Case study: Heathrow terminal 5

Abstract

The project management refers to the significant aspect of managing several projects of infrastructure and another related field. This practices, tools, and approaches applied in the project management affect the operation of the business. However, the success of the projects relies on the suitable tools and techniques along with the effective management of the company to address the potential risk the project. In this context, the current study is carried out to assess the potential risks related to the Heathrow Terminal 5 of London which is the most significant construction project in Europe. In this context, all the issues faced by the T5 and approaches used, are explained. Moreover, the focus has been laid on the lessons learned from the project where it was found that poor stakeholder engagement, ineffective communication, and technical issues are significant. It caused dissatisfaction among stakeholders and passengers had to face the considerable problem due to misplaced baggage. Despite several issues in the project, T5 was the successful project due to its effective risk management and prompt actions for the problems occurred after the completion of the project. Apart from this, collaborative work environment, quality standard and value creation processes are considered by T5 to increase the success rate of the project. However, it is imperative for project management to focus on the images of the project and value creation whereby expectations of stakeholders can be met, and the success of the project can be increased in the right manner.

Acknowledgement

The completion of entire study on my own was not possible without the extensive support from my professor and tutor. Owing to this, I extend my sincere thanks to tutor and professor who supported me and guided throughout the completion of the study. Also, I would like to impart gratitude for those who helped in the process of data collection and assisted me for presenting the completed study. I would have not done this work without their immense support; thus, gratitude for all those who supported me directly or indirectly for the successful completion of the dissertation.

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CHAPTER 1: INTRODUCTION

1.1 Background

The management of the mega construction of projects in a successful manner has become the immensely challenging because of huge potential risks. However, the development of such kind of big projects tends to affect the financial stability of associated private companies and national economies because the vast amount of money is invested for execution (Potts, 2007). Still, the scenario of constructing the number of infrastructure project has been increasing across the world as a result of growing population and demand for additional modern essential amenities. For this purpose, the government of the country or private companies invest related to infrastructure development for the ease of general public and business activities (Kerzner and Kerzner, 2017). The risk related to big projects remains high because megaproject aid resources, people, information to flow from one to another place, so it mandates the considerable investment. Although, companies which are involved in the construction of megaprojects have to face from the performance paradox because of record related to poor performance (Atkinson, Crawford and Ward, 2006). In this context, many projects confront failure due to their measurement against original quality, safety, time and cost objectives along with the expected prediction of the revenue (Le-Hoai et al. 2008; Mansfield, Ugwu and Doran, 1994).

Although, these issues occur due to poor system integration wherein governance and structure related problems are faced by the members of projects. This, in turn, imposes the severe problem for managing the project related activities and affect the overall quality. Apart from this, some projects face significant issues associated with the inadequate involvement of stakeholders whereby the actual plan deviates from the expected targets (Clarkson, 1995). These issues are generally followed by poor planning which in turn increases further uncertainties and affect the progress of the project. However, several project management tools are available for addressing the several issues related to time and cost overruns (Atkinson, Crawford and Ward, 2006; Frimpong, Oluwoye and Crawford, 2003). For example, Project Evaluation Review Technique, Simulation, 3D computer model and Total Quality Management etc. are used through which risk is assessed and efforts are put to reduce the total cost as well as the time involved with the particular project. However, Pinto and Morris (2004) argued that despite several tools and techniques, plans got failed due to the wrong application of the model.

Nonetheless, the use of model requires specific time and cost which goes waste when the wrong one is applied. Such kind of events in case of megaprojects enhances the budget and create the issues related to quality. For this purpose, the suitable model should be applied with the inclusion of skilled and competent experts who can support in the overall success of the project (Kerzner and Kerzner, 2017). By considering the numerous issues with megaprojects, the current study takes the base of the most significant project; Heathrow Terminal 5 (T5) of London. It is as one of the most complex construction projects of Europe which were approved after 46 months inquiry by the Secretary of State. After getting approval on 20th November 2001, the project was completed in March 2008 that added 50% capacity to the terminal. This multi-disciplinary project completed with the involvement of 8000 workers in different streams including communication, electronic system, civil, mechanical and technology contractors (Caldwell, Roehrich and Davies, 2009). However, 16 main projects which were divided into 140 mini projects took place for the construction of T5. Apart from this, the total cost invested in the project was 4.3 bn pound which covers the overall cost of two river diversions, M25 connected spur road, nine new tunnels and new giant terminal along with the satellite building. This project did not face an issue in meeting the deadline and completing the project within the given cost as well as quality parameters (Potts, 2007). In this context, the case study of T5 has been considered to assess the potential challenges which are faced by the mega projects and approaches used to address the same for the successful completion.

1.2 Rationale of the study

The project management is the critical field of the study as it contributes towards the effective management of several projects related to engineering, infrastructure, and energy, etc. However, these projects face issue related to extensive time span and cost overruns which might be due to wrong application of techniques and tools or ineffective approach (Dai Lee, Lee and Le-Hoai, 2008). Avoidance of the risk is also the significant contributor behind the project failure. For instance, poor communication between contractors and client leads dissatisfaction among stakeholders and cause the vital issue in the project success (Pinto and Morris, 2004). However, poor communication is the biggest reason as it creates the gap between actual and expected outcome through which the chances of further delay in the project occur.

The gap is the significant issue because resources go waste and the overall economic growth of the country is affected when problems occur in the context of mega projects. In this

context, the current study is being carried by successful T5 which could provide the information related to suitable approaches that can increase the success rate of the mega projects. The selection of right methods and tools would be helpful in optimally utilizing the limited resources and meeting the expectations of stakeholders.

1.3 Research aims and objectives

Aim

To analyze the project management issues and approaches applied for addressing it. A case study of Heathrow Terminal 5.

Objectives

- To recognize the major risks or challenges of T5
- To critically discuss how the project management issues have been addressed by applying appropriate project management concepts, tools and methods.
- To discuss the lessons learned from T5 which could be used for increasing the success rate of future megaprojects

The research objectives of the current study emphasized on the case study of T5 through which appropriate findings can be developed for addressing significant issues which are faced in the megaprojects. The T5 was completed successfully even with some crucial points in its execution. Therefore, the focus of the study on this specific case would be helpful in deriving the outcome.

1.4 Research questions

The research question has been framed in accordance with the aim and objectives.

- What are the risks associated with T5 through the value creation image?

1.5 Structure of the dissertation

The current research has been completed into five significant chapters and the brief explanation of the contents of each section has been represented in the below figure-

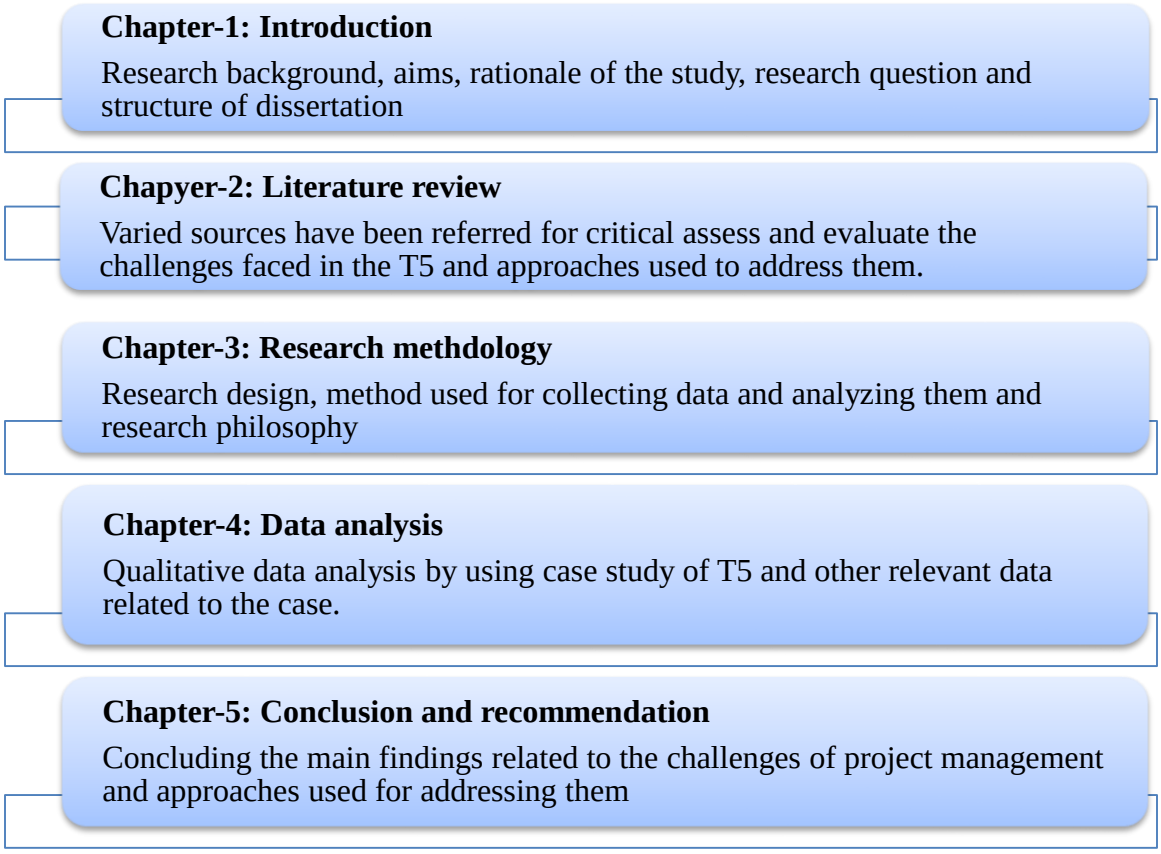


Figure 1: Structure

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This section is imperative as it provides enormous information related to the case study and other approaches which are used for the project management. In this context, varied sources have been referred for the critical analysis of the strategies used for overcoming the challenges associated with the project under consideration.

2.2 Project management issues and problems of Heathrow terminal 5

There are several challenges faced by the project managers in managing the mega projects which tends to affect the productivity as well as the delivery procedure of the project to a great extent. The explanation is as follows-

2.2.1 Risk of uncertainty

The uncertainty is the biggest challenge in the project management which affects the overall progress of the projects to a great extent. However, several studies evidenced that issues including complexity, uncertainty and value creations, etc. further enhances the chances of project uncertainty (Winter and et al., 2006, p.638). In this context, Migilinskas and Ustinovičius (2008, p789) stated that uncertainty and risk both are interlinked and these create the threats for the projects at the time of implementation of the construction projects. Further, the reason for the uncertainty is improper communication with stakeholders and team members (de la Cruz and Del Cano 2002). However, the proper interaction among stakeholders tends to increase the clarity related to the project through which success rate of a project improves.

Guide (2001) stated that the combination of risk and opportunity is helpful in minimizing the risk of uncertainty. For instance, in 1990 at the time of construction, the Heathrow terminal 5 faced a problem related to environmental change by following the perception of Scottish parliament, the British library and Jubilee line extension. In this regard, the statistics considered that the Heathrow would be constructed as generally by UK construction projects then the terminal 5 could be three years late and the budget would increase by 80% in comparison to expected cost (Fugeman, Hammond and Wolstenholme, 2008). It reflects that the scenario of uncertainty was considered under the mega project and accordingly other strategies were shaped. The aspect of uncertainty reduction contributed towards the success of the project because at the end it was completed within the given time span.

2.2.2 Material handling and logistic issues

According to Vieira and et al. (2011, pg.19), the material handling is a significant aspect for the construction of mega projects because this is associated with the flow of production. This issue directly related to the usage of resources, service levels and transaction time of the material. Moreover, the smooth transportation of material is helpful in minimizing the time and cost of the construction. However, Groover (2007) argued that to set the logistic activities at the construction site, the free flow of material is critical. However, it is associated with the maximization of cost because this would incur the 12% to 40% as a carrying cost of the total cost of material. Material handling problems created in construction which are at the busiest way of the country.

