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# Success Strategies for Project Management During National Crises: Insights from the British Aviation Industry During World War Two

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***Abstract***

*Success is a fundamental imperative in the field of project management. The authors contributed to the theme of success by exploring the strategies that assisted in the delivery of successful projects during national crises. The occurrence of these crises stimulates the emergence of different dynamics and constraints that affect every aspect of the socioeconomic system, including projects. The success strategies needed in such contexts are different from those employed during times of peace. This paper reported the results of an introspective study of 24 British aviation projects undertaken during World War Two. The authors revealed six effective strategies that support the delivery of successful projects during a national crisis period. The authors discussed the results and made Links to contemporary projects together with practical recommendations that will enhance the understanding of successful project delivery during national crises.*

***Key Words:*** *project success, national crises, project context, World War Two, content analysis, success strategy.*

## Introduction

Successful projects are key elements for sustaining businesses and ensuring a nation's prosperity (PIPC, 2005). To understand how projects can be delivered successfully, researchers have studied in depth what makes projects successful. They have produced insightful articles such as de Wit (1988), Belassi & Tukel (1996), Shenhar et al. (1997), Chua & Kog (1999), Cooke-Davies (2002), Salleh (2009), and Han et al. (2012). Nevertheless, the success rate of projects remains low (Ika, Diallo, & Thuillier, 2011) and more research in the area of project success is still required.

The topic of project success can be studied from a number of different viewpoints; for example, the focus may be on human factors, the type of industry, or project management standards. In this study, the authors

addressed the notion of success from the context perspective, that is, the conditions and circumstances surrounding the project being studied.
The context of a project and the circumstances surrounding it are key factors that influence the outcome of the project (Balachandra & Friar, 1997; Engwall, 2003; Maaninen-Olsson & Müllern, 2009). The context can take many forms including the industry type, the culture, peacetime and national crisis contexts. Each context may have different effects upon a project; consequently, the strategies for project success may differ from one context to another (Balachandra & Friar, 1997).For example, the recruitment strategy may differ between a defense project and a construction project because secrecy is an important element in a defense project but not in a construction project. Also, a construction project manager must be physically capable, while a person with mobility limitations can manage a software project effectively.

Among the different project contexts, the context of a national crisis is unique and has very high impact upon the projects being implemented at that time (Howsawi, Eager, Bagia, & Niebecker, 2014a). During such a crisis, a large proportion of the nation (if not all) is subjected to difficult circumstances which bring about many changes in the socioeconomic system of a country. For example, abnormal institutional changes may be approved as a result of the pressure of a national crisis. The British Government control of raw material during the crisis of World War Two (WW2) is an example of an institutional change that affected projects (Backman & Fishman, 1941b). Given that national crisis is a unique context in which project management needs a different approach (Howsawi et al., 2014a), the authors therefore assert that the study of project success during national crises is an important research topic.
A careful look at situations worldwide shows that national crises continue to be prevalent. 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 increasing (Degg, 1992; Gurenko & Dumitru, 2009).The number of wars has continued to increase since 1870 (Harrison & Wolf, 2011).

There are many national crises worldwide. The wars in Afghanistan and Iraq, the aftermath of Japan's tsunami, the aftermath Hurricane Katrina in the United States of America (US) and the global economic crisis are examples of recent crises. In the year 2011 alone, five incidents of civil unrest broke out in five Middle Eastern countries. The results of these crises are thousands of deaths, economic crises and regime changes.

Against the odds, projects do not stop during these times but continue to be issued and implemented in the crisis context (Howsawi et al., 2014a; Hrůzová & Thornton, 2011). These projects differ in their purpose; they may be in response to the crisis itself, or simply being implemented during the time of crisis. Nevertheless, all projects will be subject to the same demanding circumstances and all of them will need to discover how to succeed during such difficult times. Project teams need to adopt and practice certain strategies to elevate the likelihood of successful project delivery. However, given the abnormality of a crisis context, peacetime project strategies may not be suitable for delivering a successful project under such circumstances. This observation leads to the following broad research question:
What effective strategies should a project team adopt during national crises to increase the likelihood of successful project delivery?

This question will be narrowed and customized following the literature review and the definition of the case studies taken from British aviation projects during WW2 and used in this study.
Using the content analysis of original documents and a large collection of secondary data the authors revealed the strategies that have assisted in the success of several aviation projects in the context of a national crisis. They commented on the significance, generalizability and limitations of the findings.

**Cases studied in this research: British aviation projects during the national crisis of WW2**

The aviation industry in the United Kingdom (UK) in the 1930s was one of the most advanced in the world. Nevertheless, the inter-war period between World War One and World War Two witnessed slow progress

in this industry. With the signs of war looming on the horizon in the late 1930s, the industry started to shift towards preparation for war. An example of this preparation is the shadow factories plan which aimed to expand the manufacturing capacity of British factories, but this preparation was limited because the threat of war was at anticipation stage, and political effort was focused on the maintenance of peace.

With the outbreak of war in 1939,the country entered a state of national crisis. In this situation, the aviation industry was responsible for providing aircraft of all types to support the war effort, and in doing so, many aviation projects were issued. Some projects were an outstanding success, such as the construction of the de Havilland Mosquito and Avro Lancaster, and others were failures, such as the Hawker Tornado.

Twenty-four British aviation projects that were intended to produce aircraft for the war effort are included in this research. These projects were conducted during the war period and form the basis for understanding successful project management during national crises. Table 1 contains the names of all the aircraft projects in this study.

Table 1: the case studies from the British aviation industry during WW2

| | Aircraft name | | Aircraft name | | Aircraft name |
|---|---|---|---|---|---|
| 1 | de Havilland Mosquito | 9 | Fairey Firefly | 17 | Bristol Brigand |
| 2 | Avro Lancaster | 10 | Hawker Tempest | 18 | Bristol Buckingham |
| 3 | Handley Page Halifax | 11 | Hawker Sea Fury | 19 | Westland Welkin |
| 4 | Bristol Beaufighter | 12 | Avro Lincoln | 20 | Supermarine Spiteful |
| 5 | Hawker Typhoon | 13 | Fairey Fulmar | 21 | Hawker Tornado |
| 6 | Fairey Barracuda | 14 | de Havilland Hornet | 22 | Vickers Windsor |
| 7 | Short Stirling | 15 | Avro Manchester | 23 | Miles M.20 |
| 8 | Armstrong Whitworth Whitley | 16 | Blackburn Firebrand | 24 | Supermarine Type 322 |

**The national crisis of WW2 in the UK and its impact upon aviation projects**

In this study, the authors explored what enables projects to be delivered successfully during a national crisis. Because national crises can be of many types, the authors chose to focus on one type of national crisis, namely, war. Of the many examples of war worldwide, the authors selected WW2 as the particular example because it was a crisis that affected almost every nation on earth, with unprecedented outcomes. For example, the human casualties of that crisis exceeded 50 million (Harrington, 2002). This equates to one death every three seconds during nearly six years of conflict from 1939 to 1945, a statistic which illustrates the awful dimension of this crisis.

