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Delivering a Mega Construction Project Successfully During a National Crisis: Lessons Learned From The Aswan High Dam Construction Project

ESKANDER HOWSAWI
College of Engineering at Al Lith, Umm Al-Qura University, Makkah, Saudi Arabia
Faculty of Engineering and Information Technology, University of Technology Sydney, Sydney, Australia
Email: Eskander.Howsawi@student.uts.edu.au

DAVID EAGER
Faculty of Engineering and Information Technology, University of Technology Sydney, Sydney, Australia
Email: David.Eager@uts.edu.au

RAVINDRA BAGIA
Faculty of Engineering and Information Technology, University of Technology Sydney, Sydney, Australia
Email: Ravindra.Bagia@uts.edu.au

KLAUS NIEBECKER
Faculty of Engineering and Information Technology, University of Technology Sydney, Sydney, Australia
Email: Klaus.niebecker@au.yokogawa.com

Abstract

Project success is a key topic in project management research. This study contributes to this topic by presenting how projects succeed during difficult circumstances of national crises. The occurrence of a crisis leads to the emergence of new dynamics and constraints that affect projects. Success strategies pursued then are different from those employed during peacetime. This research takes the Aswan High Dam project in Egypt in the 1960s as a case study and reveals four strategies supporting ten success factors that helped that project to succeed during a period of national crises. Links to contemporary projects are presented, together with recommendations to enhance the understanding and likelihood of successful project delivery during a national crisis period.

Key Words: *Project Management, Project Success, National Crisis, Aswan High Dam, Project Context*.

Introduction

Delivering successful projects is a very important factor to support the growth of a nation (PIPC, 2005). There is a continuous stream of research that seeks to understand how to achieve this. The project management (PM) literature contains many insightful articles such as (de Wit, 1988) (Belassi & Tukel, 1996) (Shenhar, Levy, & Dvir, 1997) (Chua & Kog, 1999) (Cooke-Davies, 2002) (Salleh, 2009) and (Han, Yusof, Ismail, & Aun, 2012). However, the percentage of projects that reached the desired level of success is still unsatisfactory (Ika, Diallo, & Thuillier, 2011). There is a real need to continue researching the topic of project success.

The topic of project success can be addressed from a variety of viewpoints. For example, the effect of human factors on projects can be studied, or success can be investigated on the basis of the impact of

industry type on projects. The focus of this research is to study the topic with regard to the context of a project, that is, the circumstances surrounding the project in question.

It can be asserted that the context of a project and the circumstances surrounding it have significant impact upon the outcome of that project (Balachandra & Friar, 1997) (Engwall, 2003) (Maaninen-Olsson & Müllern, 2009). A project context can take many forms, such as geographical, industrial, peace-time and crisis contexts. The impact of one context on a project may differ from the impact of another context; consequently, each context may require different strategies to achieve success (Balachandra & Friar, 1997). For example, the recruitment strategy for a defense project may differ from that of a construction project because secrecy is an important element in the former but not in the latter.

One of the wide varieties of possible project contexts is the context of a national crisis. It is unique and has significant effect on projects, and indeed, on all aspects of a nation's socioeconomic life. During a national crisis, most segments of the nation (if not all) are subjected to difficult circumstances that bring about many forced changes. For example, fundamental regulatory and institutional changes are approved as a result of the pressure of such crises. The control of raw material by the government in the United Kingdom (UK) during the crisis of World War 2 (WW2) is an example of an institutional change affecting projects (Backman & Fishman, 1941). Based on these changes and other differences, project management during a national crisis is thought to be somehow different from peacetime project management (Howsawi, Eager, Bagia, & Niebecker, 2014b). Consequently, it can be proposed with confidence that project success during national crises is an important topic for research.

Observing the situations worldwide shows that national crises are more prevalent in the 21st century than in earlier centuries; for example, wars between countries have been increasing since 1870 (Harrison & Wolf, 2011). The frequency of financial crises has doubled since the 1970s (Bordo, Eichengreen, Klingebiel, Martinez-Peria, & Rose, 2001), and the frequency of natural disasters is also rising (Degg, 1992) (Gurenko & Dumitru, 2009).

There are currently many national crises worldwide, such as the wars in Iraq and Afghanistan, the aftermath of Japan's tsunami and the aftermath of Hurricane Katrina and the global economic crisis. Against the odds, projects during crises did not disappear but continued to be implemented in these contexts (Hrůzová & Thornton, 2011). Projects continued to be launched to respond to the crisis, to sustain businesses, or to reconstruct a devastated area. Project stakeholders clearly need to adopt and practice certain strategies to increase the likelihood of successful project delivery in such contexts; however, the abnormality of the crisis context raises doubt as to whether or not peacetime project strategies are suitable for the job. In this study, war is the example of interest as a national crisis. The case study is the successful construction of the Aswan High Dam (AHD) in Egypt during the national crises of the 1950s and 1960s. The following question is investigated:

What are the effective strategies that the project management team applied to the AHD project to assist in the successful delivery of that project?

The content analysis of several interviews with AHD project veterans, as well as contemporary Egyptian PM experts, and a large collection of secondary data revealed the strategies that assisted in the delivery of a highly successful project in the context of national crisis. Comments have made on the significance, generalizability and limitations of the findings.

The Aswan High Dam project (AHD)

Aswan High Dam is one of the largest dams in the world and it is the largest in Africa. It is 3820 meters long, 980 meters wide at the base, 40 meters wide at the top and 111 meters high. The dam can discharge

water at a rate of 11,000 cubic meters per second. Its reservoir, Lake Nasser, is 550 kilometers long and 35 kilometers wide at its widest point, and contains 162 billion cubic meters of water (Ibrahim, El-Belasy, & Abdel-Haleem, 2011). The dam is located in the Aswan province south of Egypt, where it traps and controls the flow into Egypt of the Nile River.

The dam was constructed throughout the 1960s, since which time it has contributed to the national growth of Egypt and provided many economic advantages. It has protected the country from several severe floods, and its massive reservoir provides water to the whole country during years of drought. Moreover, it provides electricity to the country, and at one time, the dam generated more than half of the country's electricity (Abu-Zeid & El-Shibini, 1997). Figure 1 shows the electrical output of the dam as a percentage of national output.