For example, Heathrow terminal 5 of London has been dealing with the logistical problem during the time of under construction of the airport in 2006. There has been an issue related to the material handling due to a single main entrance of the building. Furthermore, there was a problem in managing the 8000 workers per day because this had been constructing at Europe's busiest motorways. Moreover, T5 had limited space, so it was hard to regulate the flow of material (Gann, Douglas and Davies, 2009). Thus, it reveals that the material handling is a foremost issue for the under-construction projects because this requires the more space for the storage of material as well as management of workers per day and per hour. In this manner, the mismanagement of equipment increases the overall cost of the project.

2.2.3 Technological fault and issue in stakeholder engagement

The project complexity depends on the technologies which are used for the construction of projects (Baccarini, 1996; Sweis and et al., 2008). Several techniques have been used for the building such as risk management, scheduling tools like Critical Path Method, etc. According to Perrow (2011), accidents occur due to complex and tight implemented systems in the construction projects. These accidents happen due to unexpected interactions with the independent variables and affect the productivity of the system. Similarly, Gann, Douglas and Davies (2009) stated that before implementing the system and advanced technology, careful analysis should be carried out. Moreover, if there would not be proper testing of the systems, then it can occur the chances of uncertainty in the form of accidents along with the destruction of the satisfaction level of customers. In this context, Winter and Szczepanek (2009) asserted that three phase as mentioned in the below image should be considered in the project management. They believed that every project is always backed by social, political and development, organizational and change images

which tends to increase the reality aspect. It facilitates project management to understand the expectations of all direct or indirect stakeholder in an effectual manner.

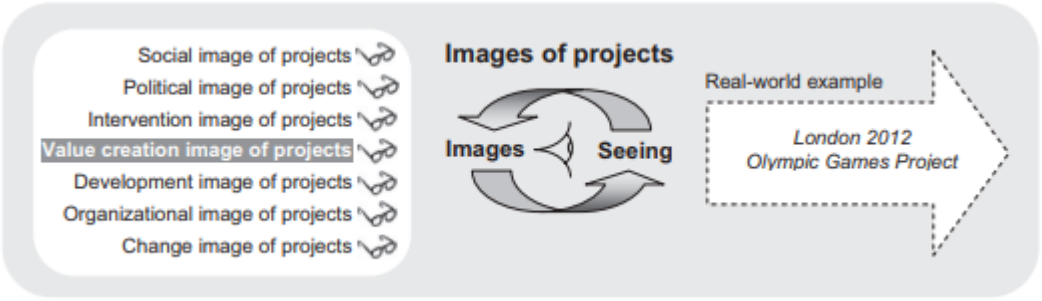


Figure 2: Three phase of the project

(Source: Winter and Szczepanek, 2009)

For instance, the Heathrow terminal 5 faced an issue related to the baggage handling system in the airport. This system was complicated for the handling of bags and creates the problems for the travelers. There was a software error as the system was not adequately tested before the execution. The system was being used with the filter process, so the major problem was occurring with the small number of begs. The error was regarding the counting of passengers bag in accordance with the number of passnagers. In this way, this was the software error that increases the dissatisfaction among the travelers regarding the mismanagement of luggage (Brady and Davies, 2010). It indicates that the technology is the central aspect for the construction of airline projects because the several links interconnect these, then only the handling of bags and material can be efficiently done.

Figure 3: Ineffective baggage system of T5

Figure 4: Baggage network of T5

(Source: *Royal HaskoningDHV*, 2018)

2.3 Assessing and evaluating the approaches used to address the project management issues

According to Stevenson, Hojati and Cao (2007), it is hard to manage the complex megaproject without cost overruns and delay. To avoid such problems effective procedure or techniques have been implemented.

2.3.1 Collaborative approach

Joslyn and Holman (1995) asserted that every project has its governance, risk, environment which might affect its overall completion project to a great extent. However, megaprojects which consist of several parts for the final delivery of the project contain relatively high risk because the project goes for a more extended time span with a higher rate of uncertainty. At this juncture, BAA formed the T5 agreement wherein responsibility of overall risk was taken and mitigated with the integration with the first-tier supplier. In this context, Diran Wickramatillake et al. (2007) argued that proper monitoring is imperatives for included partners and they must be communicated regarding the standard approaches which are to be followed. Otherwise, it tends to increase the chances of risk. In this context, Heathrow terminal 5 was based on active collaboration with the suppliers so they can understand the proper requirement and supply the right product with right quality on time.

2.3.2 System integration model for management of Megaprojects

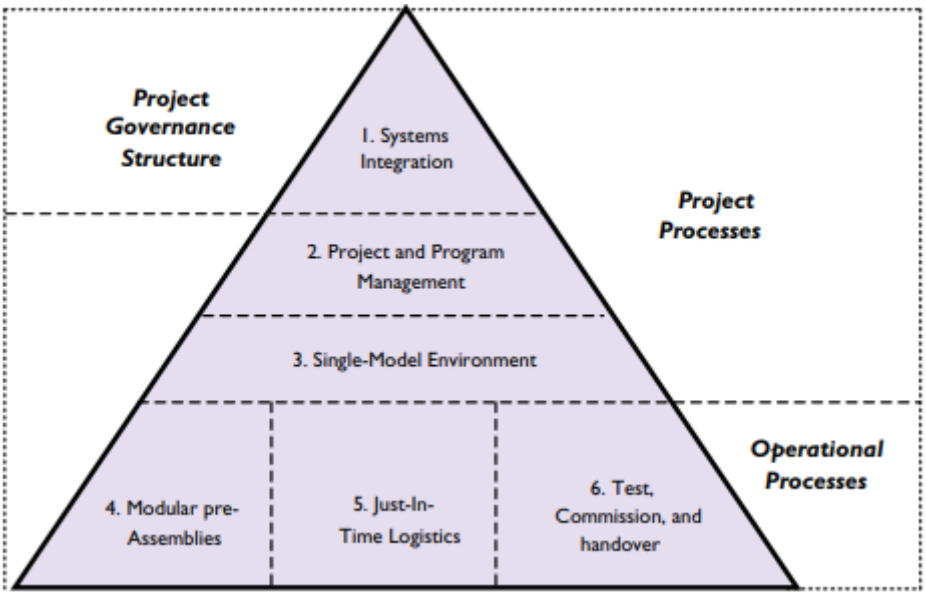


Figure 5: System integration in megaprojects

(Source: Gann, Douglas and Davies, 2009)

According to Brusoni, Prencipe and Pavitt (2001) megaprojects require active project process which consists of all primary activities including planning, designing, and construction along with operational readiness. At this juncture, outsourcing needs for a significant proportion of production, construction activities and design and production with the focus on maintaining the in-house capabilities for the integration of components and delivering the functional system by conserving the quality, cost and time targets into mind (Gann, Douglas and Davies, 2009) (*refer figure 3*).

The last stage of the model; operation processes plays an essential role as it provides extensive support to the project at the time of high-volume construction. In this context, Nahmias and Cheng (2009) asserted that advanced production methods assist contractors in dealing with potential issues related to the cost and time. They found that cost reduction is made with the help of enhanced safety, efficiency and flexibility of the components and subsystems which are to be installed on the site. For this purpose, modular pre-assemblies and testing systems were focused through which potential issues can be reduced and uncertainty associated with the project can be avoided. Budzier (2011) found that system integrators make it possible to integrate an overall project plan through which expectations of stakeholders can be met adequately. This, in turn, increases the competitive edge of the project and accomplish the set objectives in the right manner.

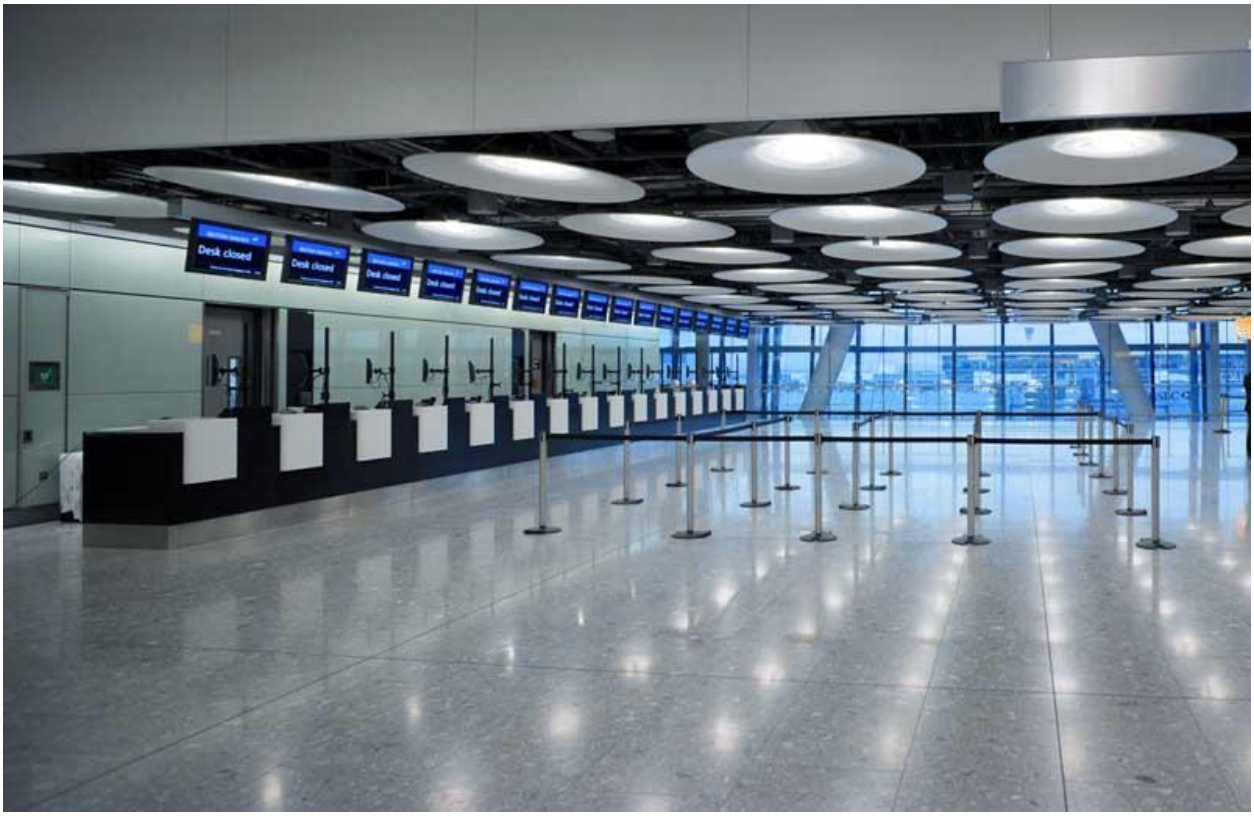


Figure 6: Heathrow T5

(Source: e-architect, 2008)

Several pieces of research found that Just-in-Time (JIT) logistics provides extensive support for the megaproject (Hutchins, 1999; Sugimori et al. 1977; Baldine et al. 2005). In this context, Thomas and Griffin (1996) asserted that the integrated supply chain is possible with the help of the successful application of JIT approach. This approach supported T5 construction to dispatch the large volume of construction components and material through the single entrance. This was just close to the main site wherein consolidation centers were responsible for storage and material handling (Basu, Little and Millard, 2009). In this regard, Prasad (1995, 116) asserted that the optimal mix of JIT tactics assists the corporation to focus on the quality because the uncertainty, as well as quality related issues of raw material, are reduced. This proves to be useful in acquiring the raw material on time and completing the project related activities within the given time span. Hoque (2000) asserted that the JIT approach helps in reducing the cost because the storage cost does not become the tension of the businesses as the material is supplied in real time with the promised quality. The free flow of material facilitates to improve the performance of the company. In this manner, application of aspects like JIT helps in resolving the issue related to

material handling in the megaproject which is also helpful in maintaining the proper quality and deal with the problem of cost overrun.

