Environmental Science

Ebenezer A. Sholarin
Joseph L. Awange

Environmental Project Management

Principles, Methodology, and Processes

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Ebenezer A. Sholarin
Petroleum Engineering
Curtin University
Perth, WA
Australia

Joseph L. Awange
Spatial Sciences
Curtin University
Perth, WA
Australia

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Foreword

Project management is by far more than just a process. It is the method to execute an organisation's strategy, and a framework to get things done in the most cost-effective, schedule-driven and successful way. It is the means to enable innovation, development and execution of new technologies that bring improved benefits into our lives.

The rapidness of technological development is having a real effect on our world, shifting away from traditional professions into completely new roles, through to the way we work, the way we live, play and communicate. Each of these are reliant on, or impact upon, our environment. That includes the source of our food, water treatment, housing, radioactivity, waste management solutions and the depletion of natural resources used for everything we process, manufacture and consume.

This effectively means that a book such as this is not restricted to projects that preserve and improve the environment as one may first think. In fact, projects that involve any form of construction, production, transportation and waste, all need consideration to its effect on the environment.

The most significant impacts on the environment come from the resource sector (e.g., major oil spills out at sea, the devastation on marine habitants, coral and the fishing industry, etc.) or even large construction projects, such as high rise buildings

and road highways, which have a direct impact on wildlife, groundwater levels, landscape, soil types and drainage system. Even the damage to our oceans that occupies over 70 % of Earth from the summation of recreational sport, over fishing, tourism, commercial shipping and the mining of oil, gas and minerals activities is also becoming a serious global issue. The reality is that environment covers everywhere we operate, from the sky, to the land and to the river, lake and ocean scape. These all have to consider the balancing of the need for land between housing, public facilities, food production and waste management, as well as the manufacturing needs against available natural resources and the call for improved methods of cleaner production. What is apparent is the growing awareness and requirements for balancing these social-economic and environmental outcomes as a part of good project management process.

Whilst there is an awareness of the many world-wide challenges that vary by geographic and economic position, more intelligent systems and methods for data analysis and international information sharing, such as the use of satellite imaging and geospatial data, is telling us more about mother Earth, enabling early warning of weather conditions, shifts in water levels, and even to the amount of forests remaining on Earth that are visible from space. This book brings together the many facets of knowledge, technology, formula and analytical approaches to enable more informed decision making. Having worked around the globe and seen many of the theories and formula for calculations in project management, this book provides a key resource in bringing together those that have become industry norms and more common practices into a single reference point.

The importance of understanding the technological, economic and social dimensions to deliver environmental-based projects that have short term results and long term impacts, coupled with the desired sustainable outcomes, cannot be understated. Even a high rise structure built in a location susceptible to flooding and earthquakes means changes in engineering design, selection of materials, and foundation preparation, and project management is about creating change.

The book has set a benchmark on the professionalism with which environmental-based projects should be planned, monitored and assessed. Its authors, both from Curtin University, Australia, are highly regarded experts with significant academic credentials, and a thirst for knowledge. Professor Ebenezer (Eben) Sholarin has qualifications in industrial engineering, petroleum economics and environmental management, specializing in Environmental Impacts Assessment (EIA). Eben is also a certified project management professional with over 20 years working experience. Professor Joseph L. Awange has international experience working in Australia, Brazil, Germany, Japan and Kenya. Joseph is a world renowned subject matter expert in the areas of environmental monitoring, Environmental Impacts Assessment (EIA), geodesy, GIS and photogrammetry. He has authored/co-authored numerous books in these fields and is a lead expert of National Environmental Management Authority (NEMA) in Kenya.

Australia
September 2015

Todd Hutchison M.Com., MBA, PMP, FPMIA
Global Chairman of Peopleistic Pty Ltd.