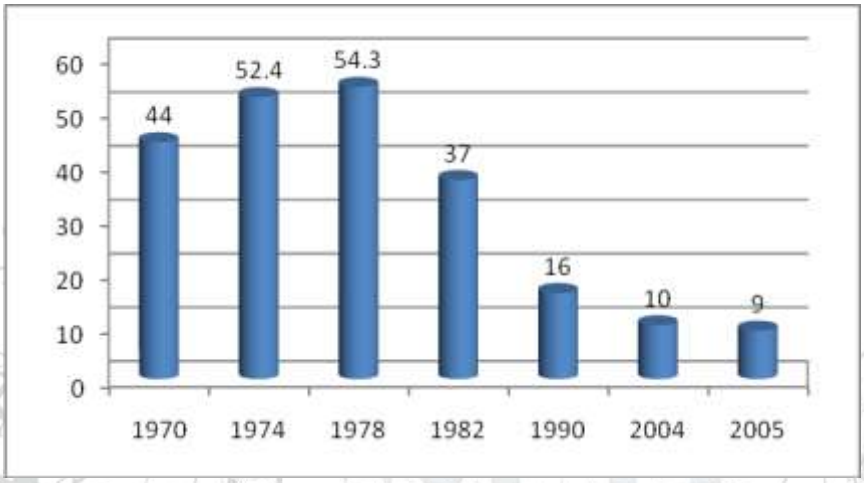

Figure 1: Percentage of Aswan High Dam contribution to national electricity generation (MoEE, 2005)

Nevertheless, the construction of this massive structure brought several disadvantages. Many people from the tribes around the dam area were moved from their homeland, and several archaeological sites were flooded in the creation of Lake Nasser. Other negative impacts of this project include water loss by evaporation and the degradation of downstream river courses (Abu-Zeid & El-Shibini, 1997). Overall, however, this project was a great construction achievement and the advantages outweighed the disadvantages (Zeid, 1989).

The construction of the dam was carried out by more than 30,000 Egyptian personnel aided by few hundred experts from the Soviet Union. The Soviet role was mainly in technical assistance and supervision of the project. The Egyptians carried out most of the managerial works, logistics and support services.

The dam was a very important and urgent solution to some accumulating Egyptian problems which, if delayed, would have catastrophic impacts. First, the 1952 revolution regime introduced huge economic reform to transform the country from an agricultural to an industrial society. This reform required sources of energy and the best option at that time for the Egyptian was the hydropower. Reform would not be possible without the cheap power the AHD provided and if the project was delayed the reform would be delayed. The second problem was that before the dam Egypt was dependant on the Nile River for drinking and agricultural water. When the river's follow decreases the country suffers from drought and when the flow exceeds the limit the country suffers from flood. In both cases there were deaths and economic losses. The solution to this problem was to control the river's flow through the AHD. Any delay in constructing this dam would mean extended vulnerability to the threat of flood and drought. The consequences of these

two problems were getting worse each year because of the rapid population growth. Throughout the 1960s the population increased by more than 2.5% annually or on average 0.75million people per year (Awad & Zohry, 2005); consequently the demand for food, water, electricity ,jobs and other services increased. This rate of population growth would be unsustainable without developing new agricultural lands, producing more energy and modernizing the economy to create jobs. The solution was the AHD.

Because of these problems and the problems emerging during the project, any delay would put the country at great risk.

National crises surrounding the AHD project

In 1952, a revolution led by army officers overthrew the royal regime in Egypt and the country entered a phase of turbulent political and socioeconomic turmoil. In 1954, an ambitious leader called Gamal Abdel Nasser seized power, and in 1956, Nasser nationalized the Suez Canal, a decision that triggered the Suez Canal crisis in which Egypt was attacked by Britain, France and Israel.

In 1962, the Egyptian army engaged in a war with Yemen. That crisis is known as the North Yemen civil war and continued until 1967.

In June 1967 Israel waged a surprise attack on Egypt and destroyed almost 90% of the Egyptian armed forces. This war is known as the Six-Day War. In response to this defeat, Egypt waged a war of attrition against Israel which continued until 1970.

The impact of the crises on AHD project

This series of national crises impacted the AHD project and made it vulnerable to high probability high impact risks. If any of these threats and risks materialized the fate of the project would be a failure. First, after the Suez Canal crisis in 1956 the Egyptian assets in UK, France and USA were frozen. This, alongside increased military expenditure because of the war, squeezed the Egyptian economy and affected its ability to finance mega projects such as the AHD. Then, while the Egyptian economy still suffers from the consequences of the 1956 war and the AHD project had already begun in 1960, another burden was placed on that economy by the North Yemen civil war. The expenditure caused by the Egyptian occupation forces in Yemen, which exceeded 70 thousand troops in addition to thousands of support personnel, exhausted a sizable portion of the Egyptian economy. This made it even more difficult for the Egyptian economy to support mega projects such as AHD. Then, after the destruction of 90% of the Egyptian armed forces in 1967 war, the rearmament effort and the dedication of the whole nation to the revenge war and the liberation of occupied land placed a huge burden on the Egyptian socioeconomic system. Indeed due to the war, Egypt lost its total income from the Suez Canal and also lost much of its income from tourism, petroleum production and foreign investment. This situation would prevent the country from supporting civilian projects such as AHD and consequently put the entire project at the risk of running out of resources. Also the project and its logistics were at risk of sabotage or bombing because the country was in a continuous state of war from the beginning of the project until its completion. For example, after the 1967 war Egypt possessed very little air defense and the Egyptian skies were almost open to an enemy air force which could reach the project site and destroy it. Moreover, the supplies of project equipment from overseas such as the electricity generators and turbines were under continuous threat of sabotage by the enemies and this needed abnormal measures in the management of supply.

However, despite this series of national crises and their threats and risks, the AHD project started officially in 1960 and was completed in 1968, with the official opening taking place in 1971.

Given the difficulties of the time, the size of the dam and the engineering success in this project, this case was chosen for investigating the strategies that led to its success despite the vulnerability and pressure of the national crises, and their risks and threats.

Literature review

This study addresses a topic which is an intersection between project success and crisis management in the field of project management. The following literature review will establish the foundation for this study.

Project success concept

Project success is a popular path of study in PM research. Since the emergence of PM as a discipline in the 1950s through to the 1970s (Carayannis, Kwak, & Anbari, 2005) the concept and definition of project success has been the focus of several studies. Project success was initially defined as the completion of a project according to cost, time and quality requirements (Atkinson, 1999). From the 1980s onwards, the understanding of project success became more profound, evolving from simple definitions to complex frameworks to understand and evaluate project success (Jugdev & Müller, 2005). Belassi and Tukel (1996), for example, created a systematic framework to assess project success. Shenhar et al. (2001) introduced a multidimensional framework that captured the different meanings of success to different stakeholders.

Howsawi et al. (2011) introduced a four-level success framework which defines and assesses project success at four different levels to achieve an overall assessment (Howsawi, Eager, & Bagia, 2011). Despite agreement on the basic meaning of project success, however, the term still has a range of meanings for different stakeholders (Han et al., 2012) (Ika et al., 2011). This fact highlights the need for providing specific project success definitions for this study.

Project success factors and strategies in context

Aggregate factors or strategies contributing to project success have been presented in the literature. A thorough examination of such studies reveals that they agree upon a limited number of factors at the top of their respective lists. For example, based on a study on large construction projects in Vietnam (Nguyen, Ogunlana, & Lan, 2004), a study from the Indian construction industry (Iyer & Jha, 2006), and a third study on multiple public and private firms in multiple industries (Mishra, Dangayach, & Mittal, 2011), the top factor for success is the competency of the project manager. Contributing factors differ further down the list due to variations in the context of the specific study (Balachandra & Friar, 1997). Whether the context is a geographical location such as Brunei (Salleh, 2009), an industrial sector such as defense (Dvir, Ben-David, Sadeh, & Shenhar, 2006), or a cultural medium such as Chilean culture vs. America culture (Pereira, Cerpa, Verner, Rivas, & Procaccino, 2008) it is critical to understand the context in which project success is being investigated to reach to more realistic findings (Engwall, 2003) (Maaninen-Olsson & Müllern, 2009). Because of this, it is necessary to define the context in which this study addresses the question of project success namely; national crisis.