The impact of WW2 was international, but some nations and areas suffered more than others. The UK was among those countries that suffered the most. The authors chose it as the spatial scope of this research because it is a good example among the allied countries in WW2 for representing the difficulties of the war. The socioeconomic system in the UK was significantly affected during the war years for many reasons; for example, in the Battle of Britain in 1940, Nazi Germany bombed British strategic targets such as industrial facilities and infrastructure. In the Battle of the Atlantic, which continued from 1939 to 1945, maritime convoys to the UK were threatened and attacked by German naval vessels such as U-boats.
It was during this crisis that the characteristic of a national crisis as a context for project management mentioned by Howsawi et al. (Howsawi et al., 2014a) materialized and impacted aviation projects as follows:

- **Government intervention:** The British Government controlled many aspects of British life, such as business practices, material supply and employment, even in private firms (Backman & Fishman, 1941a; Murphy, 1942). The British Government supported the aviation industry during the war period more than any other industry.

- **Emerging threats and opportunities:** This took the form of bombing and sabotage and was a threat that disturbed work in several ways. It prevented workers from reaching their work site, or it destroyed the work site itself, or it killed or wounded workers. Aviation production facilities were among the key targets for the enemy, which meant that the work in these facilities was under constant threat. This continuous threat exerted huge psychological pressure on all the project team members. Furthermore, the destruction of a production facility by a bombing raid caused the work (either projects or production) to stop for a period, and all time was precious. Securing project sites from saboteurs and spies was also a great challenge that exceeded the capacity of normal business firms and required coordination with national security agencies.
- **Urgency**. Many projects needed to be delivered as quickly as possible because the changing situation might render a product obsolete if it was delayed. For example, the German forces advanced so rapidly that it took less than seven weeks for them to occupy France. This created a new tactical reality which significantly changed British weapons requirements. Aviation projects in particular needed to be completed quickly so that they were not obsolete even before entering production.
- **Resources and supply disturbance**. The UK is a group of islands dependent to a large degree on imports of raw material from overseas and continental Europe (Edgerton, 2011). With the fall of Europe into the hands of Nazi Germany and the sinking of convoys, there was a notable shortage of raw material, which seriously affected aviation projects. This disturbance in material supply affected the progress of aviation projects and forced the Government to control the use of important material, such as aluminum. As a result of the call of duty to serve in the armed forces, many experienced workers left their jobs in industry; in addition, the rapid development of new technologies, such as metal works, meant that trained personnel were in short supply (Weir, 2003).
- **Uncertainty:** During WW2, the citizens of the UK were uncertain as to when a bombing raid would occur and the potential consequences of that raid on the workforce and production facilities. In the aviation field, the designers of many projects were uncertain about final specifications, because the rapidly changing tactical situation made it difficult to set the final specification for aircraft design. This volatile situation imposed changes on both the specifications and the role of particular aircraft, which designers struggled to cope with.

All projects during that time were affected by the above-mentioned circumstances. Those projects which were well handled in these conditions succeeded, while those which were poorly handled failed.

## Literature review

The topic of this study is an intersection between a number of themes within and outside the project management literature; namely, project success, crisis management and project context. The following literature review formulates the basis of this research.

### Reviewing the concept of project success

Project management literature places great emphasis on the theme of project success. Indeed, the whole discipline of project management is about success. The discipline of modern project management started to take formal shape in the 1950s (Kwak, 2005) and from that beginning through to the 1970s, many studies addressed the concept and definition of project success. The initial definition of project success was to complete a project according to time, cost and quality specification (Atkinson, 1999), but the 1980s witnessed an evolution in the understanding of project success. The concept became more profound as complex frameworks to understand and evaluate project success replaced simple definitions of the three elements mentioned above (Jugdev & Müller, 2005). For example, a systematic framework to assess project success was introduced by Belassi and Tukel (Belassi & Tukel, 1996), and 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.

Despite consensus on the intuitive meaning of project success, the term means different things to assessors (Han, Yusof, Ismail, & Aun, 2012; Ika et al., 2011). This fact shows clearly that any study should adopt and justify a particular definition of project success.

**Context-focus project success factors and strategies**

There are plenty of success factors and strategies detailed in many studies and articles in the project management literature. A careful look at these studies reveals that there is limited agreement between studies at the top of their respective lists of success factors and strategies. For example, a Vietnamese construction project research (Nguyen, Ogunlana, & Lan, 2004), an Indian construction project research (Iyer & Jha, 2006), and a research on multiple public and private projects in multiple industries (Mishra, Dangayach, & Mittal, 2011) agreed that the top success factor 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). However, 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 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 project management 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 war crisis. Also, delays in a 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 One and World War Two are crises that enabled women to undertake jobs such as aircraft manufacturing which were not widely 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 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 whether it happened to be in the process of being implemented during the crisis period. Because of this fact, the context, particularly that of national crisis, should be considered carefully when investigating project success.

**The notion of crisis**

From a 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 in which it is not possible to cope 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 totally 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 contains many similarities; however, each industry responds to crises on the basis of 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 crisis, which can often be foreseen even though it might break suddenly (Hwang & Lichtenthal, 2000).

The crisis can have specific meaning depending on its context, as in the case of economic crisis and industrial crisis, for example. This study is concerned with national crises. A national crisis can be defined as "a situation or time at which a nation faces intense difficulty, uncertainty, danger or serious threat to people and national systems and organizations and a need for non-routine rules and procedures emerge accompanied with urgency" (Howsawi et al., 2014a). Following Smith's observation that the definition of the term is problematic, this study will adhere to the definition mentioned by Eskander et al. (2014).
Because crises are in general unwanted events with serious consequences, there is a need to deal with their impact; thus, crisis management has evolved.

**The project management literature and crisis management**

The notion of crisis management in the project management field is not frequently encountered. An electronic search (October 2013) in the database of the *International Journal of Project Management* returned 36 articles containing the term "crisis management". This is possibly due to the newness of the term "crisis management" in the project management field. In the late1990s, research into crisis management within the project management field was described as being in its infancy (Loosemore, 1998). A decade or more later, it remains a poorly addressed topic within project management research (Chartier, Banville, & Landry, 2010; Geraldi, Lee-Kelley, & Kutsch, 2010) with only a few references addressing the various issues (Crawford, Langston, & Bajracharya, 2013). Nevertheless, some insights can be found there.
The literature on crisis management in project management can be classified into two categories: One concerns the search for the source and nature of crises, while the other seeks to find the right strategies and techniques to deal with such crises to increase the likelihood of success. Some articles contain the findings in one category, while others contain both types of finding.