Preface

Today, 22 billion tonnes of green-house gas emissions (methane, nitrous oxide and carbon dioxide) are emitted each year into the atmosphere from man-made sources. These are from burning gas, diesel and oil for power generation, and from flaring and venting during non-routine operations. Over the next hundred years, demand for energy is expected to more than double. Growth will be particularly critical in developing nations, e.g., China, India, Brazil and Venezuela, where industrialization and improved quality of life will increase demand for energy. Scenarios designed to predict future emissions estimate that, unless action is taken to limit emissions by 2100, annual emissions of CO_2 from fossil fuels will range from 16 to 110 billion tonnes per year. Most of these scenarios indicate a doubling of CO_2 emissions by the middle of this century.

Failure to measure and report the outcomes of environmental pollution, climate change and industrial wastes cost Australia alone several billion dollars a year in lost efficiency, repeated errors and unexploited opportunities.

The need to deliver projects within the overall strategic plan of a business organization is a *sine qua non* to increasing shareholders' wealth. However, the spectre of climate change and the daunting challenge of reducing greenhouse gas emissions are changing our collective consciousness.

How can we improve the ways in which projects are planned so that realistic and useful measurement of their outcomes and value for money becomes possible? How can we produce from these evaluations data of the quality and a standard required to drive future improvement? The authors have used the developed environmental project management (EnvPM) methodology to study and propose a sustainable solution to the problems of greenhouse gas emissions, hazardous waste disposal and deforestation.

This book is written as a sourcebook for undergraduate and graduate students, researchers and non-experts interested in environmental project management methodology using geospatial tools. It is intended to raise the bar on the professionalism with which environmental projects are planned, monitored and evaluated.

The book is divided into four parts. Part I: setting for environmental project management, consists of two chapters; part II: principles of environmental project management contains five chapters; part III: essential tools and techniques for environmental project management includes ten chapters and finally, part IV: case studies on environmental conservation and remediation projects combines three chapters together to discuss the case study of environmental projects in Australia and challenges of applying environmental project management in developing countries. Each chapter ends with a concluding remark, summarising vital points discussed.

Ebenezer A. Sholarin M.Sc., PGD in EIA, Ph.D., PMP
Joseph L. Awange M.Sc., PGD in EIA, Ph.D.

Dedication and Acknowledgements

Two people are better than one, because they can reap more benefit from their labour. For if either of them falls down, one can help the other up

—Holy Bible, Eccl. 4: 9–10

E.A. Sholarin would like to thank his wife, Irina Alexandrovna (Irene), for her love, patience and support during the writing of this book. His children, Victor Adetokunbo and Lydia Opeyemi, are his constant inspiration, and the generation to occupy that future we hope to shape for the better. He is also grateful to the School of Petroleum and Chemical Engineering, Curtin University, Australia for creating a supportive and conducive work environment that made the preparation of this book possible.

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Contents

Part I
Setting for Environmental Project Management

Chapter 1
The Need to Protect and Conserve the Environment

> *Climate change is the single greatest threat to development, and can undermine the progress already achieved in reducing poverty. It is a risk to economies large and small, and to the stability of the global financial system. It raises risks of diminished supplies in much of the world, and it can threaten peace*
>
> —Ban Ki-moon, Secretary General of the United Nations

Industrial activities of the past half century have created serious ecological problems. The list includes global warming, ozone depletion, loss of biodiversity, natural resource scarcity, air pollution, acid rain, toxic wastes, and industrial accidents (Brown et al. 1987, 1988, 1989, 1990, 1991, 1992, 1993). These problems are expected to worsen in the next 50 years

The debate over global warming and the momentum on the need to address climate change has been inexorable and accelerating. First, there is solid evidence that suggests the mean temperature at the Earth's surface has been increasing since the start of the modern industrial age (circa 1860), with a total increase of about 0.7 °C (see, e.g., Bucknall et al. 2000, Dincer et al. 2009). Although there are substantial dissenting opinions in this regard (see, e.g., Zedillo 2008, Paltridge 2010), global warming has been widely attributed to greenhouse gas effect caused by the production of carbon dioxide, a byproduct derived from combustion of hydrocarbons. Major governments and international accords such as the Kyoto, Japan, in 1997 have presumed the causal relationship between fossil fuel combustion and global warming.