There is very little distinction between peacetime and a time of crisis as a context for PM in project success studies. This highlights the assumption that the results of those studies will be applicable to both contexts. Despite the difficulties that exist in a peacetime context, the changes, challenges and conditions of crisis time are very different; for example, delay or failure in peacetime is unlikely to result in military defeat, which may be a real risk in times of crisis. Also delays in post-disaster project may lead to social breakdown in families and communities (Baroudi & Rapp, 2013).
The occurrence of a crisis, such as war, or the aftermath of a huge natural disaster, is associated with sudden changes and the emergence of new realities (Kuklan, 1986). For example, war introduces

institutional changes and restructures society into a new order (Modell & Haggerty, 1991). World War 1 and World War 2 are crises that enabled women to undertake jobs such as aircraft manufacturing which were not open to women prior to these crises (Bloomfield & Bloomfield, 1997) (Littlea & Griecob, 2011). Another example of the impact of war crisis is that an employee's commitment to an organization is affected by the event of war (Messarra & Karkoulian, 2008). Higher risk and safety issues, a greater need for change, and a shorter time for decision-making are characteristics of a crisis context (Karlin, 2007) (Riley, 2006) (Shaluf, Ahmadun, & Said, 2001). All projects will face the reality of the crisis irrespective of whether the project is a response to a crisis or happened to be in the process of being executed during the crisis period.

The Meaning of a Crisis

From language point of view a crisis means "a time of intense difficulty or danger" (OxfordUniversity, 2012) or "a situation that has reached an extremely difficult or dangerous point; a time of great disagreement, uncertainty or suffering" (CambridgeUniversity, 2011). In a more technical definition, a crisis is a situation faced by an individual, group or organization which they are unable to cope with by the use of normal routine and procedures and in which stress is created by sudden change (Booth, 1993). However, the definition of crisis has proved to be somewhat problematic and debate exists within the literature about the precise meaning of the term (Smith, 2005).

The crisis is described as a period of sudden change during which a new system is formed, In fact, the meaning of a crisis includes opportunity as well as risk, uncertainty, threat, conflict, accident, and instability (Öcal, Oral, & Erdis, 2006). Crises occur across industries so the information on crises and their management includes many similarities; however, each industry responds to crises based on its norms of practice (Hällgren & Wilson, 2008). A crisis can be abrupt or cumulative. An abrupt crisis is a result of internal or external disturbances. It is generally more specific and less predictable than a cumulative one. On the other hand, a cumulative crisis can be foreseen although it also breaks suddenly (Hwang & Lichtenthal, 2000).

The crisis can have specific meaning depending on the context it is associated with, for example, economic crisis and industrial crisis. This study is concerned with national crises. A national crisis can be defined as a situation or time at which the nation faces intense difficulty, uncertainty, danger or serious threat to people, and economy. As per Smith's observation that the definition of the term is problematic this study will adhere to the definition above.

Because crises are in general unwanted events with serious consequences there is a need to deal with their impact; thus, crisis management appears.

The Crisis Management in Pm Literature

The notion of crisis management in the PM field is not frequently encountered. For example an electronic search (as of October 2013) in the database of the *International Journal of Project Management* returned 36 articles containing the term "crisis management" as opposed to 571 articles containing the term "risk management". Perhaps this is due to the newness of the introduction of the term "crisis management" in the PM field. In the late1990s the research in crisis management within the PM field was described as being in its infancy. (Loosemore, 1998). A decade later it remains a poorly addressed topic within PM research (Chartier, Banville, & Landry, 2010) (Geraldi, Lee-Kelley, & Kutsch, 2010) with few references addressing it (Crawford, Langston, & Bajracharya, 2013). However some insights can be found there.

The literature on crisis management in PM can be classified into two directions one is searching for the sources and nature of crises while the other looks to find the right strategies and techniques to deal with

such crises to increase the likelihood of success. Some articles contain findings of one direction and others contain both types of findings.

Following first direction, Loosemore (1998) identified three ironies in crisis management in construction projects. These ironies are: at a time when effective communication is important it is less likely; at a time when mutual sensitivity between project members is important it is less likely; at a time when collective responsibility and teamwork are important they are less likely (Loosemore, 1998). He stressed that crises create opportunities for increased cohesion, harmony and efficiency within project teams. Another study surveyed 120 construction companies and came up with 28 factors contributing to a project crisis some of which are inadequate government policies of human resources and sabotages (Öcal et al., 2006). Based on a comparison between routine and post-disaster project, Le Masurier et al. (2006) pointed that the legislation for routine projects is not sufficient to cope with the needs of projects during crises namely; post disaster recovery projects. They call for revised legislation for such types of project (Le Masurier, Rotimi, & Wilkinson, 2006). The recent global crises in the 2000s such as the global financial crisis 2008-09, led to a new view of crisis management in PM which is PM during times of crises (Hrůzová, 2011). This view is concerned with the impact of the external circumstances that affect the broader portion of a nation rather than the limited sector of industry. A typology to classify unexpected events in projects was offered by (Piperca & Serghei, 2012). Because crises by definition are results of unexpected events, this typology works as a classification of the origins of crises in projects. This typology is a result of the intersection of two dimensions; event predictability and locus of generation with three types under each dimension. **Error! Reference source not found.** represents this typology.

Table 1: Crisis origin classification typology (Piperca & Serghei, 2012)

Event predictability	Locus of generation		
	Internal environment	Immediate external environment	General external environment
More intense than predicted	Overrun	Setback	Swing
Predictable but unpredicted	Oversight	Knock on door	Revelation
Unpredictable	Showstopper	Mystery visitor	Shocker

The other direction in the literature reports tactics, recommendations and strategies to increase the likelihood of success. Mallak et al (1997) suggested some useful tools in preparing for crises. These tools are risk analysis, contingency plans, logic charts and table top exercises. Also they offered some recommendations to successfully manage the crisis. They encourage; establishing a crisis team before the crisis occurs, choosing a project manager indigenous the place where the project is conducted and to be mindful of the social and political consequences of the crisis (Mallak, Kurstedt, & Patzak, 1997).