Concerning the first category, Loosemore (1998) identified three ironies in crisis management in construction projects, as follows: At a time when effective communication is important, it is less likely to exist; at a time when mutual sensitivity between project members is important, it is less likely to exist; and at a time when collective responsibility and teamwork are important, they are less likely to exist (Loosemore, 1998). He stressed that crises create opportunities for increased cohesion, harmony and efficiency within project teams. Another study surveyed 120 construction companies and identified 28 factors that contribute to a project crisis, some of which are inadequate government human resource policies and sabotage (Öcal et al., 2006). Based on a comparison between routine and post-disaster projects, Le Masurier et al. (2006) pointed out that the legislation for routine projects is not sufficient to cope with the needs of projects such as 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, namely project management during times of crises (Howsawi et al., 2014a; Hrůzová, 2011).

Table 2: 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 |

This view is concerned with the impact of external circumstances that affect the broader domain of a nation rather than the limited sector of industry. A typology to classify unexpected events in projects was offered by Piperca and Serghei (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 and is a result of the intersection of two dimensions: Event predictability and the locus of generation, which fall into three types under each dimension. **Table 2**represents this typology.

The other focus in the literature reports tactics, recommendations and strategies to increase the likelihood of success. Mallak et al. (1997) suggested some useful tools to prepare for crises. These tools are risk analysis, contingency plans, logic charts and table top exercises. They also offer several recommendations for successfully managing the crisis. They encourage establishing a crisis team before the crisis occurs, choosing a project manager indigenous to the place where the project is conducted and being 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, such as paying particular attention to the financial aspects of a crisis and balancing control with flexibility in managerial strategies. Engwall and Svensson (2004) proposed the concept of cheetah teams for responding to the crisis (Engwall & Svensson, 2004)(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 for projects in crises based on project-as-practiced observation. 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 a 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). The practical application of these pillars can increase the likelihood of success. Post-disaster recovery projects are typical examples of projects in times of crisis. The analysis of successful project management in such times from three countries, China, Indonesia and Australia, show that the two common factors for successful project resourcing are the competence of the 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 to 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.

All in all, the literature is characterized by having relatively few references scattered across several journals, some of which do not specialize in project management. Some authors offer insights into the concepts while others provide practical steps. Since the concept of crisis management is new in the project management field, there is a wide gap to fill in this respect. Continuing to derive lessons from practice will lead to the creation of a body of knowledge from which to choose in dealing with crises in the project management field.

**The research problem statement and question**

The above review shows that the topic of crisis management is covered in the project management literature in two ways. One is the description of the crisis and its root causes; the second is the search for methods and techniques to effectively deal with crises. Notably, the focus of the literature is on the internal crisis; that is, how to deal with the situation when things go wrong in a project, such as the occurrence of fire or hazardous leaks. The literature does not advise how to deal with external or contextual crises. External crises can include examples of national crises such as war and natural disaster. The need here is to present knowledge on how to improve the resistance of projects to this type of crisis. There is a need to find out what strategies to follow to reduce the vulnerability of major projects and to improve their resilience when they are challenged by a national crisis. This is the broad focus of this study. The particular focus of this study will be to investigate the topic as a UK-based spatial dimension and the period of WW2 as the

temporal dimension. The case studies will be drawn from the British aviation industry. Based on these dimensions the research question will be:
What are the effective strategies that project teams adopted in British aviation projects during the national crisis of WW2 to increase the likelihood of successful project delivery?
The importance of the topic of project success, the increasing frequency of crises (Buchanan & Denyer, 2013) and the impact of the national crisis context on projects increase the motivation to investigate the topic of success strategies in the context of national crises.

## Research Design

The field of project management is a practice-driven discipline, in which the experience and knowledge gained from practice constitute acceptable knowledge. The management guru Peter Drucker has said that, "What constitutes knowledge in practice is largely defined by the ends, that is, by the practice" (Drucker, 1985). These words are the fundamental philosophy of knowledge creation in this study.

### Definitions and concepts

For the sake of clarification and building common foundations, the authors set a number of definitions and concepts that they used in this research.

### Success factor compared to project strategy

Many studies in the project success arena use the term "success factor". The definition of the word "factor" is "a circumstance, fact, or influence that contributes to a result" (OxfordUniversity, 2012). The literature of project management defines success factors 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" also appears in project management research. The definition of the term strategy is "a plan of action designed to achieve an overall aim" (OxfordUniversity, 2012). In the project management literature, the project strategy is defined as "a direction in a project that contributes to success of the project in its environment" (Artto, Kujala, Dietrich, & Martinsuo, 2008). Based on the definitions of both terms, we assert that the strategy is a driver for enhancing or diminishing a particular factor or factors.
Because many success factors are common to almost all projects (for example, the availability of resources), greater importance lies with the search for effective strategies that enhance the success factors in a given situation. These strategies change with changes in the project context.
Based on the above definitions and distinctions, the authors preferred to use the term "strategy" to describe the findings of this study, and within each strategy they pointed out the factors that were enhanced by using that strategy.

### Micro and macro project success perspective

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 micro level success factors supported by such strategies.

### What is meant by project success in this study

One of the widely accepted definitions of a project is that it is a temporary endeavour undertaken to create a unique product, service or result (PMI, 2008). This definition suggests the uniqueness of a project, and

indeed, the definitions of success mean different things to different assessors (Han et al., 2012; Ika et al., 2011). As a result claiming a universal set of criteria to measure success or to propose single universal success definition for all projects might be problematic (McLeod, 2012).. Instead, using frameworks or models to define and assess particular project success is more dynamic and is the current trend (Jugdev & Müller, 2005).

The four-level project success framework (Howsawi, Eager, & Bagia, 2011) was chosen to define, evaluate and understand project success within the context of the British aviation industry during WW2. This framework consists of a context level, business level, product level and project level. As mentioned above, the characteristic of national crisis proposed by Howsawi et al.(Howsawi et al., 2014a) appeared in the context of WW2. Failure to deal with any of these characteristics would have meant certain failure for the project. Therefore, the first part of the success definition in this study concerns dealing effectively with the contextual characteristics. This is at the context level in the four-level project success framework.
At the business level, a successful project is one that will attract production to keep the business running in the given conditions of the context level. At the product level, success will satisfy client requirements given the conditions set at the context level. At the project level, success is the ability to produce the prototype given the conditions of the context.

