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Abstract:

There are quite a number of researches on the risk management review in public projects especially so called megaprojects, public project with high investment. Such effort, however, usually tends to offer the lessons in certain condition rather than generalize to others. Our research aims to bridge the gap by exploring the relation between the public feature of Megaproject and its risk management policy option. Under the project risk management framework, the case study of Scottish Parliament Building project focuses on the stakeholder intervenes during the whole process.

In the analysis, the risks are first outlined according to the report ex post, then we go back to examine the risk assessment and risk control policy during the project to identify the reasons leading to the deviation. The finding demonstrates the politics intervene has generated high transaction cost for project manager to implement risk reduction and mitigation policy, and the optimum way under such condition to accept or avoid the risks at all, but not handle them. Accordingly, the thesis suggests that the appropriate risk transfer and contingency allowance will be the key success factors in the megaproject.

Key Words:

Megaproject; Risk Management; Case Study; Scottish Parliament Building Project
1. Introduction

For a long time in project management study, risk management is regarded as an important component of project management. In our research, this view is reinforced by the idea that project is mainly evaluated by the deviation/variance from the planned outcome. Therefore, controlling deviation/variance becomes a key issue to project management to achieve project success. Since the main task of risk management is to large extent dealing with deviation/variance, risk management actually is placed at the core position to achieve project success.

With the popularity of Keynesnism and the suspicion for market failure after World War II, public investment policy was widely adopted to remain economic stability and continuous growth. For instance, public investment in infrastructure can increase the sales of the product of service, create more jobs, or compensate economic regression. Because of such economic impact, until now public projects is still a crucial part in any economies. The current research acknowledges the importance of such public project and conducts quite a number of researches on the risk management involved (Al-Khalil and Al-Ghafly, 1999, Aibinu, 2002, Dlakwa and Culpin, 1990, Flyvbjerg et al, 2002, 2003, Frimpong et al, 2003) to identify the critical success factors. Unfortunately, due to the complexity of our world, most of the researches offer rather specific risk reasoning and unique risk management approach under certain environment, while the common features of public project that may explain the unsuccessful risk management is largely overlooked.

To bridge this gap, we try to use one case study to exemplify the unsuccessful risks management associated with the public feature that appeared in those projects. Especially we are interested in those projects that are called “megaproject” (Flyvbjerg et al, 2003): public projects in infrastructure with large investment. According to him, those public infrastructure projects are worth noticing as it will directly contribute to the economic growth. While in our research, the term megaproject is not only confined in infrastructure project but all highly invested public projects due to the concern such project will generate considerable externalities. The externalities generated from megaproject are considered higher than ordinary public project as more stakeholders are involved and more funds are invested, therefore it is expected more public concern and more according politics will be demonstrated in such project. And our thesis will try to find out whether such public feature will generate some indigenous factors that will influence the risk management process?

Admittedly, the public feature can be interpreted variedly in different perspectives such as politics, sociology and economics. To avoid such ambiguity, we use the transaction cost framework in economics to define the public feature as the high cost in risk reduction and mitigation. Under the public project, the individual have to face the high cost when seeking information, negotiating with partners or finalizing deal (Williamson, 1985).
Most often, transaction cost is referred to those invisible costs that discourage participant seeking consensus in given transaction. In this way, the option of risk management policy is based on the calculation of the cost of handling risk and the revenue from that. Noticeably, the public ownership implies that no one can legitimately claim the personal revenue directly from the project, therefore if the cost of managing risk is considerably high while the revenue remains vague, it is likely no more will take the responsibility for risk management.

Here we use the case of Scottish Parliament Building Project, also known as Holyrood Project. The Holyrood project was launched in 1997 with an initial budget of £40 million, and expected to be completed before the new millennium. The result turned out that the project was completed in 2004 with the actual cost 10 times higher than the budget. The project management practice therefore has attracted researchers (Bain, 2005, Fraser, 2004, Jackson, 2002 and White and Sidhu, 2005) to explore the reasons behind. The case is selected due to the data accessibility. Though those researchers have focused on the specific risks rather than the risk management option, their reports provide the detailed information necessary for our research.

**Research Question**

*What is the indigenous factor influence risk management option in Megaproject?*

**Research Purpose**

- Identify the common factor indigenous to megaproject that will impact on the risk management approach adopted in such projects;
- Explore the way how the factor can exert its influence and define which part of risk management is vulnerable to such influence. The results are expected to show in which phase the factor tends to generate impact, and what are the possible consequences.
- Recommend the method to mitigate such negative influence.

**The Structure of our Thesis**

*Chapter 1: Introduction*

This chapter serves to provide the general information about the research in our thesis including the background, the rational for the topic, the research question and research purpose.

*Chapter 2: Literature Review*

A literature review is conducted to introduce the term we will later use in our analysis as well as set the theoretical background for our research. The literature is used to find out the link to our research question, therefore the current research progress in risk
management, megaproject and Holyrood project is emphasized.

Chapter 3: Methodology

In this chapter we will introduce the research philosophy and approach we adopt in our thesis, the method and the sources we retrieve the data. We also use this chapter to provide the rational for our case study selection.