Loosemore (1998) suggested some practices to resolve the three ironies he discovered; for example, paying particular attention to the financial aspects of a crisis and balancing control with flexibility in managerial strategies (Loosemore, 1998). Engwall and Svensson (2004) proposed the concept of cheetah teams for responding to the crisis (Engwall & Svensson, 2004). These teams are distinguished from other types of teams by being at the same time explicitly sanctioned, mission-specific, intended to dissolve when the mission is accomplished, staffed with full-time members and not planned in advance. Hällgren and Wilson (2008) offered 15 remedies to projects in crises based on project-as-practiced observation (Hällgren & Wilson, 2008). Their remedies include site teams to undertake overtime works and re-planning. Geraldi et al. (2010) proposed that successful crisis management is based on three pillars. These pillars are; responsive and functioning structure at the organizational level, good interpersonal relationships at the group level and competent people at the individual level (Geraldi et al., 2010). Practical application of

these pillars can increase the likelihood of success. Post disaster recovery projects are typical examples of projects in crisis times. The analysis of successful PM in crises times from three countries, China , Indonesia and Australia, showed that the two common factors for successful project resourcing in times of crises are competence of project team and government response and intervention (Chang, Wilkinson, Potangaroa, & Seville, 2012). Baroudi and Rapp (2013) suggest that to successfully manage recovery projects, organizations should be able staff their projects with capable competent teams, consider the many stakeholders involved, and particularly for project manager to build strong stakeholder relationships as well as good social awareness (Baroudi & Rapp, 2013).

All in all, the literature is characterized by having relatively few references that are scattered in several journals some of which are not specialized in PM. Some authors offered insights into the concepts while others provided practical steps. Since the concept of crisis management is new in the PM field, it is too early to have a universal framework for such concept. However, continuing to derive lessons from practice will lead to the building of a body of knowledge from which to choose in dealing with crises in PM field.

The Point of interest

As mentioned before, crisis management in PM literature addresses two directions. One is to describe the crisis and its root causes. The other is the search for techniques and methods to manage these crises. However, the focus of the previous literature is on the internal crisis when things go wrong within a project such as fire and hazardous leaks; the literature does not tell how to deal with external or contextual crises such as wars and natural disasters. There is a keen need to present knowledge in how to improve the resistance of projects against national crises: what strategies to follow to reduce the vulnerability of major projects and to improve their resilience when a national crisis is challenging them. This is the real focus of the authors. The importance of the topic of project success, the increasing frequency of crises (Buchanan & Denyer, 2012) and the impact of such contexts on projects increase the motivation to investigate the topic of success strategies in the context of national crises. This motivation is also supported by the need to present practical knowledge in the area of project success: as (Geraldi et al., 2010) said “there is a lack of studies exploring the link between practices and success”.

Research Design

In a field that is practice-driven such as PM, what constitutes acceptable knowledge is what is derived from practice. In this regard the words of the management guru Peter Drucker are fundamental. He said “What constitutes knowledge in practice is largely defined by the ends, that is, by the practice” (Drucker, 1985). This is the base of knowledge creation in this study.

The challenge in researching the AHD project is that the project was executed in the 1960s, and it is now more than 40 years since its completion. This required careful research design to capture the important lessons from such a project. The authors needed to have good awareness about the AHD project and the circumstances surrounding it, so prior to commencing this research they spent a significant amount of time learning about the AHD through different sources such as newsreels from the 1960s and visits to locations in Egypt related to the AHD or the historic context of the 1960s in Egypt.

Concepts and Definitions

Success factor vs. project strategy

The term “success factor” is a popular term in PM literature. The word “factor” means “a circumstance, fact, or influence that contributes to a result” (OxfordUniversity, 2012). It is defined by PM scholars as

"those inputs to the management system that lead directly or indirectly to the success of the project" (Cooke-Davies, 2002). The term "project strategy" is also used in PM research. The term strategy is defined as "a plan of action designed to achieve an overall aim" (OxfordUniversity, 2012). The definition of the project strategy in the PM literature is "a direction in a project that contributes to success of the project in its environment" (Artto, Kujala, Dietrich, & Martinsuo, 2008).

The authors assert, on the basis of the definitions of both terms, that the strategy is the driver to enhance or diminish a particular factor or factors. Many success factors are generic; for example, "availability of resources" and "fast response time". Thus, great importance lies in the search for strategies that will enhance success factors in any given situation or context.

On the basis of previous definitions and distinctions, the authors use the term "strategy" to describe the main findings of this study, and within each strategy they point out the factors that were supported through the application of that strategy.

Macro vs. micro project success view

There are two complementary viewpoints of project success; namely, the macro level viewpoint and the micro level viewpoint. The macro level viewpoint focuses on high level strategies that lead to success, while the micro level focuses on particular activities in relation to the project's success (Lim & Mohamed, 1999). For example, dependence on nearby sources of material is a macro level strategy for project success, while an effective procurement policy is a micro level success factor. The outcome of this research comprises macro level strategies that increase the likelihood of project success during national crisis as well as the micro level success factors supported by such strategies.

Project success concept for this study

One of the widely accepted definitions of a project is that it is a temporary endeavor undertaken to create a unique product, service or result (PMI, 2008). Since this definition suggests the uniqueness of a project, the definitions of success may mean different things to different assessors (Han et al., 2012) (Ika et al., 2011) . As a result, it is not logical to have one definition or criterion of success to fit all projects. Instead, using frameworks or models for the definition and assessment of project success is more appropriate, because they are customizable to fit particular projects (Howsawi et al., 2011).

In this paper the four-level project success framework (Howsawi, Eager, Bagia, & Niebecker, 2014a) was chosen to define, evaluate and understand project success within the context of the AHD project because this framework is highly customizable. The four-level project success framework consists of a context level, a business level, a deliverables level and a project process level.

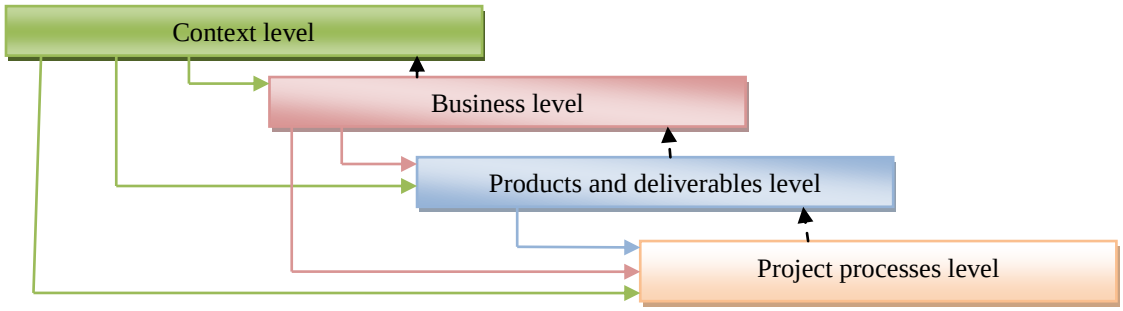

Figure 2: The four-level project success framework (Howsawi et al., 2014a)

In the four-level success framework the authors define the success at each level, and from all levels collectively they define the success of a project. Based on this, they define "success" here as satisfying the following criteria:

1. The product is delivered despite all the difficult and threatening circumstances surrounding the project
2. The advantages of the project vastly outweighed the disadvantages
3. The project provides economic benefits to the owner and good revenue to the contractors; and
4. The project provides an excellent product to the specification, within the specified time and budget.

Table **2** shows how this definition fits the AHD project.