The authors stated the definition of a successful project as: A project that deals with the contextual conditions and produces a product that attracts reasonable production orders. To customize this definition to better suit the situation of our study, the authors redefined it as: An aviation project that dealt effectively with the circumstances of WW2 in the UK and produced an aircraft that satisfied the Government sufficiently that they issued a quantity production order.
Given this definition, a justified indicator to evaluate the project was needed. The production figure serves this purpose as follows: During WW2 no aircraft was authorized to be manufactured unless it satisfied British Government standards; the production quantity was also subject to Government authorization. Moreover, the continuous evaluation of aircraft resulted in the cessation of production if an aircraft proved to be flawed, so only those with proven efficiency were produced in large quantity. For example, the Avro Manchester bomber went into production but, when it proved unreliable, production was ceased after only 209 units had been built.

This indicator complies with the logic of the four-level project success framework. A product is more likely to be produced in quantity if its project can deal effectively with the contextual circumstances. This was the case in many British aviation projects. All the projects that proceeded to the stage of mass production (more than 500 units, as shown in **Table 3**) could deal with the difficult circumstances of the war.
The large quantities were a good source of revenue for the production companies, so their business succeeded as a result of this revenue. Business success based on mass production is likely to be achieved if a business offers a satisfactory product to the customer. This was certainly the case in the UK because the circumstances of the time determined that only satisfactory products would pass into production. Effective project management processes are likely to produce a good product within the budget and on time. During WW2 in the UK, the circumstances were unforgiving and delays or overruns could result in the cancellation of a project. For example, the Martin-Baker MB3 aircraft was a good aircraft during tests but it was cancelled because of delays and late delivery, and never progressed to production.

The production figure also reflects the following:

- Ease of production to satisfy the urgency. For example, the de Havilland Mosquito aircraft could be produced using simple carpentry tools because it was made of wood. Also, it was constructed in modules so these modules were produced in many small shops.
- Good utilization of workforce to satisfy the shortage in the skilled workforce. Benefiting from an alternative trained workforce means better production capacity.
- Versatility to satisfy changing requirements, since the same aircraft could serve different roles.

- Good utilization of available material to overcome the disturbance to material supply. For example, using local material reduced vulnerability to the material shortages that occurred as a result of the sinking of convoys from overseas.

Based on this approach to defining success, the projects analyzed in this study were assessed to extract the strategies that helped several projects to succeed, and also what caused other projects to fail.

**The Research Approach**

Generally speaking, there are two distinct research approaches with their own characteristics. These are the inductive and deductive approaches. However, these two approaches are not exclusive, and it is often advantageous to mix the two in certain research (Saunders, Lewis, & Thornhill, 2009).One of the most important benefits of combining the two approaches is that it allows understanding to be gained 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. It also allows the researcher to benefit from both qualitative and quantitative data. Moreover, combining the two approaches allows the flexibility needed to address all stages of the research.

To answer the main research question the authors used the inductive–deductive approach shown in **Figure 1**. The inductive approach was used at the beginning of the research and 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.

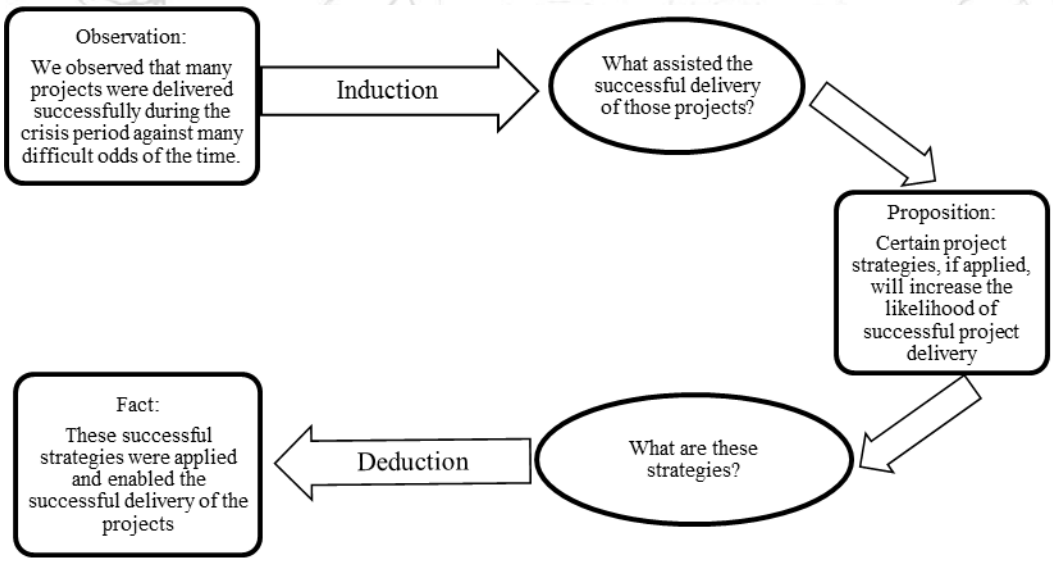


Figure 1: Inductive-deductive approach for this research

**The Research Data**

This research is a case study research. the authors used a portfolio of case studies consists of 24 WW2 British aviation projects, as shown in **Table 3**. All these projects were intended to produce aircraft to serve in the Royal Air Force and other allied air forces to support the war effort. All projects were completed during the war period, although the production of an aircraft may have continued after the war period as a result of its success.

