for</td>
</tr>
<tr>
<td>factors outside his control.</td>
</tr>
<tr>
<td>Question the threat of</td>
</tr>
<tr>
<td>liquidated damages. Appraise</td>
</tr>
<tr>
<td>carefully whether interference</td>
</tr>
<tr>
<td>by the owner in the execution</td>
</tr>
<tr>
<td>of a contract is justified.</td>
</tr>
<tr>
<td><strong>Project implementation</strong></td>
</tr>
<tr>
<td>Seek appropriate client, parent</td>
</tr>
<tr>
<td>company and senior management</td>
</tr>
<tr>
<td>attitudes and support.</td>
</tr>
<tr>
<td>Control all those aspects of</td>
</tr>
<tr>
<td>project which can affect the</td>
</tr>
<tr>
<td>chances of success. Recognise</td>
</tr>
<tr>
<td>the magnitude of task and</td>
</tr>
<tr>
<td>organise appropriately.</td>
</tr>
<tr>
<td>Obtain clear client guidance.</td>
</tr>
<tr>
<td>Foster good client-contractor</td>
</tr>
<tr>
<td>relations. Integrate the project</td>
</tr>
<tr>
<td>teams’ perspectives with the</td>
</tr>
<tr>
<td>project aims during start-up.</td>
</tr>
<tr>
<td>Assess risks adequately.</td>
</tr>
<tr>
<td>Develop good planning, clear</td>
</tr>
<tr>
<td>schedules, adequate back-up</td>
</tr>
<tr>
<td>strategies. Exercise firm,</td>
</tr>
<tr>
<td>effective management from the</td>
</tr>
<tr>
<td>outset. Recognise the</td>
</tr>
<tr>
<td>importance of effective</td>
</tr>
<tr>
<td>schedule-conscious decision</td>
</tr>
<tr>
<td>making. Provide clear and</td>
</tr>
<tr>
<td>comprehensible project</td>
</tr>
<tr>
<td>organisation appropriate to</td>
</tr>
<tr>
<td>the size, urgency and</td>
</tr>
<tr>
<td>complexity of the project.</td>
</tr>
<tr>
<td>There should be one person, or</td>
</tr>
<tr>
<td>group, in overall charge</td>
</tr>
<tr>
<td>having strong overall authority.</td>
</tr>
<tr>
<td>Ensure effective leadership.</td>
</tr>
<tr>
<td>Strive for a well</td>
</tr>
<tr>
<td>motivated, experienced team.</td>
</tr>
<tr>
<td>Develop appropriate controls,</td>
</tr>
<tr>
<td>highly visible, simple and</td>
</tr>
<tr>
<td>‘friendly’.</td>
</tr>
<tr>
<td>Check definition of success,</td>
</tr>
<tr>
<td>where changes are allowed.</td>
</tr>
<tr>
<td>Ensure resources are adequate,</td>
</tr>
<tr>
<td>properly planned and</td>
</tr>
<tr>
<td>flexibly employed. Ensure</td>
</tr>
<tr>
<td>labour practices are consistent</td>
</tr>
<tr>
<td>amongst and between</td>
</tr>
<tr>
<td>contractors. Give full recognition to quality assurance and auditing.</td>
</tr>
<tr>
<td>Recognise that good</td>
</tr>
<tr>
<td>communications are vital.</td>
</tr>
<tr>
<td><strong>Human factors</strong></td>
</tr>
<tr>
<td>Ensure top management support.</td>
</tr>
<tr>
<td>Recognise and demonstrate the</td>
</tr>
<tr>
<td>importance of effective</td>
</tr>
<tr>
<td>leadership. Seek competent</td>
</tr>
<tr>
<td>personnel. Ensure communications</td>
</tr>
<tr>
<td>are effective. Consider which</td>
</tr>
<tr>
<td>power style is appropriate.</td>
</tr>
<tr>
<td>Recognise that people are</td>
</tr>
<tr>
<td>human and less than perfect.</td>
</tr>
</tbody>
</table>

*Table A2 - Successful Project Management Procedures*
### TEN PROJECT CRITICAL SUCCESS FACTORS

<table>
<thead>
<tr>
<th>Mission</th>
<th>Initial clarity of goals and general directions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top management support</td>
<td>Willingness of top management to provide the necessary resources and authority/power for project success</td>
</tr>
<tr>
<td>Project schedule/plans</td>
<td>A detailed specification of the individual action steps required for project implementation</td>
</tr>
<tr>
<td>Client consultation</td>
<td>Communication, consultation, and active listening to all affected parties</td>
</tr>
<tr>
<td>Personnel</td>
<td>Selection, recruitment, and training of the necessary personnel for the project team</td>
</tr>
<tr>
<td>Technical tasks</td>
<td>Availability of the required technology and expertise to accomplish the specific technical actions</td>
</tr>
<tr>
<td>Client acceptance</td>
<td>The effect of &quot;selling&quot; the final project to its ultimate intended users</td>
</tr>
<tr>
<td>Monitoring and feedback</td>
<td>Timely provision of comprehensive control information at each stage in the implementation process</td>
</tr>
<tr>
<td>Communication</td>
<td>The provisions of an appropriate network and necessary data to all key actors in the project implementation</td>
</tr>
<tr>
<td>Troubleshooting</td>
<td>The ability to handle unexpected crises and deviations from plan</td>
</tr>
</tbody>
</table>

*Table A3 - Critical Success Factors*