Table 2: Fitting the definition of success to the AHD project

The level	The criteria	AHD
Context level	Delivering the desired product despite all the difficult and threatening circumstances surrounding the project	Despite all the complications of the 1960scrises, the project was completed
	The advantages of the project vastly outweigh the disadvantages	This is the judgement of many scholars concerning the AHD
Business level	Providing economic benefits to the owner and good revenue to the contractors	On completion, the AHD provided more than 50% of national electrical power, and the company which built the dam is still in business today
Deliverables level	Providing an excellent product to specification	The AHD is considered by many experts to be one of the finest engineering constructions in the world
Project process level	Providing an excellent product within the specified time and budget	The project met the time frame of 10 years and the estimated cost of one billion dollars

The Research approach

Generally speaking there are two distinct research approaches with their own characteristics. These approaches are the inductive and the deductive. However, saying that there are two approaches does not mean they cannot be mixed in a certain research; indeed it is often advantageous to do so (Saunders, Lewis, & Thornhill, 2009). One of the most important features of combining the two approaches is that it allows for gaining understanding of the overall situation of the projects under scrutiny as well as finding causal relationships between project success and the elements that caused that success. Also it allows the researcher to benefit from both qualitative and quantitative data. Moreover, combining the two approaches allows the flexibility needed for the vague part of the research and the more structured approach for the clearer part.

In order to answer the main research question the authors used an inductive–deductive approach as shown in Figure 3. The inductive approach was used at the beginning of the research and it was based on an observation followed by a derivative question from the main research question to build the proposition.

Then the deductive approach with content analysis techniques was used to extract the results that proved the proposition.

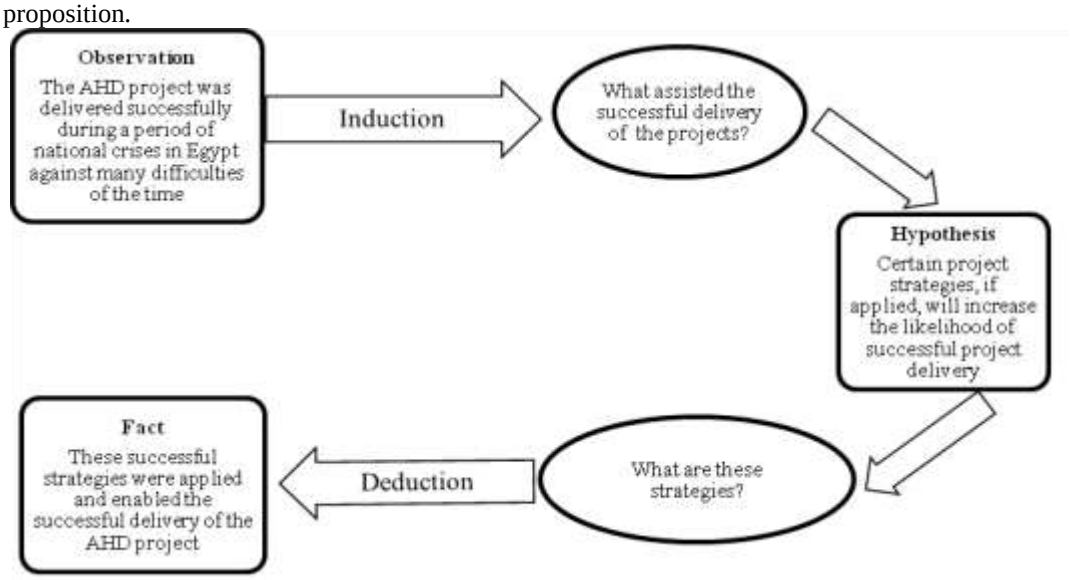

Figure 3: Inductive-deductive approach for this research

Research Data

In this study, the authors collected primary and secondary data from various sources to ensure the rigor of the research through the triangulation of the data sources. The authors were able conduct interviews with high profile engineers who held key roles in the AHD project as well as contemporary Egyptian expert project managers. These interviews were very rich and supplemented the small number of original documents available. The data of this study was collected according to the methods described below.

Veteran Interviews

The authors conducted personal interviews with high profile veteran engineers who worked in the AHD project from its early phase (since 1958) through to completion. With the help of a small local association in Egypt, the authors could identify 30 veterans. However, due to the health conditions of those old veterans and other obstacles the authors were able to interview three veterans. After the AHD project one became a high-ranking government official (a minister) while the other two continued their professional career until retirement.

Recorded interviews

The authors collected several recorded interviews with workers on the AHD project. These interviews were recorded over a period of time by different people. Ten of those interviews were found and used. All of those workers were doing ordinary labor duties such as digging, operating machines and driving trucks.

Expert interviews

The authors visited Egypt in 2012 during a time of national crisis after the 2011 revolution. Many characteristics of the national crisis context were apparent such as security issues and loss of transportation. This situation gave the expert interviewed the chance to make a good reflection on the current state of projects in Egypt and to link it to the AHD project. Eleven of the contemporary project managers in Egypt were contacted. Those interviewees fulfilled the following selection criteria: having experience in project

management, living and understanding the context and recent history of Egypt and being knowledgeable about AHD. Also all of them managed projects during the period of national crisis following the 2011 uprising and instability in Egypt. In this way, the interviewees were able to make informed comparisons between managing projects during peacetime and crisis time, while referring to the AHD project to tell what is required for success during crisis time.

The two sets of interviews (veterans and expert) consisted of open-ended questions to allow the interviewees to express their thoughts freely. The authors asked four core questions as follows:

- Do you think that the AHD project was a successful project during difficult time in Egypt and why?
- Can you elaborate on the difficulties that threatened that projects and how they threatened the project?
- What helped that project to achieve success despite these difficulties?
- How do you think the lessons learned from AHD project success can be applied to achieve the success in other projects in similar situations?

Other follow-up and clarification questions were asked throughout the interviews. The logic of the sequence of these questions was that the first question was to establish the common ground about the assessment of the project then second question was to elaborate the circumstances surrounding the project which were the national crises. After having common assessment of the project and knowledge about the project context, the third question was to discuss the strategies that led to success in the given context. The fourth question was about the reflection and the application of the results in other projects in similar situations.

Beside such sources, the authors conducted an extensive literature review about the AHD and investigated a wide array of data sources which do not have direct relationship to AHD but are necessary to understand the historical context in which the project was executed.

Data Analysis

In the research world the process that follows data collection is data analysis. It involves extracting meaningful results, conclusions and decision from the data. It is done through many techniques and procedures. Some of these techniques work with quantitative data while others work with qualitative data. Examples of these techniques include regression analysis and correlation analysis in the quantitative domain, content analysis and discourse analysis in the qualitative domain. Due to the nature of the data in this study content analysis was chosen to analyze the data.

What is content analysis?

Content analysis is a technique that has long history and is widely used in the modern research. A scholar documented the first use of this technique to the 18th century (Hsieh & Shannon, 2005) (Krippendorff, 2004).
The definition of content analysis evolved over time from a simple counting process (quantitative analysis of qualitative data) to more a comprehensive method to analyze data (Hsieh & Shannon, 2005) (Krippendorff, 2004).