Table 3: WW2 British aviation projects used in this study

| | The project name (aircraft name) | Manufacturer | Engine type | Number built | Class |
|---|---|---|---|---|---|
| 1 | de Havilland Mosquito | de Havilland Aircraft Company | Rolls-Royce Merlin | 7,781 | fighter |
| 2 | Avro Lancaster | A. V. Roe and Company (Avro) | Rolls-Royce Merlin | 7,377 | bomber |
| 3 | Handley Page Halifax | Handley Page Limited | Bristol Hercules | 6,178 | bomber |
| 4 | Bristol Beaufighter | Bristol Aeroplane Company | Bristol Hercules | 5,928 | fighter |
| 5 | Hawker Typhoon | Hawker Aircraft Limited | Napier Sabre | 3,317 | fighter |
| 6 | Fairey Barracuda | Fairey Aviation Company Limited | Rolls-Royce Merlin | 2,607 | fighter |
| 7 | Short Stirling | Short Brothers plc | Bristol Hercules | 2,383 | bomber |
| 8 | Armstrong Whitworth Whitley | Armstrong Whitworth Aircraft | Rolls-Royce Merlin | 1,814 | bomber |
| 9 | Fairey Firefly | Fairey Aviation Company Limited | Rolls-Royce Griffon | 1,702 | fighter |
| 10 | Hawker Tempest | Hawker Aircraft Limited | Napier Sabre | 1,400 | fighter |
| 11 | Hawker Sea Fury | Hawker Aircraft Limited | Bristol Centaurus | 860 | fighter |
| 12 | Avro Lincoln | A. V. Roe and Company (Avro) | Rolls-Royce Merlin | 604 | bomber |
| 13 | Fairey Fulmar | Fairey Aviation Company Limited | Rolls-Royce Merlin | 600 | fighter |
| 14 | de Havilland Hornet | de Havilland Aircraft Company | Rolls-Royce Merlin | 383 | fighter |
| 15 | Avro Manchester | A. V. Roe and Company (Avro) | Rolls-Royce Vulture | 209 | bomber |
| 16 | Blackburn Firebrand | Blackburn Aircraft Limited | Bristol Centaurus | 193 | fighter |
| 17 | Bristol Brigand | Bristol Aeroplane Company | Bristol Centaurus | 147 | fighter |
| 18 | Bristol Buckingham | Bristol Aeroplane Company | Bristol Centaurus | 119 | bomber |
| 19 | Westland Welkin | Westland Aircraft | Rolls-Royce Merlin | 77 | fighter |
| 20 | Supermarine Spiteful | Supermarine | Rolls-Royce Griffon | 19 | fighter |
| 21 | Hawker Tornado | Hawker Aircraft Limited | Rolls-Royce Vulture | 4 | fighter |
| 22 | Vickers Windsor | Vickers-Armstrongs Limited | Rolls-Royce Merlin | 3 | bomber |
| 23 | Miles M.20 | Miles Aircraft Ltd | Rolls-Royce Merlin | 2 | fighter |
| 24 | Supermarine Type 322 | Supermarine | Rolls-Royce Merlin | 2 | fighter |

The data on these cases and in other aspects of this research were compiled from several sources to ensure the rigor of the research through the triangulation of data. The authors analyzed a sample of original documents obtained from The National Archives; The UK Government's official archive, the Imperial War Museum in London and the Royal Air Force Museum in London. More than 600 pages of documents were analyzed. These documents belong to the Ministry of Aircraft Production, Air Ministry, War Cabinet, Ministry of Supply and companies that managed several projects during the war, such as de Havilland and

Vickers. The documents are related to industrial arrangements, product specifications, contracts, test reports, priority management, funding, staffing policies and practices during the period from 1938 to 1945.
In addition to the documents, eight recorded interviews with WW2 industry veterans were used in the analysis. These recordings were obtained from the Imperial War Museum collection in London. The analysis also included a collection of approximately seven hours of media, including films, newsreels and documentaries produced and aired in the UK between 1938 and 1945.

**Background information: a novel approach to understanding the context of WW2**

To study any event or phenomenon, it is essential to understand its context; however, it is not always possible to take part in the event under scrutiny to understand its context. The required understanding must be achieved through other methods, such as intensive reading of previous research and historical publications about the phenomenon.
In the case of this research, the context of WW2 in the UK needs to be understood thoroughly to gain a detailed mental image of the war context and the British socioeconomic system, particularly concerning the aviation industry and how it performed during that period, especially in the delivery of projects. This mental image is necessary as background for the data collection and analysis process.
Since WW2 ended before any of the authors of this paper was born, an alternative technique was developed instead of live participation. After a period of research and trials, the authors found that, to gain deep understanding of the context, time spent in the following activities was very useful:

- Watching documentaries. This is an effective way to understand the context (Howsawi, Eager, Bagia, & Niebecker, 2014b). The authors spent more than 250 hours combined watching and understanding series of documentaries about every aspect of WW2.
- Visiting places that represent important information about the WW2. The authors visited the following locations:
  - Imperial War Museum London;
  - Royal Air Force museum archive London;
  - Churchill War Rooms; and
  - Britain at War Experience (permanent exhibition).
- Listening to BBC radio interviews and programs from the era. The authors listened to many hours of shows that were broadcast during that period

These activities, along with the traditional practice of reading literature and veterans' diaries, were added to archival documents and recorded interviews. Collectively, these resources provided a rich source of information that significantly helped the authors to gain a good conception of the context of WW2.

**Data Analysis Procedure**

Data analysis involves extracting meaningful results, conclusions and decisions from the data. Several techniques are used to analyze the data. *Due to the nature of the data in this study*, the authors *chose content analysis as the main technique for data analysis.*

**The definition of content analysis**

Content analysis is a technique that has a long history and is widely used in modern research. Scholars documented the first use of this technique in 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 of analyzing data (Hsieh & Shannon, 2005; Krippendorff, 2004).

One highly cited scholar who defined content analysis is *Krippendorff. He was cited more than 13,000 times in Google Scholar as of February 2014. 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 February 2014. 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 analysis, backed by verbal, visual, or written data to describe a phenomenon and its dynamics. This technique can be applied well to subjects such as project management research (Wasiak, Hicks, Newnes, Loftus, Dong, & Burrow, 2011) and engineering education (Magenheim, Nelles, Rhode, Schaper, Schubert, & Stechert, 2010).

**The framework of data analysis**

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 use 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 on 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, and the valid and supported inference is more suitable. This highlights the fact that there is no simple single right way to do content analysis; instead, researchers should judge what is appropriate for their problem (Weber, 1990).

The data was coded into four main categories: 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. Consequently, the results reflect on the conditions. Figure 2represents the analysis framework designed for this study.

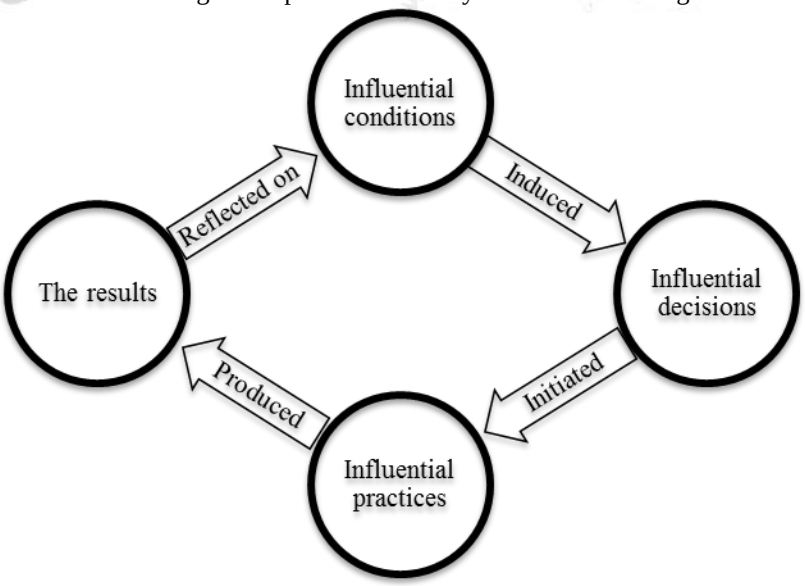


Figure 2: The analysis framework for this study

The influential conditions category contains the main themes or characteristics of the context of the phenomenon under analysis. The influential decisions category contains themes that represent the decisions that stakeholders take 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.