Emission of harmful substances into the oceans, deforestation of the planet lungs and air pollution has already resulted in serious problems for the entire mankind (see Fig. 1.1). Scientists now believe "it is "extremely likely" that the result of human activities is the dominant cause of global warming, a long-term trend that is clear despite a recent plateau in the temperatures" (IPCC 2013). This is the first time scientists have unequivocally stated (with 90 % certainty) that global warming is a fact, and that human impact is a significant cause (Newman et al. 2009). United Nations Secretary General Ban Ki-moon declared climate change as "the defining challenge of our age" (Rosenthal 2007). President Barrack Obama of the United States of America, in his speech on global warming, puts it more succinctly:

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Fig. 1.1 The effects of deforestation, climate change, and natural disasters on Marovo Lagoon, Solomon Island

"We are the first generation to feel the impact of climate change, and the last generation that can do something about it." (Obama 2014). Such pronouncements fuel the quest for rapid and drastic reductions in greenhouse gas (GHG) emissions and concentrations.

Fossil fuels have offered astounding opportunities during the 20th century especially in the rich countries of the western world, but now, mankind has to face the challenges arising from fossil fuel exploitation. The energy problem is entwined with many social and environmental issues (see, e.g., Othieno and Awange 2016). The fundamental challenge is associated with many vital and entangled questions that we are called to answer, such as:

- should we progressively stop burning fossil fuels?
- how do we mitigate the expected rise in sea levels over the next century against the opportunity cost to government and society?
- will it be possible for all the Earth's inhabitants to reach the standard of living of developed countries without devastating the planet?
- will science and technology alone take us to where we need to be in the next few decades?
- can we execute our projects in a better way with great outcomes for the economy, planet, and its habitats?

Of course, some production facilities cannot be 100 % ecologically clean, and at the same time the humanity has got used to the products and services offered by such enterprises. In such a case, we cannot talk about elimination of harmful substances. However, it is possible to decrease negative impacts of industrial activities on the nature.

This book seeks to address these difficult questions, first, through its application of project management principles, then guide the reader to achieve the best outcome possible, using environmental project management processes, tools, and techniques.

It builds on the Guide to project management body of knowledge (PMBoK Guide), a globally recognised standard for managing mega projects, programs, and portfolio (PMI 2013)—and offers a new framework for handling the challenges of climate change, radiological contamination, carbon, and toxic waste sequestration.

1.1 Environmental Project Management—An Introduction

"The future belongs to those who understand that doing more with less is compassionate, prosperous, and enduring, and thus more intelligent, even competitive."—Paul Hawken

For many years, resource exploration professionals appreciated the basic principles of geology, geophysics, and construction engineering because they are integral parts of the recovery process. Today, these engineers must interface with biologists for habitat management; with atmospheric physicists for air-dispersion issues, and epidemiologists concerning the effects of toxic chemicals and various diseases on workers' health and safety. In addition to these hard "technical disciplines", the softer disciplines (such as leadership, stakeholder management, and project management) cannot be ignored. All these subjects belong in the arsenal of modern project management professional.

Environmentalism has captured a sizeable portion of national and international debate. The debate is often fueled by press notices presenting incidents that cause pollution that may have chronic impact on ecosystems, be it offshore or onshore operations. A life example of this is the devastating situation plaguing the Niger Delta oil region of Nigeria, West Africa. The oil communities had to endure the result of reckless oil production and exploration. This ushered in excruciating environmental conditions, which were often aggravated by oil spills, gas flaring, discharge of waste and water pollution, and other fallout of poor oil field management by the multinational oil companies. The discharge of refinery effluents into fresh water sources and farmlands devastates the environment and threaten human lives. Such effluents contain excessive amount of very toxic material like mercury and chromium. Slowly, but relentlessly, petroleum exploration and production activities such as gas flaring, oil spillage, indiscriminate construction of canals and waste dumping, have brought the human ecosystem of the Niger Delta to the point of near collapse (Aluko 2001). An example of the devastating effect of oil spill on farmlands and vegetation in Nigeria is shown in Fig. 1.2. This is the price the country has to pay for drilling petroleum resources without considering the potential environmental impact.