One of the highly cited scholars to define content analysis is Krippendorff. He was cited more than 12,000 times in Google scholar as of October 2013. Krippendorff defines content analysis as "a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use" (Krippendorff, 2004). Another holistic definition came from Michael Quinn Patton in his book *Qualitative research & evaluation methods* which has been cited in Google scholar more than 30,000 times

as of October 2013. Patton defines content analysis as "any qualitative data reduction and sense-making effort that takes a volume of qualitative material and attempts to identify core consistencies and meanings" (Patton, 2002).

These definitions cover the characteristics of this technique. The technique is largely used for qualitative data in verbal, visual, or written format to describe a phenomenon and its dynamics. This technique can be applied well to subjects such as PM research (Wasiak, Hicks, Newnes, Loftus, Dong, & Burrow, 2011) and engineering education (Magenheim, Nelles, Rhode, Schaper, Schubert, & Stechert, 2010).

The data analysis framework

The data for this research is mostly qualitative descriptive narrative which contains the details woven between the lines. Content analysis is a very suitable technique to be used with such data (Elo & Kyngäs, 2008; Krippendorff, 2004).

The execution of content analysis in a research project is based on the objective of that research. Some researchers aim to find trends in the data so that they may focus in counting the occurrence of certain themes. Others may aim to find answers to particular questions: in this case the frequency is not the primary target but the valid and supported inference is more suitable. This highlights the fact that there is no simple single right way to do content analysis; however, the researchers should judge what is appropriate for their problem (Weber, 1990).

In this study the data was analyzed in multiple rounds. The aim of first round was to explore the nature of the whole data and the possible categories to be identified from such data. Four main categories resulted from first round of analysis namely; 1. the *influential conditions*; 2. the *influential decisions*; 3. the *influential practices*; and 4. the *results*. The logic for choosing these categories is that the conditions (the context characteristics) induce a stakeholder to take decisions in response to these conditions. The applications of a stakeholder's decisions are practices; these practices produce results, and the results reflect on the conditions. Figure 4 illustrate the analytical framework designed for this study.

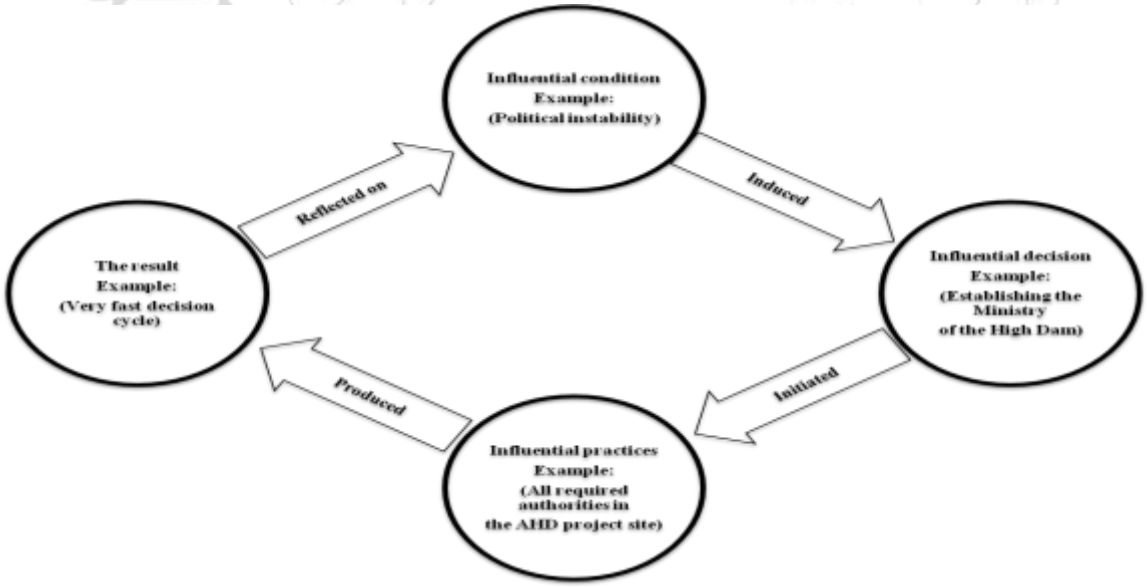

Figure 4: The analytical framework of this study

The following rounds of analysis aim to allocate the relevant content into each category.

The *influential conditions* category contains the main codes or characteristics of the context of the phenomenon being analyzed. The *influential decisions* category contains the code that represents the decisions taken by stakeholders in response to the influential conditions. The *influential practices* category includes the practices that are applied in response to the decisions taken. The *results* category contains the results generated totally or partially through the practices applied.

The success strategies resulting from this study are statements compiled based on the content of the *influential decisions* category and the *influential practices* category.

The application of the analysis framework is illustrated in Figure 4. For example, an interviewee described the onsite supervision of the Minister of High Dam as an important practice in the success of the AHD project. From other documents, it is discovered that the Ministry of High Dam was established exclusively to supervise this project. Also from another source, information about the political instability during the 1960s in Egypt was revealed, and finally, there was information that the success of the AHD supported the government. The authors established the relationship between these disparate pieces of information by placing "political instability" under the category of influential conditions. The government, which is the owner of the AHD project, responded to this instability with a decision to establish an exclusive ministry called "Ministry of High Dam" operated by a powerful minister who reported directly to the President of Egypt. This ministry brought all the required support and authorities including the minister himself, to the AHD project site. The result was a very fast decision cycle which enabled corrective action to be taken on the spot as problems occurred. This result contributed to the success of the project and this success supported the government in bringing political stability in the country.

Research trustworthiness

Reliability and validity concepts are not as clear in qualitative and mixed method research as they are in quantitative research (Golafshani, 2003). To deal with this issue in this qualitative research, the authors adopted a trustworthiness model based on the work carried out by Shenton (2004) to establish equivalent qualitative approaches to validity and reliability (Shenton, 2004). In
Table **3**, the quality dimensions are defined and the actions to establish them are detailed.

Table 3: Trustworthiness model (Shenton, 2004)

Quality dimension	Definition of the dimension	Suggested action to establish the quality dimension
Credibility	Credibility (in preference to internal validity): is about the representation adequacy of the constructions of the phenomenon under study	Triangulation of data sources
Transferability	Transferability(in preference to external validity/generalizability): is concerned with the extent to which the findings of one study can be applied to other situations	Providing background data to establish context of study and providing examples of results application in different cases
Dependability	Dependability (in preference to reliability): is concerned with the coherence of the internal process of the research, such as data collection and analysis	In-depth methodological description to allow study to be repeated
Confirmability	Confirmability (in preference to objectivity):is concerned with the extent to which the findings of the research are supported by the data collected	In-depth methodological description to allow integrity of research results to be scrutinized

Results and Discussions

This study revealed the four main strategies that were applied in the AHD project which in turn supported ten factors that led to the success of the project.
Table **4** summarizes the strategies and factors identified by this study.

Table 4: Summary of the strategies identified by this study and the success factors they supported

Strategies	Factors
1. Consolidating national interest in AHD project 2. Obtaining government support for AHD project 3. Co-locating all personnel and equipment to the AHD project site 4. Depending on nearby sources of material and workforce	1. Adequate material supply 2. Adequate work force 3. Reduced bureaucracy 4. Having priority and authority 5. Short time for assessment, decision and action 6. Having public support 7. Adequate funding 8. High morale in project team 9. Availability of appropriate expertise, knowledge and equipment as needed 10. No communication or transportation loss

The model in Figure 5 is a general influence diagram that represents the relationship between success strategies and factors in the AHD project.