To give an example: In a collection of Government documents from 1940, reviewed in this study, the discussion about aircraft allotment for development works contains the statement "it is clearly impracticable to attempt to impose a limit on the number of aircraft…. Air staff and operational problems require high speed solutions which can only be obtained on the basis of a separate aircraft for each experiment" (The-National-Archives, 1940).

The phrase "require high speed solutions" represents the urgency and was coded in the condition category. The section that says "it is clearly impracticable to attempt to impose a limit on the number of aircraft" means allowing more aircraft for development work, and this statement was placed in the decision category, The section that says "a separate aircraft for each experiment" means the simultaneous development and testing of subsystems. This statement was placed in the practices category. **Figure3** illustrates the application of the analysis framework to the statement above.

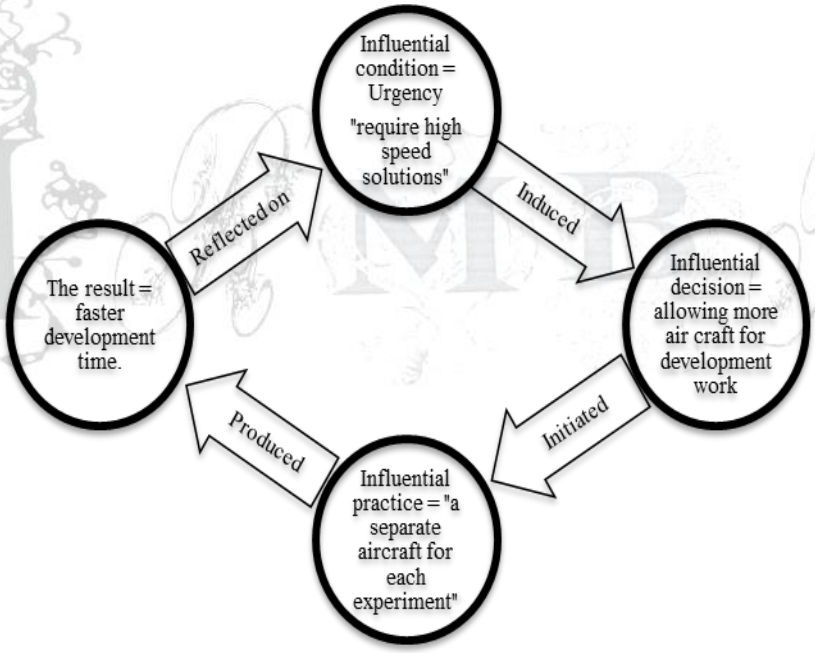


Figure3: The application of the analysis framework

**The research trustworthiness approach**

Reliability and validity are widely accepted quality measures in quantitative research. However, these concepts are not as clear in qualitative and mixed method research as they are in quantitative research (Golafshani, 2003). This study is largely a qualitative research, thus to deal with this issue of quality the authors adopted a trustworthiness model based on the work carried out by Shenton (2004) to establish equivalent qualitative measures of validity and reliability (Shenton, 2004). In **Table 4**, the quality dimensions are defined and the actions to establish them are detailed.

Table 4: 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 Discussion

### Summary of the Results

This study revealed six major strategies that proved effective in delivering successful projects during a time of crisis, based on the study of British aviation projects during WW2. **Table 5**summarizes these strategies and nine generic success factors supported by these strategies.

Table 5: Summary of the success strategies resulting from this study

| Strategies | Factors |
|---|---|
| 1. Obtaining Government support. A dedicated ministry for aircraft production.<br>2. Depending on nearby alternative material and workforce<br>3. Consolidating interagency collaboration<br>4. Applying a common platform strategy in new product development projects<br>5. Implementing the strategy of simultaneous development and testing of subsystems.<br>6. Incorporating versatility in the product design | 1. Adequate material supply<br>2. Adequate work force<br>3. Reduced bureaucracy<br>4. Having priority and authority<br>5. Short time for assessment and rework<br>6. Adequate funding<br>7. Having appropriate expertise, knowledge and equipment as needed.<br>8. No communication or transportation loss<br>9. Having public support |

The success model in **Figure 4** below is a general influence diagram that illustrates the relationship between success strategies obtained from this study and the generic success factors from the project management literature.