2.3.4 Application of right tools and techniques

There are several tools used in the field of operation research or project management which facilitates project managers to accomplish the project objectives effectively. In this context, Chin, Marcolin and Newsted (2003) asserted that simulation modeling is the practical technique to assess the risk involved in several fields such as energy, project management, engineering, finance, environment, and transportation, etc. through the application of computerized mathematical technique which enables project managers to take the appropriate decision on the basis of quantitative analysis. Earl and Deem (2008) found that to found the most likely outcome of the risk, application of Monte Carlo Simulation is appropriate as it has the causal relationship between the result and causes through which project managers can take the proactive measure for dealing with the particular situation. However, Watt and Watt (2000) argued that techniques such as 3D computer model are helpful for reflecting the clear picture of the proposed. This use of the 3D computer model enhances the certainty because every single aspect of the project is studied intensely to take the corrective action. However, Beck (2011) asserted that both the generic simulation model and 3D computer model were used to look at the infrastructure requirement of T5 and asses the risk related to different areas. For instance, the risk associated with wrong construction was avoided with the simulation; however, the baggage system got failed due to the system error. Therefore, technological up-gradation in the project management is crucial which demands the application of the right technology.

According to Winter and Szczepanek (2009) images of the project influences the project manager to follow the perspective approach wherein a single project is evaluated from multiple prescriptive. By using this thoughtful and more pragmatic approach, suitable actions strategies are formulated for the most complicated situation of the business. In this context, Winter et al. (2006) asserted that revision of the project from a varied perspective reduced the risk as strategies are applied to make sense of complex realities of the projects. Furthermore, Winter and Szczepanek (2017) emphasized primarily the value creation of the project where it is assessed that whether the project has created the equal proportion of value and benefited or not. Although, traditional approach will still be followed the primary concern is value creation instead producing the products and services. However, this shift is imperative which helps in making the value creation

image that is quite relevant in the current era of project management. They further explained that value does not only reflect the financial outcome for the business. Instead, it focuses on the value and benefit including contribution towards the economic regeneration, social improvement and environmental protections (Winter and Szczepanek, 2008).

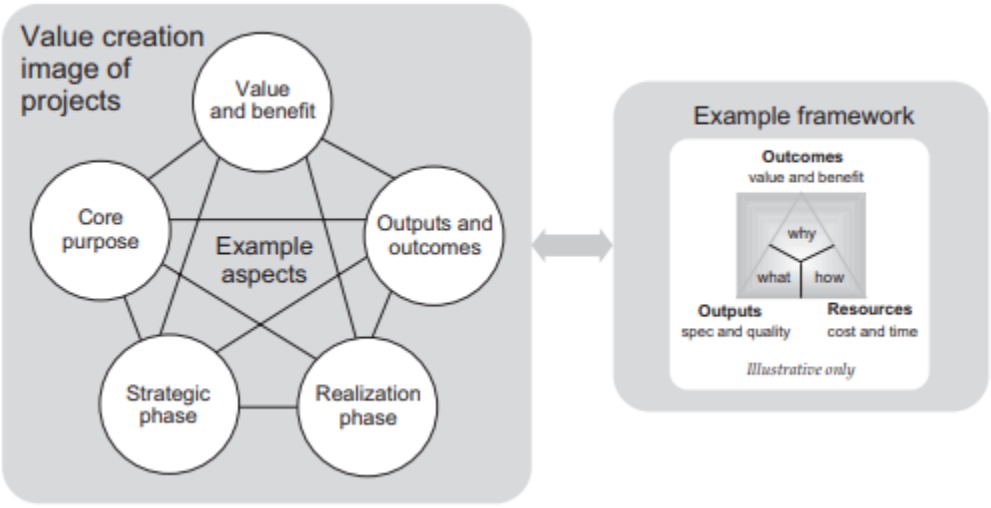


Figure 7: Value creation image of the projects
(Source*: Winter and Szczepanek*, 2009)

By considering the importance of value creation processes, T5 mitigated all potential risks with the application of images of projects and resolved those issues through prompt action. Although initial problems were difficult to manage later, it proved to be useful in creating the value and benefit through the economic regeneration and social improvement. Therefore, the motive of project management is not only constructing the final project but assessing its potential impact in the context of the mentioned factors.

2.4 Discussing the lessons learned from the T5 for managing the mega projects

There are several lessons learned from the T5 which can be implemented for the effective management of the megaprojects. It consists of the integration of stakeholders, pre-testing of technologies, application of right techniques, focuses on system integration and continuous improvement. Some of these lessons have been explained as follows-

2.4.1 Team integration

The construction industry has been critically analysed by the lack of efficient and integrated teams in the various projects (Bresnen and Marshall, 2000). However, Goodliffe (2002) argued

that there is no requirement of fully integrated units for the construction projects. He believed that the lack of integration could help a team in handling the contingency situation effectively because all people will not be focused on the particular aspect of the project completion. On the other hand, Baiden, Price and Dainty (2006, p.13) mentioned that without the integration of the parties it becomes hard to complete the project within the given standards. In this regard, Belbin (2012) asserted that Belbin team role theory is helpful in assessing the influence of team work on the successful completion of the project. Prichard and Stanton (1999) stated that it consists of several roles of the group including resources investigator, Co-Ordinator, Plant, Monitor Evaluator, Specialists, and Implementer. For example, implementer facilitates to turn the ideas into actions for completing the related work whereas the coordinator determines that the entire team is integrated to execute the plan on time.

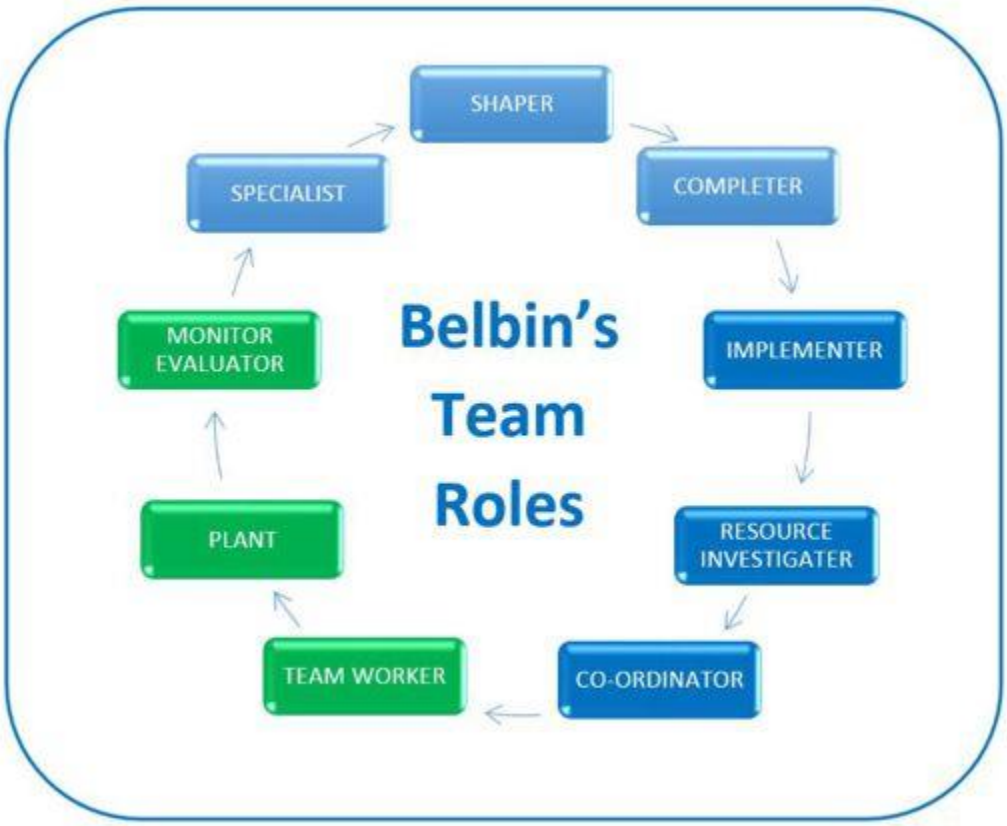


Figure 8: Belbin team role theory

(Source: Belbin, 2012)

Nonetheless, Love, Gunasekaran and Li (1998) argued that the integrated teams are necessary for the development of projects and to adopt the changes to the project. For instance, in

the Heathrow express rail link project, there was an integrated team for the management of all risk and uncertainties. In this regard, on 21st October 1994, the Heathrow express project came under the trouble because the main tunnels were destroyed and collapsed. In this condition, the Balfour Beatty broke the contract and denied to continue for further processing of the project. Then, in this situation, British Airline Association (BBA) has been decided that not to sue on the Balfour Beatty and work as a stakeholder with the whole integrated team of suppliers and save the time as well as cost which might be wasted in such kind of events (Gann, Douglas and Davies, 2009). Therefore, the success of a project depends on team integration wherein experts, project managers, and others work together for accomplishing the specified objectives.

2.3.3 Continuous Improvement Project Process (CIPP)

By the progress of the Heathrow project, it was ascertained that risk should be minimized with the appropriate action on time to time. For this purpose, Brady et al. (2006) asserted that the continuous improvement project process was the key to success behind T5 which enable the project manager to rectify the issues on time. For instance, the baggage related matters were faced initially in the T5, but it was addressed in the short time span with the continuous improvement plan. However, Evans (2002) asserted that the application of models like Total Quality Management (TQM) helps in bringing continuous improvement in the project (*refer to figure 6*). Under this, customer focus should be considered in managing the project which was reflected in the management of T5. However, Brady and Davies (2010) asserted that earlier there was the issue in addressing the requirement of customers due to poor engagement of stakeholders. The continuous improvement plan assists the project in dealing with those specific issues. In this regard, Jung and Wang (2006) asserted that TQM is on-going process under which active efforts are put to managing the change under the planning process and manage the same with the integration of all related stakeholders. The integrated stakeholders facilitate to enhance the chances of success of the project. In this manner, even with the specific issues, T5 got success as it was completed in the given cost, time and quality parameters. Therefore, the continuous improvement plan is considered as the significant learning aspect for engagement of stakeholders and bringing improvement in the project success.