From an environmental standpoint, Niger Delta oil spill and dumping of hazardous waste was not an isolated event. By 2010 the world had already witnessed dozens of environmental and public health disasters: Kuwait oil well disaster in 1991 in which 650 oil wells were set ablaze spilling almost 1 million tons of oil and killing over 20,000 sea birds, the Lake Nyos CO_2 gas eruption in 1986 releasing 80 million cubic meters of carbon dioxide, killing 1,700 people and 3,500 livestock, and the British Petroleum (BP) Macondo oil well disaster in 2010 killing huge populations of

Fig. 1.2 Forest and farmland covered in a sheen of greasy oil near the Nigerian village of Otuegwe: A case of environmental degradation in Ogoniland, Niger Delta region, River State of Nigeria

marine animals (see Table 1.1). In addition to the foregoing, there are many problems resulting from nuclear waste, including Chernobyl explosion in Ukraine, former Soviet Union in 1986. Evidence of ongoing contamination is presented in Sect. 1.3.

Indeed, much of the current environmental legislations and regulations were formed in an era of confrontation between the extractive industry and respective host governments with command and control regulation as the *modus operandi*. On the other hand, industry has learned by experience that goal setting, management systems, and incident-free operations are the keys to improved performance. For a successful enterprise in this respect, it is imperative that an overlying management strategy integrating *cost, social, and environmental* performance targets at every phase of opportunity development life cycle are implemented. This is the essence of environmental project management.

Traditional environmental project management often does not incorporate environmental factors in the planning documents. The government agencies that are responsible for legislative monitoring and compliance have little or no understanding of the particular industry, where the inspection is being conducted. Even environmental reviews are often conducted without due diligence or prior to conducting feasibility studies and other activities. Moreover, public and environmental officers often become impatient, confused, frustrated over apparent revisiting of previously made decisions, which require the whole process to be revisited all over again.

In order to understand the concept of environmental project management, one must begin with a definition of an environment and then progress to defining a project. Once a project has been defined, it then becomes possible to move further in defining project management and, ultimately, to employ these three definitions to describe environmental project management.

Table 1.1 World's worst environmental disasters showing their corresponding effects

Incidence	Amount spilled	Cost implication	Environmental effect
Macondo—2010, BP Gulf of Mexico, USA	492,000 tones	$5.4 billion possible fines and $21 billion (if gross negligence) (Robertson and Kraus 2010). $20 billion for compensation and clean up (Welch and Joyner 2010)	11 people dead, 997 birds dead; 400 sea turtles dead; 47 Mammals including Dolphins dead
PTTEPA Montara Gas Well disaster, 2009, Timor sea, Western Australia. The worst oil disaster in Australia	4,750 tones of light sweet crude oil for 74 days	Unknown	Unknown
1991 Gulf war in which 650 oil wells in Kuwait set ablaze (Enzler 2006)	1 million tones	Not known	20,000 sea birds killed
1989 Exxon Valdez in Prince Williams Sound Alaska (Cleveland et al. 2010; Cutler et al. 2010; Enzler 2006)	10.9 million gallons	$7 billion for fines, penalties and claims of which over $2.1 billion used for clean up	Casualties include 250,000 sea birds, 2,800 sea otters, 250 bald eagles and 22 killer whales
1986 Lake Nyos Limnic eruption, Cameroon, West Africa	80 million cubic metres of carbon dioxide	Not known	1,700 people dead. 3,500 livestock dead
Ixtoc, 1-1980, Gulf of Mexico, USA	454,000 tones	Unknown	Unknown
1978 Amoco Cadiz off the coast of Brittany, France (Bourne 1979; Boyes and Enzler 2006)	230,000 tones of light crude	$282 million of which $85 million for fine	Killed over 3450 sea birds, fisheries, oysters and sea weed beds were also greatly affected