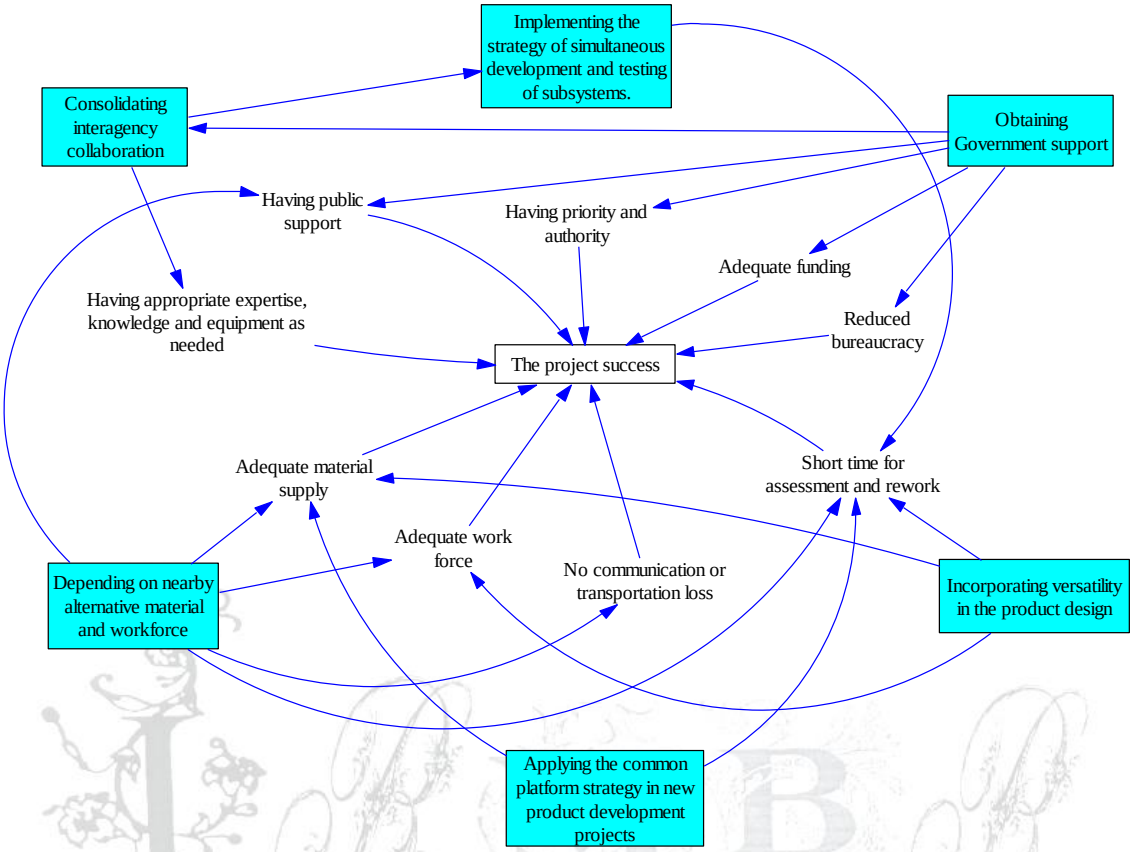


Figure 4: The success model

## Discussion

**Strategy No.1: Obtaining government support: A dedicated ministry for aircraft production.**

During times of crisis, businesses face difficulties in obtaining the required resources, permissions to work, or special services. This was the case in the UK during WW2. Because the nation was at war, the Government imposed many restrictions on the British socioeconomic system. Government support in such a situation is an essential ingredient for success. The aviation industry enjoyed the privilege of having exclusive support at the highest governmental level. There was a dedicated powerful ministry to exclusively support aviation projects, an action which was somewhat similar to the cheetah teams proposed by (Engwall & Svensson, 2004). This ministry was called the Ministry of Aircraft Production. All other war-related projects came under the jurisdiction of another ministry called the Ministry of Production.

The impact of this support was that the obstacles hindering aircraft projects were discussed at Cabinet level. The reports of the War Cabinet reviewed in this study show that many discussions about aircraft projects took place. Decisions made by the War Cabinet were translated into priority for aircraft projects, which meant they were afforded extra resources. The Ministry of Aircraft Production was exclusive to the crisis period. It was created a few months after the outbreak of WW2 and before the Battle of Britain in July 1940. Three months after the war it was attached to another ministry, and eight months later it was abolished.

Other forms of government support were the security services the Government provided to projects. This was essential, because during national crises new types of threats emerge (such as sabotage) which exceed the capacity of normal business firms to handle (Howsawi et al., 2014a). For example, national security agencies participated in deception plans and camouflage to disguise projects sites and production facilities against air raids.

Seeking a strong project supporter such as the government is not an exclusive strategy for times of crisis. However, it is very important to seek a supporter who can grant the project the required authorities, priorities and resources. Without the priority the aviation industry was granted during the early years of WW2, it might not have achieved all that it did.

An example that supports the effectiveness of this strategy is found in the case of the Aswan High Dam (AHD) construction project in Egypt in which took place during a series of Egyptian national crises in the 1960s. There are many differences between the AHD and the British aviation projects, such as the industry type, the geographical location, the culture, the era and the government regime. However, despite all these differences, one similarity is that an exclusive ministry called the Ministry of the High Dam was established exclusively to oversee all aspects of this project. This ministry was abolished after the successful completion of the project.

The Chilean miners rescue project in 2010 is also a representation of 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: Depending on nearby alternative material and workforce**

One important condition that emerges during national crises is the disturbance of supplies and the shortage of skilled labor (Howsawi et al., 2014a). In addition, the risk of transportation loss increases dramatically; for example, a bombing raid can paralyze transportation for days.

This was a condition of considerable impact on the British aviation industry during WW2. Nevertheless, some projects overcame this condition and succeeded in producing some of the finest aircraft of the war period. One of these projects was the de Havilland Mosquito. One of the main strategies that contributed to this project's success was the use of available alternative material – wood instead of aluminum. The wood supply was plentiful because most projects had abandoned wood in favor of metal. In addition, wood was available in Britain (Edgerton, 2011), unlike aluminum, of which more than half was imported (Weir, 2003). By using wood, the project and the company also benefited from the availability of carpenters who worked in trades less essential to the war effort, such as furniture-making so those workers can be easily redirected to work in this aircraft production. This strategy reduced the impact of the shortage of skilled metal workers.

In managing projects during national crisis, reliance on sources of materials and workforce that require long distance transportation to the project site puts the whole project at risk of running out of resources due to transportation loss. Innovation is required to help projects to benefit from the available local resources to prevent them from running out of resources due to scarcity.

**Strategy No. 3: Consolidating interagency collaboration**

In the course of managing a project, there might be phases that require information, knowledge, or technologies that are not in-house; for example, the results of the research and development phase of a product component. In peacetime, companies usually retain their information, knowledge and technology –

especially the secrets of their R&D – as a competitive advantage and may refuse to collaborate with rivals no matter what the immediate financial benefits might be.
In the UK during WW2, interagency collaboration was well-practiced, which helped to reduce the development time. This collaboration was ordered and enforced by the Government. In the document reviewed in this study, there were many Government orders to companies to share the results of their R&D or their facilities with other companies (peacetime rivals) to reduce development time. For example, one company might have advanced results in respect of the pressurized cabin while the other had a better airframe. In these circumstances, the Government would order the transfer of the cabin technology to the other company and arrange for reasonable compensation to the provider.
Failure to collaborate during national crises may lead to delays and overruns when they are least welcome. The consequences of delays during national crisis time exceed the financial losses to greater losses such as lives.

Recent examples that support this strategy are the reconstruction projects in Afghanistan following the 2001 war. The lack of sufficient interagency collaboration led to delays and overruns in reconstruction projects funded by the US (Sopko, 2012).

**Strategy No. 4: Applying the common platform strategy in new product development projects: The conservative approach.**

Greater uncertainty is one of the conditions of a national crisis (Howsawi et al., 2014a). There are plenty of sources for uncertainty in such a context, and there is a consequent need for uncertainty reduction strategies.
The aircraft industry during WW2 was in its early stages and the major components of aircraft were limited. These major components were at that time, the engine and airframe. It is much easier to modify, adapt or rework the airframe than the engine, so the engine has greater criticality in respect of the fate of an aircraft project.
In the UK during WW2, the project design team followed one of two approaches when a project to develop an aircraft was initiated:

1. To design an airframe around an existing and fully operationally tested engine. the authors call this the conservative approach; or
2. To design an airframe based on a perceived engine where the engine was at either the specification stage or the factory test stage, but was not in full operational use. the authors call this the pioneering approach.