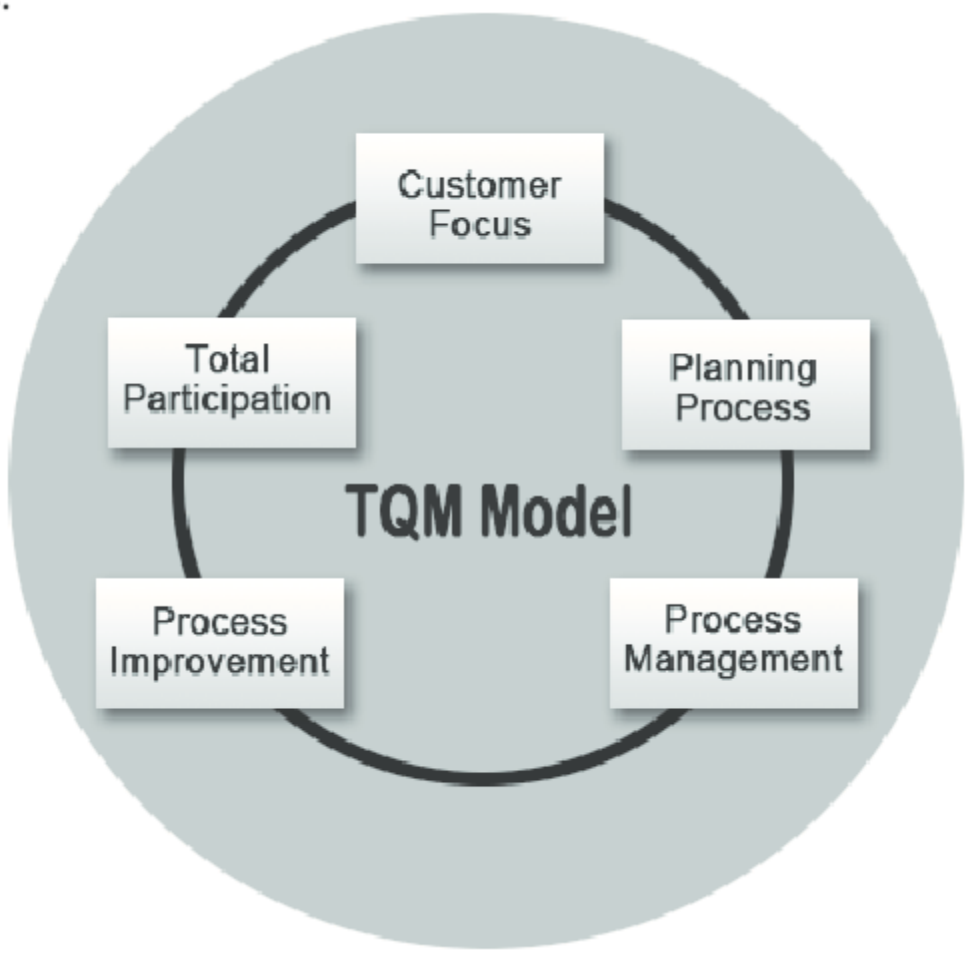


Figure 9: Total Quality Management

(Source: Evans, 2002)

2.5 Research gap

Several studies have been carried on aspects related to the strategies used for the successful completion of megaprojects. Although, less focused has been done on the approaches determining the successful completion of the project with the equal emphasis on issues faced in the megaproject. In this respect, the current study would cover the problems encountered in the management of Europe's biggest megaproject and approaches used to address the same. It would be helpful in adopting the right strategy for future megaprojects through which potential risks can be avoided, and the overall success of the project can be increased effectively. Also, key aspects to be considered under the project such as the involvement of stakeholders, continuous improvement and other related elements are essential so that resources employees in the project can be utilized successfully.

CHAPTER 3: CASE STUDY AND METHODS

3.1 Introduction

This chapter analysed the collected on the basis of specific requirement of the study with its specific focus on the aims and research questions (Saunders, 2011). In this regard, discussion or explanation has been provided for type of study, research design, methods for collecting and analysing the data research philosophy and approach. For this purpose, various kinds of research have been referred, and then selected means have been justified in the context of the qualitative study. In the present research, the mind map has been used under which potential risks of T5 has been presented. This indicates that poor stakeholders, improper evolution, time management issues, financial risk and ineffective contingency plan are some of the major problems which had the direct impact on the project performance. However, every risk affects several aspects of the project through the satisfaction level of stakeholders gets affected.

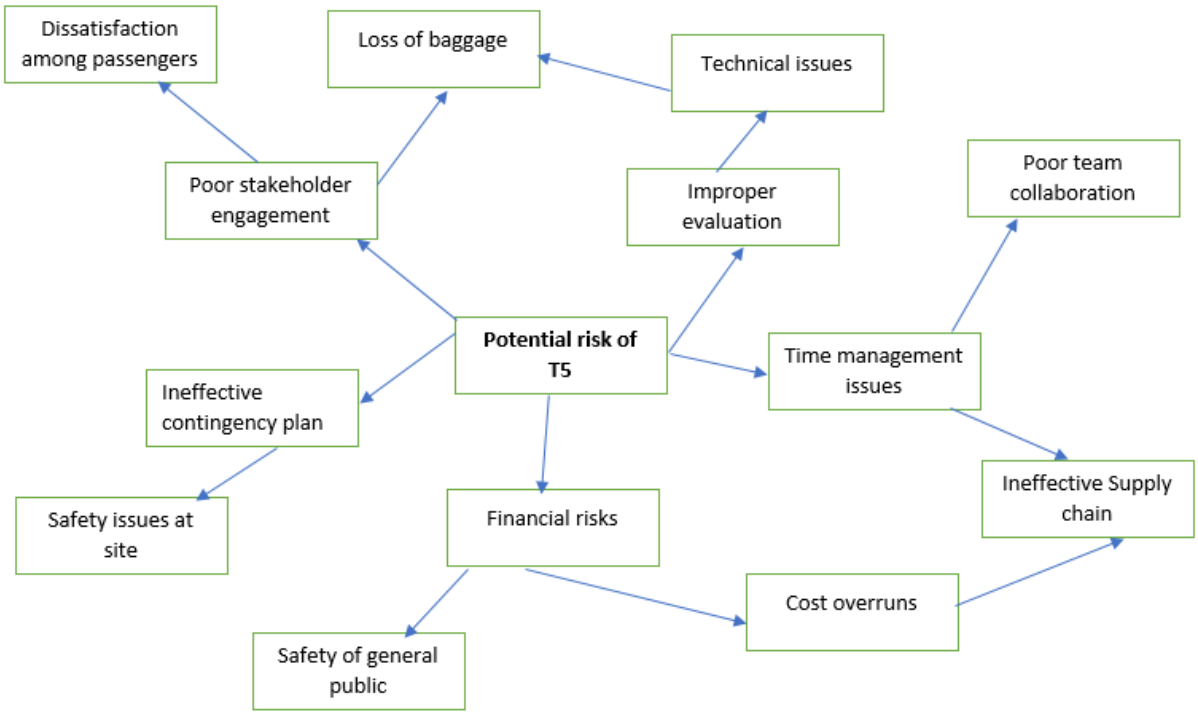


Figure 10: Mind map showing potential risks with T5

3.2 Type of the study

Qualitative and quantitative are two main types of studies which are selected following the aim and objectives (Roertson et al. 2013). The qualitative research generally focuses on extracting

the findings from an in-depth analysis of the collected information. However, the quantitative study assesses the impact of one variable on another variable with the application of scientific tools (Saunders, Lewis and Thornhill, 2009). Due to the selection of real-world case and demand of the in-depth analysis, use of the quantitative type of study is not beneficial. However, qualitative studies are more generalized by the specific event such as T5 case study. On the contrary, the quantitative research addresses the research issue explicitly with the investigation of the problem in the more specific manner. Thus, the application of a qualitative study is more suitable for the current research to carry out the detailed analysis (Saunders and Lewis, 2012).

3.3 Research design

Research design serves as the blueprint of the study through which findings are presented in the line of framed research aim and objectives. There are different types of research design such as descriptive, exploratory and explanatory wherein the former one is generally applied in case of qualitative study (Saunders, Lewis and Thornhill, 2000). On the other hand, exploratory research discovers something new through the thorough understanding of the problem. Apart from this, an explanatory research design defines the cause and effect relationship between different variables. Since the current study is based on the specific case study of T5 to reflect upon its success and failure aspects to improve the project management process. In this regard, explanatory research design would be helpful for deriving the correct outcome. However, the exploratory research design cannot be used as the problem is already understood whereas descriptive has not been used due to the focus of the study on the specific focus on the cause and effect. For this purpose, the Fishbone diagram has been used to ascertain the cause and effect relationship between two different variables. This evidences that the application of explanatory research design is the most appropriate and it is justified for the current study. In this regard, the following fishbone diagram reflects the cause and effect relationship which provided the outcome in term of successful completion of T5 with some minor risks.

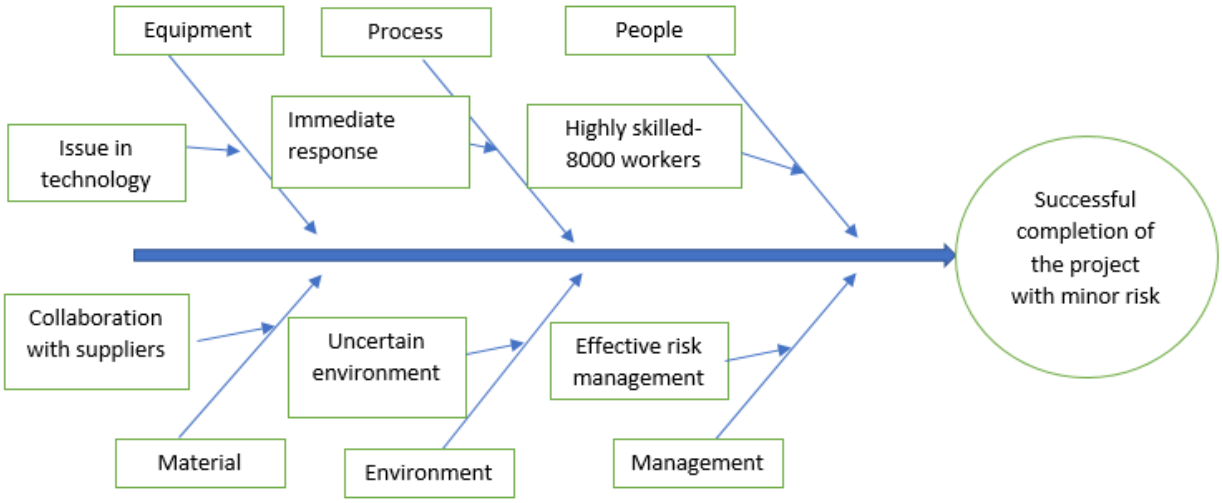


Figure 11: Fishbone diagram for T5

3.4 Research philosophy

It refers to the assumption, beliefs, and norms of the researcher related to the particular study. In this context, two types of research philosophies are used including interpretivism and positivism (Creswell and Creswell, 2017). The study under consideration is based on the positivism research philosophy because the researcher emphasized specific information about the case study. Although, a researcher in the case of positivism philosophy remained involved in the study but restricted to use own knowledge and insights because information of the real world is considered (Creswell and Clark, 2017). At this juncture, interpretivism philosophy is not suitable, and the application of positivism is justifiable. Also, applying the positivism philosophy researcher has collected the specific information through which potential risks occurred in the project of T5 has been explained in the right manner. Moreover, the strategies used to overcome those challenges has also been critically evaluated in the light of specific information only. In this manner, positivism philosophy wherein researcher is not allowed to assume anything rather considering the real work scenario (Creswell et. al, 2003). Therefore, the selected research philosophy is useful for extracting the outcome in the line of a case study.

3.5 Research approach

The research approach refers to the set pattern of the researcher related to the particular study. In this context, two types of research approaches including inductive and deductive are used in the field of research. Generally, deductive research approach is suitable for the quantitative type

of study wherein research aims to test the hypothesis (Creswell, 2014). For this purpose, general information is collected and then it is tested with the specific case considered. Apart from this, the application of inductive research is generally found in the qualitative type of study which begins with the specific investigation to the general aspect. The application of inductive research in the study may produce the new theory by assessment of the specific research issues. In this manner, the inductive approach promotes the general understanding related to the issue under consideration and accordingly provide the outcome. By considering the difference between two approaches, inductive research approach is justifiable for the current study because it also started with the specific investigation of T5. Furthermore, the risks, challenges, and issues faced by the T5 have been assessed, and then strategies applied to mitigate the same have also been evaluated. Owing to this, selection of inductive research approach is suitable for the current study.