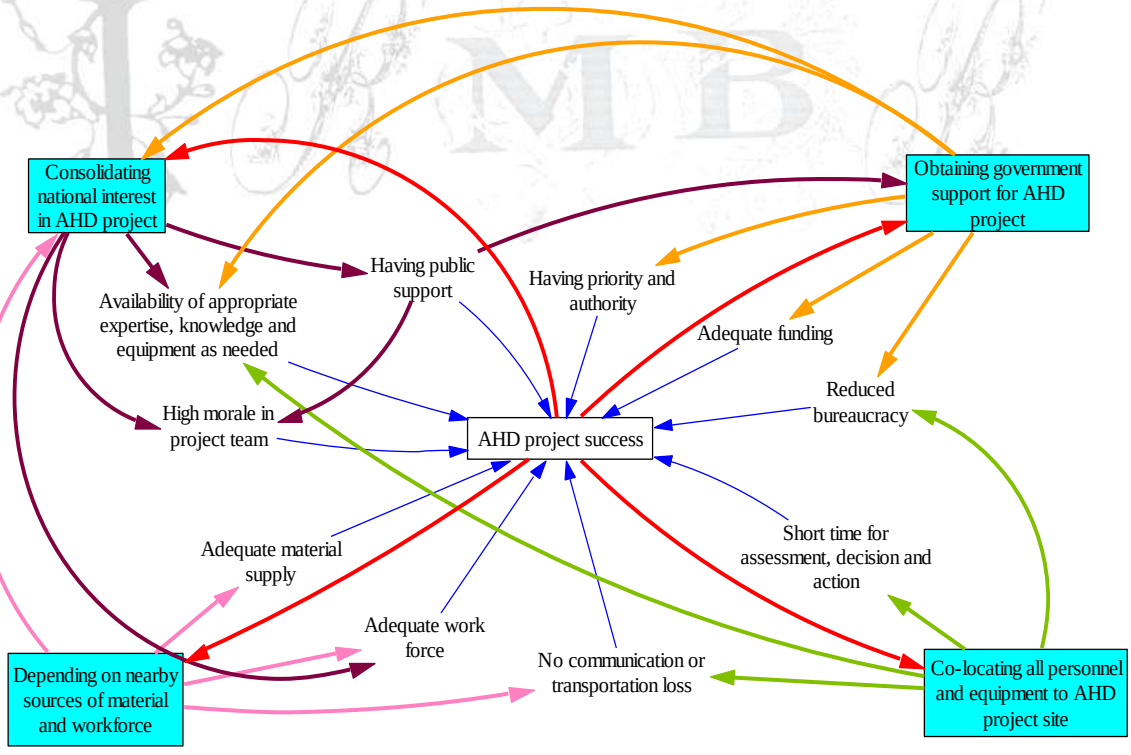

Figure 5: The success model for the AHD project

Strategy No.1: Obtaining government support for the AHD project- an exclusive ministry called the Ministry of High Dam

During times of national crisis, businesses face difficulties in obtaining required resources or permissions to work or special services. In such circumstances, there is a keen need for a strong sponsor who can obtain the required resources or permissions or special services for the project. The AHD project enjoyed the strongest sponsorship possible at that time. Unlike any other project or major endeavor at that time, a dedicated ministry called the Ministry of High Dam was created. This ministry was established exclusively to oversee all aspects of the AHD project. This has some similarity to the cheetah teams proposed by (Engwall & Svensson, 2004)

The Ministry of High Dam was authorized to take any necessary executive, financial or political decisions in relation to the project and reported directly to the President. This gave the project unprecedented priority all over the country.

Another form of government support was the security services the government provided to that project. For example, national security agencies participated in deception plans to protect the shipment of vital project components such as the turbines and generators against possible sabotage by the enemy.

Seeking a strong project sponsor is not an exclusive strategy for times of crisis; however, it is very important to seek a sponsor who can grant the project the required authorities and priorities. An example that matches with this strategy – despite the difference in industry type and geographical location – was the creation of the Ministry of Aircraft Production in the United Kingdom during WW2. This ministry was established exclusively to support the aviation industry in the production of existing aircraft or projects to develop new aircraft. It was exclusive to the crisis period and was established a few months after the war began. It was attached to another ministry three months after war ended, and was abolished eight months later. However, during the period of its operation it played a decisive role in the success of many aircraft projects (Howsawi, Eager, Bagia, & Niebecker, 2014c).

The Chilean miners rescue project in 2010 represents proof for the effectiveness of this strategy. In that project, the country's president was appointed as the topmost responsible person in the rescue endeavor and the mining minister was on site 24 hours a day, seven days a week. All the required authorities and priorities were thus brought directly to the project, which strongly supported the success of that short-term, high-impact project (Crenshaw, 2010) (Useem, Jordan, & Koljatic, 2011).

Strategy No.2: Co-locating all personnel and equipment to AHD project site

One important aspect of any project is schedule management. Faster response to incidents means a higher likelihood of the project staying on schedule. The AHD project was a monumental project, yet it was completed on time despite all the difficulties. The strategy that helped to facilitate this was the relocation of all personnel and equipment to the site. Prior to applying this strategy, the project's top management was located in Cairo, some 1000 km away, and they relied on casual visits to the project site and reports sent to them to keep abreast of progress. As a result, the project slipped more than one year behind schedule. By applying this strategy, all personnel, including the Minister of High Dam, were housed adjacent to the project site. Consequently, the response time to any incident was reduced to the minimum possible. All technical and managerial decisions were taken on the spot. For example, if any incident arose, the Minister of High Dam called for an "on the spot meeting" to assess the incident technically and make an immediate corrective decision. Having all responsible personnel on site also kept bureaucratic correspondence to a minimum, which in turn supported faster action.
This strategy is also not exclusive to the crisis context, but because during a crisis period time becomes a very pressing factor, applying such a strategy becomes critical. Also other risks associated with national

crises, such as the loss of communication and transportation affect the progress of projects but applying this strategy mitigates the negative effect of such risks.

Strategy No.3: Consolidating national interest in AHD project

One of the effects of a national crisis and the stress accompanying it, is that it draws people closer to each other (von Dawans, Fischbacher, Kirschbaum, Fehr, & Heinrichs, 2012). The Egyptian Government (as the AHD project owner) brilliantly exploited this phenomenon and used the national crisis of the 1956 war to create a national interest in the AHD project through massive propaganda. This generated enormous public support, making many of the citizens keen to help, and many bright minds in the country wanted to work on the project.

At first glance, this strategy does not look like a PM strategy. However, when the authors investigated the reasons for the high morale of that project's workers, they found that everyone believed in the AHD as his own family project. Despite the harsh work conditions, such as temperatures above 50 C˚ and poor safety, the number of workers exceeded 30 thousand and more were waiting to join the workforce. The workers often exceeded their shifts without overtime pay.