1.1.1 What Is Environment?

"The environment is everything else except me"—Albert Einstein

In this section, the concept of environment and its possible definitions are presented. The word *environment* has different meaning in different jurisdictions, and is therefore widely recognized as a broad term with many interpretations and definitions. In Western Australia, for example, the *Environmental Protection Act (EPA) WA* 1986 defines environment as including water, air and land and the inter-relationship which exists among and between water, air and land, and human beings, other living

creatures, plants, micro-organism and property.[1] The *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) on the other hand, which is Australian-wide environmental legislation, defines environment as including[2];

(a) ecosystems and their constituent parts, including people and communities; and
(b) natural and physical resources; and
(c) the qualities and characteristics of locations, places and areas; and
(d) heritage values of places (i.e., places included in the Register of the National Estate kept under the *Australian Heritage Council Act* 2003; and
(e) the social, economic, and cultural aspects of a thing mentioned in paragraphs (a), (b), (c) or (d).

In Canada, the *Canadian Environmental Assessment Act* (CEAA) 1992 define the environment as the components of the Earth, and includes

(a) land, water, and air, including all layers of the atmosphere,
(b) all organic and inorganic matter and living organisms, and
(c) the interacting natural systems that include components referred to in paragraphs (a) and (b).

In general, therefore, the term '*environment*' may be used narrowly, with reference to '*green*' issues concerned with nature such as pollution control, biodiversity, and climate change; or more broadly, including issues such as drinking water and sanitation provisions (often known as the '*brown agenda*') (Nunan et al. 2002). For instance, Neefjes (2000, p. 2) uses the term in a broad sense, referring to the environment as a vehicle for analysing and describing relationships between people and their surroundings, now and in the future, while Bucknall et al. (2000, p. 3) points out that the word environment generally refers to a natural resource base that provides sources and performs sink functions, and uses a broad definition of the environment in his background paper to the World Bank's Environment Strategy (Nunan et al. 2002).

Owing to the varied definitions of the term environment, certain terms and expressions that relate to it such as environmental degradation, environmental change, and environmental quality are also problematic in that they vary widely in usage within and between disciplines, and several have been used as synonyms (e.g., Johnson et al. 1997). In an attempt to correct the problem and standardize usage, Johnson et al. (1997) defines or redefines 10 of the most common environmental terms, e.g., *natural environment* and *environmental change* are defined on the basis of what is meant by natural as reflected by common usage and dictionary entries while *environmental degradation*, *land degradation*, and *soil degradation*, are defined as any change or disturbance to the environment, land, or soil perceived to be deleterious or undesirable. In part III of the book, we will encounter some of these terms and how they are linked to environmental project management.

[1] EPA 1986, Sect 2(a).
[2] EPCA 1999, Sect. 528, Definitions.

1.1.2 What Is a Project?

"I don't work on a project unless I believe that it will dramatically improve life for a bunch of people"—Dean Kamen.

The definition of a project has been the subject of considerable debate among project management professionals, researchers, and associations. Dinsmore and others define a project as a *complex effort* involving interconnected activities, with the purpose of achieving an objective, and a temporary, non-repetitive process (see e.g., Dinsmore and Cabanis-Brewin 2006; Khatib 2003; Lewis 2000; Nicholas 2004). Turner and Westland describe project as a *unique endeavor* to produce a set of deliverables, in which human, material, and financial resources are organized in a novel way, to undertake a unique scope of work, of given specification, within clearly specified time, cost, and quality constraints (Turner 2009; Westland 2006).

The UK Association for Project Management defines project as a set of interrelated tasks that are undertaken by an organisation to meet defined goals (objectives), which have an agreed start and finish time, is constrained by cost and have specified performance requirements and resources (APM 2012). The International Project Management Association (IPMA) defines project as a temporary endeavour with a defined beginning and end (usually time-constrained, and often constrained by funding or deliverables), undertaken to meet unique goals and objectives, typically to bring about beneficial change or added value (IPMA 2006).