3.6 Data collection

Data collection is the process of gathering the information related to specific research issue by considering several sources. Generally, two types of data including primary and secondary data collected by referring varied sources of information. However, Houghton et al. (2013) argued that it is not necessary that every research is based on both types of data as it is based on the requirement of the study. Further, the primary data are collected with the help of survey, interview, and observation. On the other hand, journals, books, and online sources are referred to for the collection of secondary data. In this context, the current study would refer to several secondary sources including journals, books and other published material which provides detailed information related to T5. Since the study focuses on the risk associated with the T5 with the use of the value creation process; therefore, application of primary data is not suitable. However, secondary data would serve as the rich sources because it showcases how the system got failed and how quickly it was repaired for the successful operation of the business. Therefore, case-specific information has been collected for a detailed analysis of the risk associated with the T5 and solution applied for the same. Owing to this, the collection of secondary data is justifiable.

3.7 Data analysis

It refers to the process of processing and analyzing the collected information in the direction of specified aim and objectives through which results can be obtained. For this purpose, qualitative, quantitative and case study method are applied through which specific findings can be

derived. The qualitative technique focused on the thematic analysis wherein collected data are considered, and themes are constructed in the same line (Flyvbjerg, 2006). On the other hand, the quantitative method is applied to the application of statistical tools such as correlation, regression, and ANOVA. Apart from this, the case study method is applied through the specific themes related to case-related information. Research aim and objectives construct these themes. It indicates that both thematic analysis and case study has gone simultaneously for the analysis of collected data. Therefore, the case study method is justifiable for the current research wherein the analysis part has considered both the literature review and other relevant cases related information. The findings derived from this analytical part helps in meeting the framed research objective in the right manner.

3.8 Ethical consideration

The ethics for every research is quite important because it increases the worth of study by assessing how the researcher has addressed the ethical issues (Dörnyei, 2007). Although, the scope of the research issue has been reduced to a great extent as the study is based on secondary information only. Still, the issues related to plagiarism and unauthentic access remains high in case the study is based on secondary information (Wiersma and Jurs, 2005). For this purpose, the focus was laid on the proper rephrasing of the all specific information related to the case study and everything is backed by proper support. Apart from this, reference list consists of all related references so that sources considered for completing the current study can be accessed quickly. On the other hand, unauthentic access to books and other sources is the critical issue in collecting the secondary data. At this juncture, access was taken for the respective sources to meet the requirement of the overall study.

CHAPTER 4: RESEARCH FINDINGS, INTERPRETATION AND EVALUATION

4.1 Introduction

This chapters aims to analyse the collected information in accordance with the research questions which defines the particular issue of the topic under consideration. The data analysis is one of the most important chapters of the dissertation which provides the detailed analysis of the collected data in the light of research aim and objectives. The current study is based on the case study analysis so that related information of T5 has been constructed and the themes are presented accordingly. However, the data analysis part has been provided with the findings and discussions of the collected information. This would be helpful for the researcher to present the findings in the right manner.

4.2 Findings or results along with the interpretation (Thematic Analysis)

The findings or results derived from the current study are shown in the below themes along with the interpretation-

4.2.1 Identifying the main project management issues of the project

By collected secondary data, it was found that T5 faced several problems related to poor stakeholder engagement and technical barriers and material handling etc. This is because the construction site was the busiest route for passengers where it is quite challenging to work on the construction site. However, the construction which is carried out on the busiest route is prone to risk for the general community. Owing to this, being the most significant project T5 also faced the issue related to material handling and managing the busiest route along with the on-going work. At this juncture, the problem related to material handling was encountered in the T5 wherein it was hard to supply the raw material. It has happened due to the single entrance of the site where the movement of 8000 workers was the complicated tasks. However, megaprojects require extensive space for the material storage and movement of labor for the continuous work. It is consistent with the study of Groover (2007) who asserted that material handling requires extensive attention for reducing the disruption and enhancing the overall success of the project in the right manner. It leads to saving the considerable amount of cost and time span so that management can shift their focus to other essential tasks. It reveals that material handling is quite problematic which

further increases the chances of failure in the mega projects. The primary reason behind the same is a requirement of adding management activities and high cost.

Poor stakeholders' engagement is the crucial issue which affected the project's growth to a great extent. However, T5 faced issue just after the completion of the project wherein it was revealed that customers are highly dissatisfied. However, this dissatisfaction was caused by the technical problems in the terminal wherein many passengers lost their baggage. At this juncture, it was important for terminal management to understand the potential requirement and effectually assess the risk so that issue does not occur in delivering the outcome for the end users. This outcome is similar to the study of Fugeman, Hammond and Wolstenholme (2008) who asserted that active engagement of stakeholders make the clarification regarding the project requisite and helps management in determining the overall success.

On the contrary, excess importance to some stakeholders, those are involved with the regulatory framework increase the uncertainty associated with the project. This is because T5 already got late approval for its initial; yet, it was completed in the less time as well as in the given budget. It indicates that uncertainty related to mega projects increases the chances of failure through which project managers become unaware of some issues which may impede the overall performance of the project to a great extent.

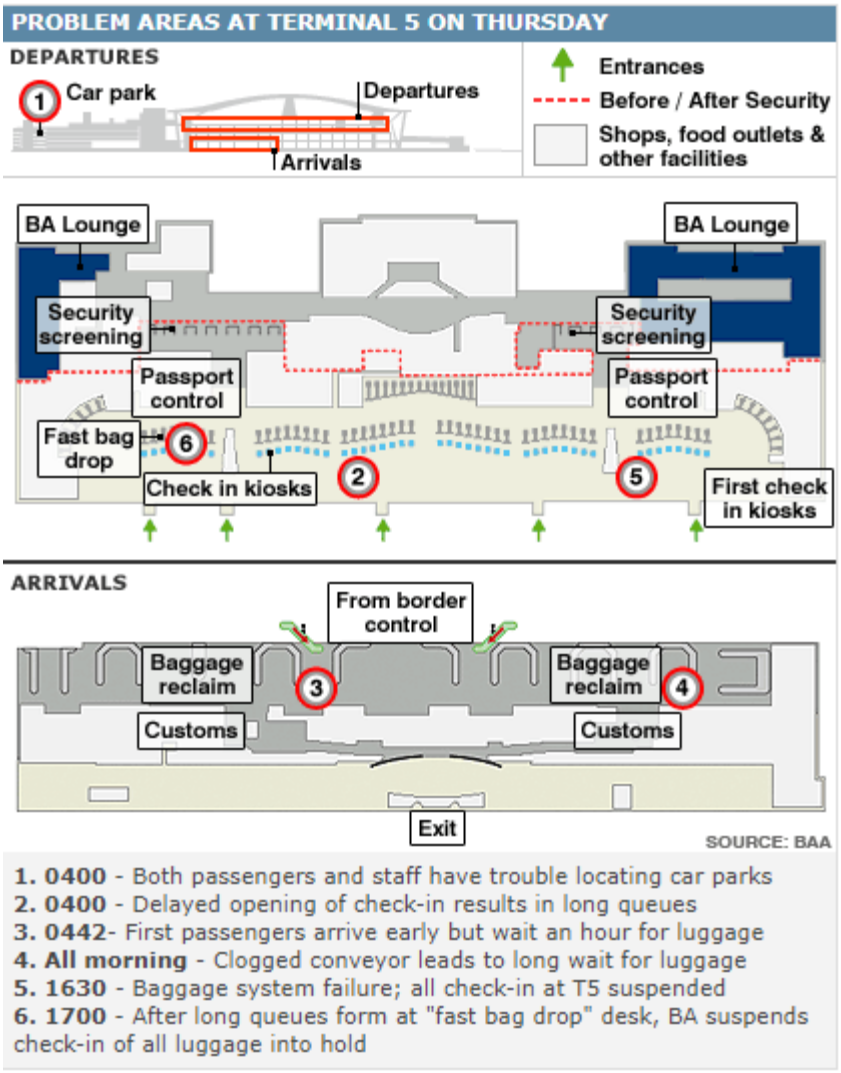


Figure 12: Problems of Heathrow T5

(Source: BBC News, 2018)

The construction of the mega project was so confusing under which workers or staff working in the terminal were unaware of their job duties. This is because place becomes enormous wherein staff was unable to know that where exactly need to go. In this context, at the particular point of time BA was blamed for lack of essential support and training among the staff workers to manage the routine activities at a terminal. Not only this, but the technical issue affected the consumers to the great extent as they have to cancel their flights and some flights got delayed to take-off (*refer figure 12*). The crucial point behind the project was people were unclear about the geography of the project, and this is the reason they were not even ready to work. It indicates that a clear picture of the project was not provided; however, all related issues got solved on time. Still,

extra efforts would have put to resolve the project related issues. These extra efforts facilitate to derive valid outcome and guide all staff members to accomplish the related tasks effectually.

The issue related to poor communication and IT glitches were the primary issue whereby the terminal immediately ran into the problem. Since the major problems were faced in addressing the issue related to the project where a corporation or BAA (terminal operator) could have taken necessary steps to improve the communication between related parties. The improved communication leads to derive the outcome and meet the expectations of all relevant stakeholders. Nonetheless, poor communication serves as the most significant barrier in the project management through which the overall success rate of the project gets affected. At this juncture, lack of communication in the staff of T5 further increase issue for the customers or passengers; thus, increases the need of free flow of communication.

4.2.2 Approaches, tools and concept used to manage the issues of T5

A long-term strategy is related to the larger time span of the project in which the organization can achieve the targets with possible outcomes (Pearce, Robinson and Subramanian, 2000). This type of strategy is helpful to specific amendments in the whole projects as per the analysis. In this context, the Heathrow terminal 5 was dealing with the several issues including the baggage problem, where people did not perceive the specific way to that where they should go to the airport, etc. Further, the Heathrow T5 was catering the demand increasing population by expanding the capacity with the 30 percent of total passengers of the UK airports. The UK government set an aim for developing the air travel facilities of UK till the time span of 2030 (Caldwell, Roehrich and Davies, 2009). In the long-term strategy, the project manager would have sufficient time for the development and further expansion in the airport. The long-term plan is helpful for the economy because a significant amount is contributed by the Heathrow terminal to the national economy.

The Heathrow terminal 5 has emphasized on the better procurement strategy to complete the entire project effectively. This project is multidisciplinary because it deals with the civil, engineering, electrical systems, communication and technology contractors during the whole phase of the project. Further, the T5 also focuses on the adequate supply chain management for the timely delivery of material, resources, equipment, etc. for the construction of the airport. Further, the terminal project manager emphasized the procurement strategy which was developed by the BBA. In this strategy, the client takes the responsibility to complete the project within the

given specification (Fugeman, Hammond and Wolstenholme, 2008). These strategies were helpful for the Heathrow T5 because this provides the quality material and tools on time for the completion of the project. Moreover, the terminal was dealing the problem of a single entrance, so by applying effective supply chain, the supplier will deliver the material at the time of requirement. In this manner, there would be the effective handling of material and equipment.