All the projects in this research that succeeded in achieving more than 500 units of production were the result of projects that followed the conservative approach; that is, 13 out of 24 projects. On the other hand some of the unsuccessful aircraft which scored less than 250 units of production followed a pioneering approach, namely the Avro Manchester and Hawker Tornado projects. For example, the Avro Manchester failed because the Vulture engine was under development when the aircraft was designed. The same design was later modified to accommodate the Merlin engine, which was fully operational, and the result was the Avro Lancaster, which was one of the most successful bombers in British aviation history.
Following a conservative approach reduces the uncertainty that might result from using new, untried complex components in a new product development project. It is observed that the British aviation industry followed the conservative approach as a guiding rule. The Government document reviewed in this study showed many orders enforcing this approach.
Nevertheless, although the majority in the industry followed a conservative approach, this does not mean that there was no research or pioneering trials. Some works, such as R&D, are pioneering by nature. Also, following this approach does not contradict the uniqueness of a project because by definition the combination of proven vital components (the engine) with a new, less vital component (airframe) will result in new aircraft that perform unique sets of tasks.

**Strategy No. 5: Implementing the strategy of simultaneous development and testing of subsystems**

During national crisis time is considered to be among the top pressing factors (Howsawi et al., 2014a). Things need to be achieved quickly otherwise the rapidly changing circumstances may bring unwanted surprises. This was the case during WW2; the urgency to produce weapons was a pressing condition for British industries. To deal with this condition, the British aviation industry adopted a strategy of simultaneous development and testing of subsystems to reduce the overall development time. In applying this strategy, they developed and tested the subsystems of an intended aircraft on multiple experimental aircraft before assembling them all in the intended airframe. For example, a gun might be tested on an experimental airframe even before the intended airframe was finished, rather than waiting until the airframe was complete, then the gun would be mounted on the finished frame to test it.

This strategy by the British aviation industry during WW2 has now evolved into a more sophisticated technique called concurrent engineering which considerably reduces development time (Smith, 1997). Although this strategy works in crisis time as well as peacetime, the pressing urgency during crisis time makes this strategy essential for meeting time requirements and achieving project success.

**Strategy No. 6: Incorporating versatility in product design**

During times of crisis, a common problem is that requirements change rapidly, which requires many changes in specification during the development or application of the product. One strategy that helped some British aviation projects to neutralize the impact of changing requirements during WW2 was the versatility of the product. The de Havilland Mosquito and the Avro Lancaster, for example, were easy to modify to serve new roles. This feature gave them a very high rate of success at the product level of the four-level success framework. This feature considerably reduced the response time needed for changing requirements. For example, in the case of the de Havilland Mosquito, several changes to the aircraft specifications were requested after the contract was signed, yet the company managed to deliver the required quantity on time due to the versatility of the aircraft design.

**Recommendations for Project Management Practice**

The results of this research are intended to increase the likelihood of project success during national crises. Based on the strategies discussed above, the authors recommend the following:

1. The project management team should obtain government support, because the government is the strongest authority during national crisis. 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 support can grant the project required permissions, priorities and some special services such as security services when the environment is in chaos. This can mitigate the crisis making factors mentioned by Öcal et al. (2006) such as sabotage and government policies that act against the project.
2. Locally available resources should be prioritized in project resourcing because crises disrupt transportation (Chang et al., 2010; Natarajarathinam, Capar, & Narayanan, 2009). This recommendation mitigates the risk of transportation and communication 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 substitutes should be highly considered to utilize the maximum available materials and workforce.
3. The project management team should establish an effective interagency collaboration system. This system should allow the required information, knowledge and technology to flow between projects as needed. By doing this, important lead time reduction can be achieved. As mentioned before, time is among the most pressing factors during national crises.

4. National crisis time is not a suitable time for trial and error, so the project team should follow a conservative approach in developing new product; in other words, they should follow incremental innovation, not radical innovation. Apart from R&D projects, the number of new untried components in a product should be minimized to reduce the uncertainty resulting from the combination of multiple untried components.
5. The project team should design and schedule the project from the outset according to the strategy of simultaneous work. This is more complicated but saves much precious time. During national crises, saving time always wins the trade-off with extra effort.
6. The project team should be aware that the requirements of a product change rapidly during national crises, leaving the team with very limited time to react. The team should design the product from the outset with the idea of versatility in mind. A versatile product means the ability to fulfill new and emerging needs with minimum cost, time and effort.

**The Research Contribution**

Because the context of a project has a significant impact upon a project (Howsawi et al., 2011) and the peacetime context is different from the national crisis context, a different project management approach is needed to increase the likelihood of project success during a national crisis. This research expanded the literature of project management to that new arena; Project management during national crisis. This paper takes crisis management knowledge in the project management field beyond internal project crises to include external contextual crises, namely, national crises. In a broad sense, this paper solidified the concept of project management during a national crisis proposed by Howsawi et al. (2014a) by presenting six strategies proven to increase the likelihood of project success in such a context.

This study addressed a portfolio of projects from the British aviation industry during WW2 with a focus on the circumstances surrounding those projects. This work is particularly important because the world had never faced a crisis on the scale ofWW2. The success lessons from that situation are likely to work in less intense circumstances. The results of this study are building blocks in understanding how to deliver projects successfully during national crises. The strategies presented by this study increase the immunity of projects to the impacts of national crises.

This study strengthened previous research findings related to project success during national crises. Previous studies provided strategies thought to increase the likelihood of project success during a national crisis; for example, Kwak et al. 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 US (Kwak, Walewski, Sleeper, & Sadatsafavi, 2014) The results of this study support the findings of other 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.
The increasing frequency and scale of national crises worldwide now makes the contribution of this study particularly important.

## The Limitations of this Research

This study tackled a theme that is relatively rare in project management research, namely, project success during national crises. It took the approach of extracting the lessons from past successes and introducing them to present and future projects.
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 enrich the knowledge about successful project delivery during national crises.
This study also addressed a set of cases from one industry (aviation) in one crisis (WW2). Despite referring to cases from other crises, more case studies are needed to reach an appropriate level of generalizability.

Moreover, the results were extracted from the data set available for this study. Other results might emerge from different sets of data. Meanwhile, the authors aim to produce a framework for success during national crises and are investigating other cases. Early results show a great deal of similarities between different cases despite differences in industry type, geographical location and socioeconomic system.
The strategies presented here 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 for any given project.

## Conclusion

Project success is an important topic that is being studied from many perspectives. This research has investigated the reasons behind the successful delivery of projects during national crises. Based on the 24 case studies of this research, six strategies were extracted and presented to increase the likelihood of project success. This paper contributes to the project management literature by solidifying the concept of project management during national crisis as well as supporting the findings of previous research. The results have limited generalizability because of the limitations of the case studies involved in this research. More diverse cases studies are needed to enhance generalizability. Nevertheless, this research represents a building block in the foundation for a sound body of knowledge to assist with the successful delivery of projects during national crises.

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