Perhaps the most complete definition is found in the Project Management Body of Knowledge (PMBoK) Guide, 5th edition, published in 2013 by the Project Management Institute (PMI). PMI is the world's largest professional project management association with more than 460,000 members and over 660,000 project management professionals (PMPs) worldwide as of July, 2015, with close to 5 million copies of all editions of the PMBoK Guide in circulation (PMI 2015). In the PMBoK guide 2013, a project is defined as "a temporary endeavour undertaken to create a unique product, service, or result. Temporary means that every project has a definite beginning and a definite end. Unique means that the product, service, or result is different in some distinguishing way from all other products, services or results" (PMI 2013, p. 3). Thus, a project can be any new structure, plant, process, system or software, large or small, or the replacement, refurbishing, renewal or removal of an existing one. It is a one-off investment (Smith 2002, p. 2).

Every project has *deliverables*. These are unique and verifiable products, results or capability to perform a service that is identified in the project management planning documentation, and must be provided in form of project verification to complete the project. The deliverable is a visible sign that an activity or task is complete. This sign could be an approving manager's signature, a physical product or document, the authorization to proceed to the next activity, phase, or other indicated sign of completion.

From the definitions provided above, it may be concluded that a project has the following characteristics:

- a complex or ad hoc, one-time endeavor (processes) with a clear life cycle, specific time frame or finite life span, i.e., temporary;
- a defined and unique set of products, services or results, limited by budget, schedule and resources;
- developed to resolve a clear goal or set of goals;
- customer-focused;
- a network of building blocks in the design and execution of organizational strategies;
- terminated upon successful completion of performance objectives.

Project exists in a relatively turbulent environment; change is the purpose of the project itself and uncertainty is inherent in the objectives of that project. Projects can also have social, economic, and environmental impacts that far outlast the projects themselves (PMI 2013).

1.1.3 What Is Project Management?

"Plan the Work, and then Work the Plan. If you fail to plan, you plan to fail"

Project management is a phrase used to describe a *planned*, *methodical approach* to project completion. Such an approach emphasizes "front-end" planning in order to minimize problems in the later stages of the project, as well as emphasizing control of timing and spending. It is an add-on to general management, meaning that it cannot readily exist or be effective without a solid management base. Although it requires its own methodology to bring to bear, in general, it provides the means of focusing attention on a specific goal, task or target. Project management deals with the application of knowledge, skills, tools and techniques to the planning, coordination, and reporting of project activities with a view to meeting project requirements. Projects bring about change and project management is recognized as the most efficient way of managing such change (APM 2012, p. 3).

Thus, project management can be defined either as a *process* (e.g., input and output process, cause-and-effect process) or *toolbox* for executing different functions (e.g., planning tool, monitoring and control tool, resource optimization tool).

Badiru (2008), for instance, describes project management as the process of managing, allocating, and timing resources in order to achieve a given objective in an expedient manner. The objective may be stated in terms of time (schedule), performance requirements (quality), or cost (budget). It is the process of achieving objectives by utilizing the combined capabilities of available resources. Havranek (1999) on the other hand, describes project management as the "art and science of planning, organizing, integrating, directing, and controlling all committed resources—throughout the life of a project—to achieve the predetermined objectives of scope, quality, time, cost, and customer satisfaction". The ultimate benefit of implementing project management principles is having a satisfied customer, whether in form of an

individual, community or an organisation. Completing the full scope of work of the project in a quality manner on time and within budget provides a great feeling of satisfaction. When projects are successful, everybody wins!

It is in view of the above that project management institute (PMI) defines project management as the "application of *knowledge*, *skills*, *tools* and *techniques* to project activities to meet project requirements" (PMI 2013). Australian institute of project management (AIPM), on the other hand, defines project management as "the integration of project activity through the project life-cycle to achieve the delivery of a defined product or service within prescribed constraints of time, budget, scope and quality" (AIPM 1996), while project management is defined in the UK Association for Project Management Body of Knowledge as the "application of processes, methods, knowledge, skills and experience to achieve the project objectives"(APM 2012). The challenge in large companies is to provide guidelines for managing project activities and a consistent procedural framework, both for individual projects and across projects. This enables leaders from all specialities to work together and communicate with one another (Salazar-Aramayo et al. 2013).