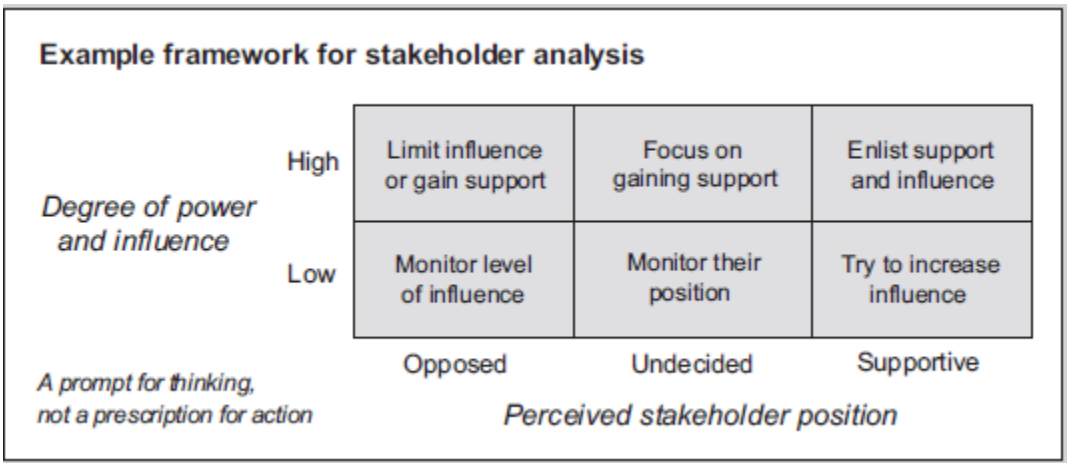
The proper evaluation strategy was applied through which management of T5 assessed all potential risk even after post completion. This strategy was applied when the technical error was detected and passengers provided relief. With the effect of this evaluation it was possible for BAA to ensure successful completion of the project along with the satisfaction among all related stakeholders. Here, the satisfaction among stakeholders determined the success of T5. Therefore, it is crucial to understand the potential requirement of the project and apply suitable strategy to complete the specific criteria. Owing to this, risk management approach of T5 is effective through which problems faced in the projects are provided the quick solution. This quick solution makes it possible to derive the valid outcome and determine the success of overall field of construction sector. Thus, these practices can be applied by the construction sector so as to resolve the potential issues which are faced during the project management.

The primary purpose of the communication plan is resolving the communication breakdowns among the team members. Further, this is also helpful in monitoring the progress and difficulties in the project. In this regard, the Heathrow terminal 5 was dealing with the issue of poor communication among members and teams. So, the manager has decided to focus on the better communication plan to resolve the problems occurring in the activities during the entire construction of the terminal (Fugeman, Hammond and Wolstenholme, 2008). With the help of this plan, the completion time was communicated to the team members. In this context, appropriate communication plan was implemented for quick resolution of the issue faced by T5. However, this solution was backed by integrated team of project wherein BAA worked with the technical experts of British Airways so that baggage related issue can be resolved in the right manner. Here, the integration has huge impact on the success of project management because it meets all the quality related criteria. The aspect of meeting the quality standards facilitates to increase the satisfaction level of stakeholders associated with T5.

The Heathrow T5 was dealing with the problem of baggage system because the system got failed. The failure occurred due to the error of the system which increases the dissatisfaction among

customers regarding the services of airports. In this context, the 3D computer model is helpful to reflect the clear picture of the problem and the instant actions can be taken to resolve the issues. The passengers were having a problem regarding the mismanagement of luggage, but with the help of the 3D system, the whole scenario can be identified that where the system is lacking. At this juncture, flux of events was considered whereby desired outcome for the project was anticipated and accordingly proper plan was prepared to resolve the issue. Although, the management of T5 did not get chance to celebrate its success due to potential risks related to terminal but then it was succeeded with the active efforts of the project team.

As evidenced in the case of T5, the stakeholders' poor engagement affected the performance of the project. Owing to this, it is crucial to assess the potential requirement of different stakeholders associated with the project. As shown in the value creation image of project, project managers' target is not only to complete the project rather creation of its value for different stakeholders including social, political and social is important. However, core purpose remains the central focus of the project through which all important strategies are framed. These strategies are set in order to increase the satisfaction level of stakeholders and ensuring their direct involvement in the project. The image as shown below shows that supportive position of stakeholders tends to have high degree of influence ad power. On the contrary, undecided position of stakeholders is focused for the purpose of gaining the support. These actions are included in the strategic phase of value creation image wherein entire external as well as internal environment of the project is considered. In this regard, several business cases are considered as an example so that risk plan can be prepared in the right direction. Apart from this, value perspective including economic, international, national and organizational level context are evaluated. This evaluation is imperative for the analysis in context of megaproject through which BAA conducted detailed analysis prior starting the work on T5. Still, the project got failed but the prompt action was taken to resolve the issue. In this regard, queries of passengers and security related to system of terminal was taken into consideration. This way it was possible for different stakeholders to consider the specific issues and provide the quick response for risks occurred in the project.



The development phase of the project was planned in accordance with the strategic phase wherein specific requirement related to stakeholders, internal and external environment were considered. At this juncture, illustrative examples might have been considered by BAA so that success rate of project can be increased. Yet, the images of project provide an opportunity for project managers to look on the projects in varied aspects. The deep analysis for these different aspects provides an opportunity to deal with crucial issues which arise while assessing the images. For instance, images of project would have provided a view related to parking problem of the T5. With these effective proactive actions might have taken through which actual outcome can be reduced. Despite of several minor issues or risks in the T5, important internal key stakeholders as employees and management helped a lot for the effective management of the project. For this purpose, proactive actions as inclusion of skilled and competent personnel was taken which aid corporation to reduce the significant risks to a great extent. Therefore, the proactive actions and focus on the stakeholder's engagement help in reducing the risk to a great extent. Apart from this, appropriate emergency assisted T5 to get the immediate success and resolve the occurred risk post completion of the project.

4.2.3 Lessons learned from T5 which could be used for increasing the success rate of future megaprojects

The most significant construction of mega project T5 serves as the guideline in the field of project management. This was the crucial aspect for different stakeholders involved in the project to get their queries resolved. From cause and effect relationship of T5, it has been found that people related issues such as lack of support, training and communication has the negative impact on the project performance and can even cause the failure of the project. For this purpose, project manager

need to ensure a free flow of communication through which different parties can work together for accomplishing specified objectives. However, to resolve the issue related to poor communication suitable technologies can be used to carry out the meeting with each level of workers (Prichard and Stanton, 1999). It would increase the transparency and general staff working in the terminal will not get affected as evidenced in the case of T5.

The technical part must be sound enough which support the testing and all related activities of attached technologies. However, the cases related to terminal construction should consider the active monitoring of baggage performance. At the same time, the focus can be laid on the training and development of employees involved with the project through which it would be helpful in rendering the services just after the completion of the project. Otherwise, it becomes quite challenging to manage the routine activities at the end of mega projects. In this context, the risk after the completion of the project can be on priority because it has an enormous impact on the success of T5. It was found that although, the project got completed on time and within the budget but still it affected risk after its completion increased and accordingly project manager suffered through workload at the end.

Despite several challenges, such most significant construction project was successful due to the innovative procurement through which the overall cost of construction went down with the high-quality standards. This makes the BAA at the heart of the construction sector due to its quick risk awareness and aspect to address those potential risks occurred in the project (New Civil Engineer, 2017). Baccarini (1996) found that risk awareness is the crucial part of the project management because it might increase the cost and violate the quality standards to a great extent. For this purpose, practical approaches are applied through which stakeholders can be satisfied by the proactive measures of the risk management. On the contrary, the method of risk management in case of T4 was already unique because the risk was not shared instead the single party or operator addressed it. This concept helps BAA to get reward or incentive of managing the project at their part. In this context, this approach can be applied in the future project management field with the focus on the risk management approaches.

The appropriate management in the projects is the key to success because it is one of the crucial reasons behind the project failure. For this purpose, BAA had the partnership with the BA for the development of software, and several other suppliers were enrolled. The management of suppliers was quite effective whereby the company arranges its material and cost-effectively

ensure proper storage. Apart from this, the general public or other stakeholders should be managed on time to time through which it would be easy to make them aware of the performance of the new project. This awareness would also help stakeholders to get prepared for the changes. Moreover, skilled and competent personnel can be hired in the specific field to reduce the risk after the completion of the project. At this juncture, it might be possible or useful to share the risk to some extent with the client. In this context, Groover (2007) provided the same outcome that if the client is well known about the internal environment of the business and can be helpful in addressing some potential challenges in the right manner. Therefore, T5 serves as the practical approach for the proper management of the risk and resolving the potential dangers which create the threat in the field of management.

4.3 Discussion and evaluation

It is evidenced that T5 went through different minor risk during the project and after completion of the same. However, the risk sharing approach of this project is different from other wherein it was not shared. Therefore, it might be a potential reason behind the failure of the system post completion. As evidenced in the collected and analysed data, T5 caused higher dissatisfaction among passengers due to misplaced baggage which caused a delay in the flights and even the cancellations. In this context, Winter and Szczepanek (2009) asserted that images of the project could be used for the bright reflection of the future project. These images help in checking the project from numerous perspectives and increasing its worth for the project stakeholders. However, Gann, Douglas and Davies, (2009) found that the cost reduction and quality are not the only parameters for the judgment of the project. Preferably the aspect related to value creation is essential which influences management to focus on the value created by the project for the stakeholders. These findings are not consistent with the approach used by BAA in T5 as it focused on the cost reduction along with the quality management. It was manifested as the system failure or IT glitch post completion of the project which did not create value for the passengers. In spite of establishing the value for the project, T5 disappointed the stakeholders because they were unable to celebrate the success of the project.

The analysed data shows that stakeholders' engagement was poor in case of T5 through which project although met the requirement but the certain level of disappointment. This scenario might have dealt through the application of a suitable approach and the free flow of communication. These findings are consistent with secondary data which shows that the

involvement of stakeholders increases the success of the project (Winter and Szczepanek, 2009). On the contrary, the project success is derived through the combination of the social, political and developmental environment which provides valuable input for the project (Stevenson, Hojati and Cao, 2007). This outcome derived from the secondary study is in the line of case study information wherein it was evidenced that due to political interruption the project got late in its initiation. Furthermore, the issues related to development was faced and its potential impact was observed on the stakeholders. At this juncture, the focus on the political intervention images can be laid so as to get the view of the risk prior initiating the project. This view facilitates to apply the suitable strategies for mitigating the risk so that all related stakeholders can be considered to determine the success of the project. Thus, valuable insight is based on the proper analysis of the internal or external environment.

The team integration and collaborative work environment is the major contributor to the project success because of the team of experts with different specialization can efficiently address the challenges of the project by forming the suitable strategies. This was also shown in the case of T5 but since the project is massive and all risks were tolerated by the operator only. In this context, the risk increased and the project met with certain issues. Although, other risks related to material handling and supplier management were managed cost-effectively. It was made possible with the application of risk management approaches wherein suppliers were directly involved with the project. It facilitates to make them aware of the quality and cost standards to complete the project on time. However, Nahmias and Cheng (2009) found that uncertain environment affects the project performance and its success rate because emergency plans are required to implement. This, in turn, reshapes the strategies applied by the project management to achieve the success of the project at any cost.

The collaborative work environment and team integration were helpful for BAA to work on the project and get it completed on time. However, the continuous improvement plan was on the place which helps in tracking the overall performance of the project. For instance, approaches like TQM wherein focus is laid on the process, total participation, customer focus, planning and improvement, etc. on the on-going basis. With the incorporation of such kind of approach, T5 was free from significant safety-related issues. Although, the project was prone to high risk because the route is busiest; still, the active management approaches make it possible to complete the activities without affecting the routine tasks. These findings are consistent with Joslyn and Holman

(1995) where it was found that collaboration and team integration are essential for the collective success. Also, it increases the clients' satisfaction level because the primary focus is laid on the specific requirement. In this context, the learning derived from the T5 can be used in the future megaprojects for the reduction of the risk and applying the suitable plan for the mitigation of the same. In this context, the proper evaluation of the technical issues or risk associated with the project of T5 serves as the learning through which it becomes easy for construction sector to handle the mega projects. Thus, the risks management practices in case of T5 were unique which in turn project got success despite of minor risks or issues.

CHAPTER 5: CONCLUSION AND FUTURE RESEARCH

5.1 Conclusion

It can be articulated from the findings and discussion that the main risks which are faced by the project managers are regarding the risk of uncertainty. The extreme level of uncertainty has an enormous impact on the implementation as well as the working of the projects. On the other hand, this further gives rise to an increase in the budget that impacts the overall functioning of the project. Heathrow Terminal 5 has witnessed different challenges regarding the handling of material, logistics issues. Due to the wrong and the inappropriate construction, the project managers have to deal with some of the difficulties which caused problems and problems for the passengers. With this, the problem of improper communication between the stakeholders occurred which also caused specific issues regarding the delay of baggage, etc. Every time, the projects are affected by the social, political reasons which give rise to the problems. However, it was the result of a technical issue that wrongly occurred in the construction time only.