Strategy No.4: Depending on nearby sources of material and workforce

During a national crisis, the risk of transportation loss increases dramatically. For example, after Hurricane Katrina hit New Orleans in 2005, people remained trapped in evacuations centers such as the Superdome for days because the roads were totally cut off.

In managing projects during national crisis, reliance on sources of materials and workforce that require long distances transportation to the project site put the whole project at the risk of running out of resources due to transportation loss. Also the people who are not indigenous to the place may face more problems in coping with the environment or the social system.

In the AHD project, most of the workforce and the material used in the construction were from the Aswan area. This reduced the risk of transportation loss and also guaranteed an adequate supply of workforce and materials such as concrete and sand. Transporting workforce or importing materials from far away can be cheaper, but the risk will be very high and during national crisis, mitigating the risk of failure has higher priority than cost.

An example that supports this strategy comes from a British aviation project. During WW2, aluminum was the principal metal used in aircraft construction. The UK imported more than half of its aluminum requirement, which put the entire industry at risk of shortages due to the sinking of convoys by German U-boats. Instead of aluminum, the de Havilland Mosquito aircraft project used locally-produced wood, and this contributed significantly to the success of that project by allowing that project to benefit from the abundant resources available nearby.

Practice Recommendations

Based on the results found in this study, to increase the likelihood of project success during national crises, the authors recommend the following:

- Project stakeholders should obtain the strongest sponsorship available, particularly government sponsorship. The intervention of the government is reported to be decisive in solving problems that face projects during crises such as resourcing bottlenecks (Chang, Wilkinson, Potangaroa, & Seville,

2010) (Chang et al., 2012). Government sponsorship can grant the project required permissions, priorities and some special services such as security when thing around are in chaos. This can mitigate the crisis making factors mentioned by Öcal, et al. (2006) such as sabotages and government policies that act against the project.

- All project personnel and equipment should be housed in or adjacent to the project site. It is reported that crises disrupt transportation (Chang et al., 2010) (Natarajarathinam, Capar, & Narayanan, 2009). This recommendation reduces the amount of bureaucratic correspondence to increase the communication effectiveness, increasing the response time to incidents, and mitigating the risk of transportation loss. This can be a practical solution to the ironies mentioned by Loosemore (1998) "at a time when effective communication is important it is less likely" (Loosemore, 1998). Also this is a practical application of the success pillar "responsive and functioning structure at the organizational level" mentioned by Geraldi, et al. (2010).
- The project stakeholders should spend a portion of the resources to build nationwide interest in the project. This will attract various types of help to the project that are otherwise difficult to obtain directly. This will also induce more support from the government based on public support for the project. The effect of this recommendation can be seen in the Apollo program in the 1960s. The Unites State found itself lagging behind the Soviet Union in the space race after the Soviets successfully launched the first ever satellite; the Sputnik . This situation was considered " a national crisis" and it was titled as "sputnik crisis" (Kennedy, 2005). In response the United State government launched several projects one of which was the Apollo program. This project was very expensive to tax payers money yet it enjoyed huge public support because of the effort made to consolidate national consensus upon the project (Gisler & Sornette, 2009). Without that public support such a project would not have succeeded
- The project should depend on and make use of nearby sources of material and workforce to guarantee supply as required. Mallak, et al (1997) recommended that the successful management of projects in the crisis context need a project manager who is indigenous to the place (Mallak et al., 1997). Actually it is recommended that not only the project manager but other project team members are better to be indigenous to the place. They are more adapted to the environment and more sensitive to the social aspects.

The Contribution of the study

This paper contributes to the existing PM knowledge by expanding the focus of crisis management in the field of PM beyond internal project crises to include external contextual crises such as national crises. The contribution of this paper has been, in general, to solidify the concept of project management during a national crisis (Howsawi et al., 2014b) by presenting four strategies proven to increase the likelihood of project success in such a context. Because the context of a project has a significant impact upon a project (Howsawi et al., 2011) and the peacetime context is different from national crisis context, a different project management approach is needed to increase the likelihood of project success during a national crisis.

For the first time in PM literature, this study addressed the success of the AHD construction project with focus on the context of national crises surrounding the project. The significance of this is that, in a generation, there are few projects of such size and context worldwide so when they occur there is no time for learning from trial and error. The costs and consequences of trial and error in such projects are very high, so there is a need for understanding the proven strategies of success and presenting them for the benefit of current and future projects in similar context. The results of this study are building blocks in understanding how to deliver projects successfully during national crises. The strategies presented by this study improve the immunity of project against the impacts of national crises.

Moreover, this study strengthens previous research findings related to project success during national crises. Previous studies suggested strategies to increase the likelihood of mega project success during a

national crisis. For example, Kwak et al.(2014) revealed that federal government support was a key factor for the success of the Hoover Dam project during the national crisis of the great depression in the 1930s in the United States (Kwak, Walewski, Sleeper, & Sadatsafavi, 2014). The results of this study support the findings of other t case studies such as that of the Hoover Dam. This mutual support between different studies makes the results more generalizable to the context of national crisis rather than individual project cases.

Also it is widely acknowledged that national crises promote some social changes. The results of this study show how a project can benefit from this social change. It is very useful to utilize of the phenomenon of emerging collaboration attituded between people during national crisis (Rodríguez, Trainor, & Quarantelli, 2006) (von Dawans et al., 2012) as this phenomenon can be turned into valuable resources and support for the project.

The contribution of this study is particularly important nowadays because of the increasing frequency and scale of national crises worldwide.

Limitations of the study

The theme of this study – delivering successful projects during national crises – is relatively rare in the PM literature. The case study of a huge construction project, the AHD, formed the basis for the results of this study.

The research was limited to a macro view of project success during national crisis. This means that the results are top level strategies. The investigation of micro level details of success factors during national crises was not attempted in this research, and this level of investigation is needed to expand the knowledge about successful project delivery during national crises.

The research is based on one case study which, while big enough to constitute a case study, still represents only one type of industry - construction. There has been some reference to other industries and cases but more case studies are necessary to reach an acceptable level of generalizability.
The results of this research are based on the data available, and because the AHD was such a huge project, it is anticipated that more results could be obtained if more data were made available. However, the results of the research identified the most important strategies and factors and support the claim that they contributed significantly to the success of the AHD.

Meanwhile, the authors are designing a framework for success during national crises based on this case and other cases. So far, there is a great deal of similarity between the results, despite differences in industry type, geographical location and socioeconomic system.
The results of this study might be applicable to other cases, although it is not necessary for all strategies to be applied simultaneously. Suitable strategies should be employed as needed.

Conclusion

This research has investigated the reasons behind the successful delivery of projects during national crises. With the increased occurrence of national crises, there is a correspondingly greater need to understand how to deliver projects successfully. Based on the case of the AHD project, this research has revealed several effective strategies and factors, such as obtaining government support and having short decision-making times. The results have limited generalizability because of the limited number of cases involved in this research, and more research is needed to enhance generalizability. Nevertheless, this research forms a very sound foundation for understanding the successful delivery of projects during national crises.

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