Project management in the environmental restoration and remediation industry comes with a unique set of challenges involving the management of engineering, technology, science, cost, schedules, procurement, risk, safety and environment, personnel, and communication. The general approach for resolving the challenge is to empower an environmental manager, who possesses leadership attributes to become a project manager through informal mentoring and the professional acquisition of lesson learned from his/her own work experiences.

Managing a project implies planning and monitoring its execution, enabling objectives to be achieved. Project management no longer has a specific focus (managing projects), but rather has become an organisational skill that permeates all levels of the company (Kerzner 2010; Lewis 2000; Nicholas 2004; PMI 2013; Westland 2006). The need for project management is no longer debated, but rather what form it will take (tools, techniques or processes) (IPMA 2006).

1.1.4 The Importance of Project Management

> *"The balance between the global supply and demand for crude oil is becoming progressively tighter, increasingly requiring our industry to face new and unique challenges. Our industry of tomorrow will have to address the demands of operating in an adverse environment, development of new technologies and expediting implementation in the field, as well as optimization of processes and enhancing collaborative efforts to reduce cost"*[3]

The critical role of project management as a key enabler of organisational strategy to implement projects successfully has been widely established in areas such as the

[3]This was a very inspiring statement made by the former president of Society of Petroleum Engineers, Dr Behrooz Fattahi at his University of Western Australia presentation on "Challenges of the Future", delivered on the 7th April, 2011.

planning and control of *time*, *resources*, *cost* and *quality*. Sixty years ago, project management was confined to the Department of Defence contractors and construction companies (see, e.g., Bowman 1967; Chapman 1973; Mungo 1967). Today, the concept behind project management is being applied in such diverse industries and organisations such as defence, construction, pharmaceutical, petro-chemicals, mining, banking, hospitals, advertising, information technology, state governments, local governments, and the United Nations.

Majority of literature on management science stresses the importance of project management as an efficient tool to handle novel or complex activities. Kerzner (2010), for example, has suggested that it is more efficient than traditional methods of management, such as the practice of functional divisions in a formal hierarchical organisation. The process of bringing new projects on stream and into the market imposes demands on established organisations and necessitates different management techniques from those required to maintain day-to-day operations. In such circumstances, where companies have a finite, unique and unfamiliar undertaking, the techniques of project management can be successfully implemented. These undertakings would call for more and faster decision making techniques than possible in a normal operation and making the right choices will be critical to company success.

The use of modern project management has become associated with such novel complex problems, which are inevitably called a project. Consequently, the success of project management has often been associated with the final outcome of the project. Project management and project success are not necessarily directly related (Munns and Bjeirmi 1996). A project is considered successful when it is carried out within the desired deadline, budget and quality level, meeting the expectations of the primary stakeholders. At this point, the work of Baccarini (1999) and Cookie-Davies (2002) is particularly relevant in distinguishing between "project management success" and "project success".

Specifically, project management success is measured against the widespread and traditional measures of performance (cost, time, and quality), and project success is measured against the overall objectives of the project, which is the customer's overall satisfaction with project outcome. This is considered the most significant, if not the single most important success factor (Havranek 1999). This implies that project success cannot be measured until after the project is completed. By contrast, project performance can be measured during the life of the project. IPMA (2006, p.40) defines project management success as "the appreciation of the project management results by the relevant interested parties". Thus, "project management success" is synonymous with "project management performance", because the interest is in assessing management performance and not project results.

There are many projects, where everything is done by the book, even applying the PMBoK guide, but the customer (society, government or investor) is left unsatisfied. For example, there is no point in finding substantial reserves of oil, gas or minerals and in successfully developing them unless the product or result can be disposed at a realistic price, thus generating cash revenue to pay operating costs, to meet the requirements of the host government's "take" (i.e., taxes, royalties or share of production), minimize the environmental impact of the exploration venture on