In this case, the stakeholder's engagement is the prominent aspect that is required to support the construction and the purpose. Effective project management helps in understanding the need and requirement of the stakeholders for accomplishing the project. In the big projects, generally, these are the issues which frequently occurred because of complex structure and huge planning done by the engineers. Due to the software and the technical error issue with the baggage handling increased and this was one of the main reasons for dissatisfaction among the travelers. Without the proper testing, the chances of the uncertainties increase among the project which gives rise to issues which sometimes becomes incurable by the project managers. For substantial infrastructure projects, proper planning with risks mitigation strategies is required to overcome the existing problems. The same is expected in case of the terminal which has been facing the issues for the more extended period.

It can be concluded that significant problems and failure in the infrastructure occurred in the Heathrow Terminal 5, but it was resolved quickly through the prompt actions by emphasizing on the strategies of the project management. The central aspect that was witnessed in the terminal was the application of appropriate tools and techniques related to the project management for resolving the problems and making it practical for functioning. With the assistance of the collaborative approach, integration with the first-tier supplier and contractor helped in proper

monitoring of the parts and with active communication between them assisted in reducing the chances of risks among the project. From the past project management has involved specific problem because of the inefficiency in identifying and managing the difficulties by the managers. Further, inappropriate usage of resources also leads to making the project ineffective regarding practicality view of the passengers.

Proper planning, strategies and tools and techniques are the major problem for the challenges faced by the project managers. But sometimes due to inefficient talent, the application is not made correctly which involves specific risks for the project and the customers who will be using the services of the project. As per the present scenario, the efficient staff and proper operations of the challenges helped the Heathrow Terminal 5 to make their customers satisfied with the services proposed by the project. The system integration models for management in the megaprojects are vital for the high-volume project construction. The significant role played by the system is to support the project by introducing new methods and system that can help in handling the potential risks which can occur at the time of the implementation process. With the help of modular pre-assemblies and the testing system, the chances can be reduced to some of the extents and majorly the uncertainty level also decreases with it. This gives direction to the planner to further accomplish the project.

On the other hand, JIT approach helped the Heathrow Terminal 5 for effectively handling the issues. There was several techniques as well as methods were adopted by the project managers for effectively resolving the issue. The central aspect that can be witnessed in project management is regarding the duration of time which was taken by the Heathrow Terminal 5 for overcoming the problems. Generally, in the process, significant time is received by the project managers. Further, with the help of the simulation technique, it helped the managers in taking the appropriate decision for executing the projects. Other than this, the 3-D model also assisted the Heathrow Terminal 5 for studying every aspect of the problem and providing a solution for the issues faced by in the construction

There were many types of risks which were avoided by the strategies incorporated by the manager. Baggage failure was one of the main issues which were avoided with the help of the simulation technique as this stated that technology is the main component in the project management system which helps in resolving the major problems in the construction projects. Another appreciation part for the project managers was to apply the right technique at the right

place this showed the competency and the effectiveness of the individual working in the construction project. Despite the tools and techniques, there are other significant reasons which helped in accomplishing the project in the given period. The most important among this is team integration as with the active collaboration and the team working, the workers handled the contingency situation expertly which led to project completion. It becomes essential for the employees as well as the managers to identify their role in the work that can help in determining the problem. For the big project, teams are made in the project management to assist in identifying the problem from every single angle to make it competent to function. Due to the collapse of the tunnels, another problem emerged for the Heathrow Terminal 5, but with the active collaboration and the team working, the problem was solved effectively. These are some of the lessons which can be extracted from the present scenario. The significant need for the vast construction project depends upon the TQM models which help in managing and catering continuous improvement in the project. Due to these reasons, the project got success, and the reconstruction of the project was completed in the given time.

Project management models make the work more accessible for the managers and employees, but the major problem is their execution and implementation process which leads to failure and delay in the process. The work carried out by the Heathrow Terminal 5 was appreciable because of the vast efforts and effectively utilizing the resources. Even with the significant problems regarding baggage handling and improper communication, the managers and the staff were able to handle the situation effectively. Last but not the least, it can be further evaluated that project management requires proper planning and the strategies for executing and implementing the work which can assist in reducing the significant problems and further minimizing the risks uncertainties in the construction project. Heathrow Terminal 5 is known for the immediate effect and the ways as well as the methods for accepting and overcoming the issues of the terminal. It is recommended that, with the significant project construction project, the risks are also, but it can be defeated with the assistance of project management tools. This can help in increasing the success rate of the future projects.

5.2 Recommendations for further study

The further study can be conducted to assess the risk management approach followed by the BAA as it was not shared with the client instead owned by the operator. Owing to this, the study in this specific field can provide the novel approach for the risk management and introduce

the successful risk management initiatives in the construction industry. Moreover, further research can be carried out to assess the challenges associated with the T5 and its potential impact on the construction industry. This would be helpful in taking the corrective steps to deal with the significant issues occur in the mega projects. However, the present study also covers this aspect, but the primary focus on the challenges can provide more deep-insight through the interaction with the respondents enrolled in the project management practices. Apart from this, the quantitative study can be done which provide more scientifically proven outcome in the field of the project management on the basis of megaprojects as T5.

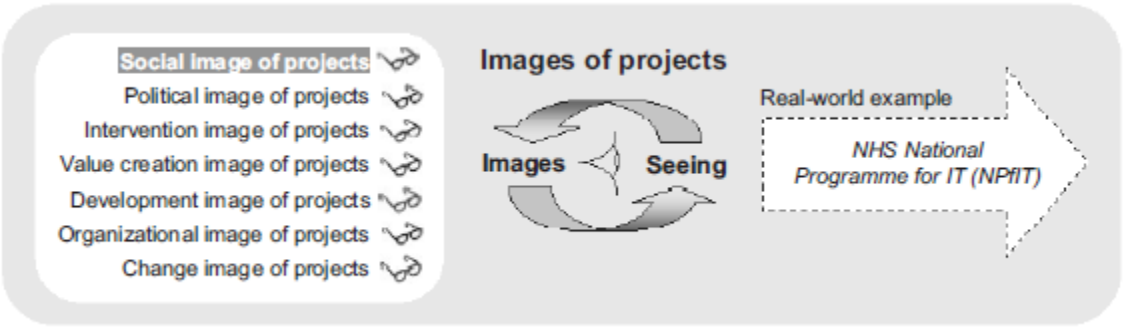


Figure 13: Three phases of projects

(Source: Winter, Mark, and Szczepanek, 2009)

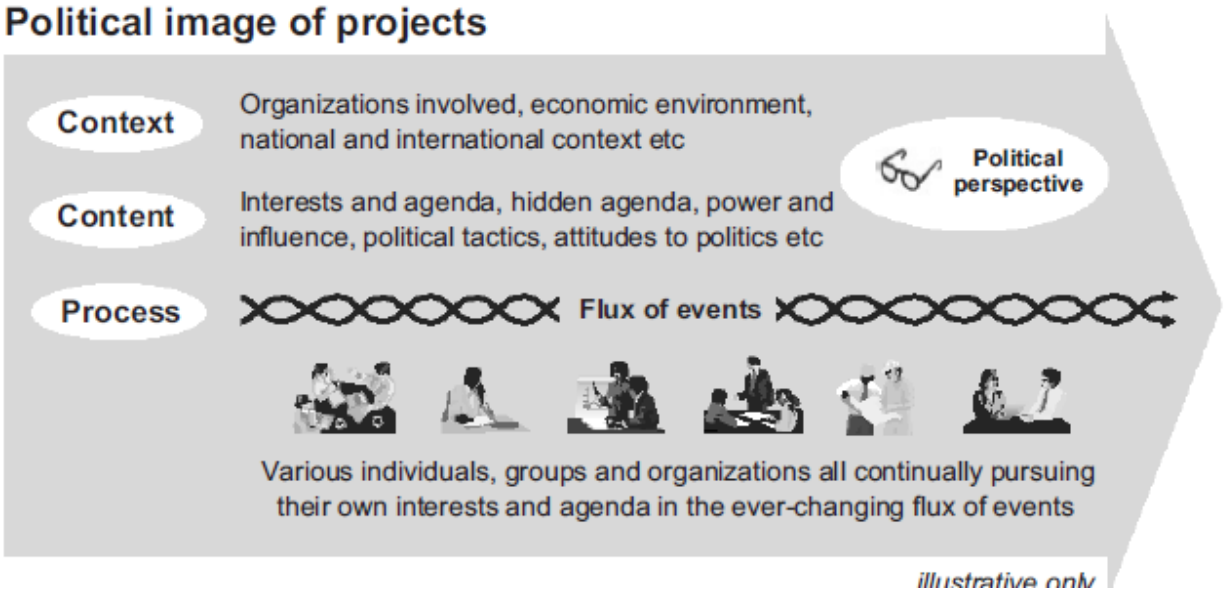


Figure 14: Political image of the projects

(Source: Winter, Mark, and Szczepanek, 2009)

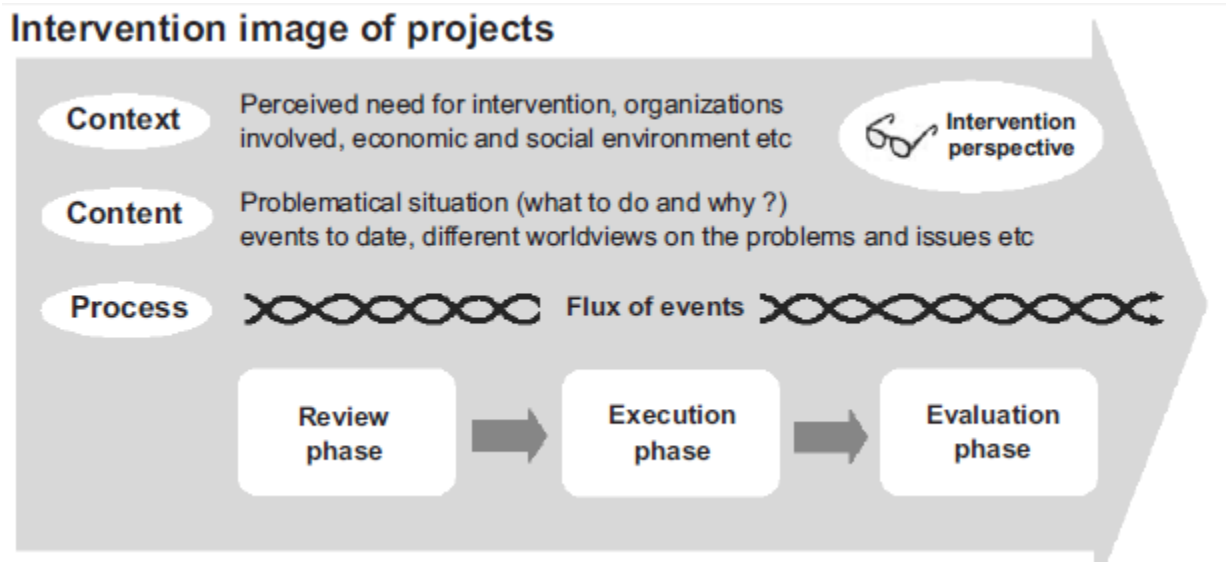


Figure 15: Intervention image of projects

(Source: Winter, Mark, and Szczepanek, 2009)

REFERENCES

Atkinson, R., Crawford, L. and Ward, S., 2006. Fundamental uncertainties in projects and the scope of project management. *International journal of project management*, *24*(8), pp.687-698.

Baccarini, D., 1996. The concept of project complexity—a review. *International journal of project management*, *14*(4), pp.201-204.

Baiden, B.K., Price, A.D. and Dainty, A.R., 2006. The extent of team integration within construction projects. *International journal of project management*, *24*(1), pp.13-23.

Baldine, I., Rouskas, G.N., Perros, H.G. and Stevenson, D., 2002. JumpStart: A just-in-time signaling architecture for WDM burst-switched networks. *IEEE communications magazine*, *40*(2), pp.82-89.

Basu, R., Little, C. and Millard, C., 2009. Case study: A fresh approach of the Balanced Scorecard in the Heathrow Terminal 5 project. *Measuring Business Excellence*, *13*(4), pp.22-33.

BBC News, 2018. *What went wrong at Heathrow's T5?*. [online]. Available at: http://news.bbc.co.uk/2/hi/uk_news/7322453.stm [Accessed on 30 August 2018].

Beck, A., 2011. Case study: modelling passenger flows in Heathrow Terminal 5. *Journal of Simulation*, *5*(2), pp.69-76.

Belbin, R.M., 2012. *Team roles at work*. Routledge.

Brady, T. and Davies, A., 2010. 9 Learning to Deliver a Mega-Project. *Procuring Complex Performance: Studies of Innovation in Product-Service Management*, p.174.

Brady, T. and Davies, A., 2010. From hero to hubris–Reconsidering the project management of Heathrow's Terminal 5. *International Journal of Project Management*, *28*(2), pp.151-157.

Brady, T., Davies, A., Gann, D. and Rush, H., 2006. Learning to manage mega projects: the case of BAA and Heathrow Terminal 5. *Learning to manage mega projects: The case of BAA and Heathrow Terminal 5*.

Bresnen, M. and Marshall, N., 2000. Building partnerships: case studies of client–contractor collaboration in the UK construction industry. *Construction Management & Economics*, *18*(7), pp.819-832.

Brusoni, Prencipe, A. and Pavitt, K. (2001) "*Knowledge Specialization and the Boundaries of the Firm: Why Do Firms Know More than They Make?*" Administrative Science Quarterly, 46/4. pp. 597-621.

Budzier, A., 2011. The risk of risk registers–managing risk is managing discourse not tools. *Journal of Information Technology*, *26*(4), pp.274-276.

Caldwell, N.D., Roehrich, J.K. and Davies, A.C., 2009. Procuring complex performance in construction: London Heathrow Terminal 5 and a Private Finance Initiative hospital. *Journal of Purchasing and Supply Management*, *15*(3), pp.178-186.

Chin, W.W., Marcolin, B.L. and Newsted, P.R., 2003. A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study. *Information systems research*, *14*(2), pp.189-217.

Clarkson, M.E., 1995. A stakeholder framework for analyzing and evaluating corporate social performance. *Academy of management review*, *20*(1), pp.92-117.

Creswell, J.W. and Clark, V.L.P., 2017. *Designing and conducting mixed methods research*. Sage publications.

Creswell, J.W. and Creswell, J.D., 2017. *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Creswell, J.W., 2014. *A concise introduction to mixed methods research*. Sage Publications.

Creswell, J.W., Plano Clark, V.L., Gutmann, M.L. and Hanson, W.E., 2003. Advanced mixed methods research designs. *Handbook of mixed methods in social and behavioral research*, *209*, p.240.

Gann, D., Douglas, T. and Davies, A., 2009. Innovation in megaprojects: systems integration at London Heathrow Terminal 5. *California Management Review*, *51*(2), pp.101-125.

de la Cruz, M.P. and Del Cano, A., 2002. Integrated methodology for project risk management. *Journal of construction engineering and management*, *128*(6), pp.473-485.

Diran Wickramatillake, C., Lenny Koh, S.C., Gunasekaran, A. and Arunachalam, S., 2007. Measuring performance within the supply chain of a large scale project. *Supply Chain Management: An International Journal*, *12*(1), pp.52-59.

Dörnyei, Z., 2007. *Research methods in applied linguistics: Quantitative, qualitative, and mixed methodologies* (pp. 95-123). Oxford: Oxford University Press.

e-architect, 2008. *Heathrow Airport T5 : London Architecture*. [Online]. Available at: <https://www.e-architect.co.uk/london/heathrow-airport-t5>. [Accessed on 21st August 2018].

Earl, D.J. and Deem, M.W., 2008. Monte carlo simulations. In *Molecular modeling of proteins* (pp. 25-36). Humana Press.

Evans, J.R., 2002. Total quality management. *INFOR*, *40*(4), p.364.

Flyvbjerg, B., 2006. Five misunderstandings about case-study research. *Qualitative inquiry*, *12*(2), pp.219-245.

Frimpong, Y., Oluwoye, J. and Crawford, L., 2003. Causes of delay and cost overruns in construction of groundwater projects in a developing countries; Ghana as a case study. *International Journal of project management*, *21*(5), pp.321-326.

Goodliffe, M., 2002. The new UK model for air traffic services—a public private partnership under economic regulation. *Journal of Air Transport Management*, *8*(1), pp.13-18.

Groover, M.P., 2007. *Automation, production systems, and computer-integrated manufacturing*. Prentice Hall Press.

Guide, A., 2001. Project Management Body of Knowledge (PMBOK® GUIDE). In *Project Management Institute*.

Hoque, Z., 2000. Just-in-time production, automation, cost allocation practices and importance of cost information: an empirical investigation in New Zealand-based manufacturing organizations. *The british accounting Review*, *32*(2), pp.133-159.

Houghton, C., Casey, D., Shaw, D. and Murphy, K., 2013. Rigour in qualitative case-study research. *Nurse researcher*, *20*(4).

Hutchins, D., 1999. *Just in time*. Gower Publishing, Ltd..

Jin, X.H. and Ling, F.Y.Y., 2005. Constructing a framework for building relationships and trust in project organizations: two case studies of building projects in China. *Construction Management and Economics*, *23*(7), pp.685-696.

Joslyn, E. and Holman, P., 1995. Collaboration through project management. *Journal of nursing management*, *3*(3), pp.109-114.

Jung, J.Y. and Wang, Y.J., 2006. Relationship between total quality management (TQM) and continuous improvement of international project management (CIIPM). *Technovation*, *26*(5-6), pp.716-722.

Kerzner, H. and Kerzner, H.R., 2017. *Project management: a systems approach to planning, scheduling, and controlling*. John Wiley & Sons.

Dai Lee, Y., Lee, J.Y. and Le-Hoai, L., 2008. Delay and cost overruns in Vietnam large construction projects: A comparison with other selected countries. *KSCE journal of civil engineering*, *12*(6), pp.367-377.

Love, P.E., Gunasekaran, A. and Li, H., 1998. Concurrent engineering: a strategy for procuring construction projects. *International Journal of Project Management*, *16*(6), pp.375-383.

Mansfield, N.R., Ugwu, O.O. and Doran, T., 1994. Causes of delay and cost overruns in Nigerian construction projects. *International journal of project Management*, *12*(4), pp.254-260.

Migilinskas, D. and Ustinovičius, L., 2008. Methodology of risk and uncertainty management in construction's technological and economical problems.

Nahmias, S. and Cheng, Y., 2009. *Production and operations analysis* (Vol. 6). New York: McGraw-hill.

New Civil Engineer, 2017. *Building on the lessons of Terminal 5 hand over*. [online]. Available at: https://www.newcivilengineer.com/building-on-the-lessons-of-terminal-5-hand-over/1994961.article [Accessed on 30 August 2018].

Pearce, J.A., Robinson, R.B. and Subramanian, R., 2000. *Strategic management: Formulation, implementation, and control*. Columbus, OH: Irwin/McGraw-Hill.

Perrow, C., 2011. *Normal Accidents: Living with High Risk Technologies-Updated Edition*. Princeton university press.

Pinto, J.K. and Morris, P.W., 2004. *The Wiley guide to managing projects*. Hoboken, NJ: Wiley.

Potts, K., 2007. Managing mega construction projects–learning from two case studies: London Underground's Jubilee Line Extension and BAA's Heathrow Terminal 5. In *CIB World Building Congress*.

Prasad, B., 1995. JIT quality matrices for strategic planning and implementation. *International Journal of Operations & Production Management*, *15*(9), pp.116-142.

Prichard, J.S. and Stanton, N.A., 1999. Testing Belbin's team role theory of effective groups. *Journal of Management Development*, *18*(8), pp.652-665.

Robertson, G., Caldwell, G., Hamill, J., Kamen, G. and Whittlesey, S., 2013. *Research methods in biomechanics, 2E*. Human Kinetics.

Royal HaskoningDHV (2018) *World class baggage network for London Heathrow*. [Online]. Available at: < https://www.royalhaskoningdhv.com/en-gb/united-kingdom/projects/world-class-baggage-network-for-london-heathrow/5732>. [Accessed on 20 August 2018].

Saunders, M., Lewis, P. and Thornhill, A., 2009. *Research methods for business students*. Pearson education.

Saunders, M.N. and Lewis, P., 2012. *Doing research in business & management: An essential guide to planning your project*. Pearson.

Saunders, M.N., 2011. *Research methods for business students, 5/e*. Pearson Education India.

Saunders, M.N.K., Lewis, P. and Thornhill, A., 2000. Research Methods for Business Students: Lecturers' Guide.

Stevenson, W.J., Hojati, M. and Cao, J., 2007. *Operations management* (Vol. 8). Boston: McGraw-Hill/Irwin.

Sugimori, Y., Kusunoki, K., Cho, F. and Uchikawa, S., 1977. Toyota production system and kanban system materialization of just-in-time and respect-for-human system. *The International Journal of Production Research*, *15*(6), pp.553-564.

Sweis, G., Sweis, R., Hammad, A.A. and Shboul, A., 2008. Delays in construction projects: The case of Jordan. *International Journal of Project Management*, *26*(6), pp.665-674.

Thomas, D.J. and Griffin, P.M., 1996. Coordinated supply chain management. *European journal of operational research*, *94*(1), pp.1-15.

Vieira, G.B.B., Pasa, G.S., do Oliveira Borsa, M.B.N., Milan, G.S. and Pandolfo, A., 2011. Materials handling management: A case study. *Journal of operations and supply chain management*, *4*(2), pp.19-30.

Watt, A.H. and Watt, A., 2000. *3D computer graphics* (Vol. 2). Reading: Addison-Wesley.

Wiersma, W. and Jurs, S.G., 2005. Research methods in education: An introduction.

Winter, M. and Szczepanek, T., 2008. Projects and programmes as value creation processes: A new perspective and some practical implications. *International Journal of Project Management*, *26*(1), pp.95-103.

Winter, M. and Szczepanek, T., 2009. *Images of Projects*. Gower Publishing.

Winter, M. and Szczepanek, T., 2017. *Images of projects*. Routledge.

Winter, M., Andersen, E.S., Elvin, R. and Levene, R., 2006. Focusing on business projects as an area for future research: An exploratory discussion of four different perspectives. *International Journal of Project Management*, *24*(8), pp.699-709.

Winter, M., Smith, C., Morris, P. and Cicmil, S., 2006. Directions for future research in project management: The main findings of a UK government-funded research network. *International journal of project management*, *24*(8), pp.638-649.

Fugeman, I., Hammond, F. and Wolstenholme, A., 2008, May. Heathrow Terminal 5: delivery strategy. In *Proceedings of the Institution of Civil Engineers-Civil Engineering* (Vol. 161, No. 5, pp. 10-15). Thomas Telford Ltd.

Winter, Mark, and Szczepanek, T. 2009. *Images of Projects*. Routledge.