Chapter 4: Findings and Discussion

This chapter introduces the findings based on the data we retrieved. The findings are analyzed under a general risk management framework: risk identification, risk analysis and risk response. In each of the 3 subsection, the findings are analyzed with the relation to the public feature of the project.

Chapter 5: Suggestions

In this chapter, we will briefly summarize our findings and introduce our recommendation to mitigate the impact. The suggestions are presented according to the findings in the previous chapter, and illustrate how the suggestion would work.

Chapter 6: Conclusion

The conclusion summarizes our findings and discussion points, and relates them to the research question and purpose to ensure our research has reached the objectives we expected. Some limitations are also acknowledged there and provide recommendation for the further research.
2. Literature Review

Based on our idea, the literature review will be mainly divided into four parts. At the beginning, the review of project management and project success is presented in order to raise the concern for the later megaproject review. In the following, a review of megaproject and its public feature is conducted. The relation of project management and project success criteria with the public feature is illustrated by the term “externality” and the framework of “transaction cost”. Accordingly the literature regarding the two terms is also introduced. In the third section, risk and risk management is elaborated referred to Project Management and Project Success, with the effort to justify our rational for risk management perspective. The last section introduces risk and risk management in megaproject, and the gap found in current literature will further solid our choice of research topic.

In order to have a good literature review, besides necessary reviewing skill, having high quality literature is of significance as well. Therefore, having sound sources of literature and then choosing high quality literature become a very important issue for us to consider when doing the literature review. Basically, the following principles are adopted:

• Large part of articles that we chose is from International Journal of Project Management, Project Management Journal, and European Management Journal etc, such as kind of first – class journals in project management or management field.
• For internet literatures, we find them only in some professional project management website, for example www.maxwideman.com
• When reviewing the literature, we try to balance the literature both from academicians and practitioners, in order to have a comprehensive view to the issue that we analyze.
• When looking for the literature, we also purposely search for some key authors’ articles in certain field and include their important theories in our literature review, for instance, Pinto’s classical theory on project success.

2.1 Fundamental Issues in Project Management

Acknowledging the comprehensive knowledge in project management, we conduct the literature review regarding project management and project success in order to prove that project is defined as success when its deviation is well managed, which is the essence of risk management. Therefore, our choice for risk management perspective is first justified here.

2.1.1 Project Management

As for project management, many have put forward their definitions. For example, one of the early attempts may be from Oisen in 1970’s. He defined “project management” as “the application of a collection of tools and techniques (such as the CPM and matrix organization) to direct the use of diverse resources toward the accomplishment of a unique, complex, one-time task within time, cost and quality constraints.” (Oisen, 1971)
The British Standard for project management (1996) defined project management as: The planning, monitoring and control of all aspects of a project and the motivation of all those involved in it to achieve the project objectives on time and to the specified cost, quality and performance.

Besides, PMI (Project Management Institute) and APM (Association for Project Management) also provide definitions of project management in their Body of Knowledge respectively:

The application of knowledge, skills, tools, and techniques to project activities in order to meet or exceed stakeholder needs and expectations from a project. (PMI, 2004)

The planning, organization, monitoring and control of all aspects of a project and the motivation of all involved to achieve the project objectives safely and within agreed time, cost and performance criteria. (APM, 2000)

Almost all of these definitions emphasize the importance of delivering the project within the time, cost, and quality constraints from clients, and PMI’s definition lays emphasis on meeting or exceeding stakeholder needs and expectation, which provides a different criterion to judge the performance of project management. In this paper, a combined definition of PMI’s and APM’s will be used, and the new definition will be:

Project management is the application of knowledge, skills, tools, and techniques to plan, organize, monitor and control all aspects of a project as well as motivate all involved to achieve the project objectives safely and within agreed time, cost and performance constraints along with meet or exceed stakeholder needs and expectations from a project.

Actually, whatever the definition of project management is, the underlying objective of project management is to lead a project to success. And many researches on project management are about how to achieve success. So how the project can be defined as “success”?

2.1.2 Project Success

Literature on project success contains two components - critical success factors and project success criteria (Jugdev and Müller, 2005; Morris and Hough, 1987; Wateridge, 1998; Turner, 1999):

- critical success factors, elements of a project that can be influenced to increase the likelihood of success; these are independent variables that make success more likely
- project success criteria, the measures by which we judge the successful outcome of a project; these are dependent variables which measure project success.

- Critical Success Factors

The understanding of project success factors has been changing for several decades. (Jugdev and Müller, 2005) Rubin and Seeling (1967) were the first to introduce success
and failure factors in projects. They investigated the impact of a project manager’s experience on the project’s success or failure.

Later, during the 1980s and 1990s, the quality of the planning and hand-over was identified as important. Lists of Critical Success Factors (CSF), which also took into account organizational and stakeholder perspectives, became popular. (Turner & Müller, 2005) Andersen, Grude, Haug, & Turner (1987) identified project pitfalls, things that project managers might do, or not do, which increased the chance if failure. Pinto and Slevin (1988), in a now-classic piece of work, identified 10 project success factors. (see Table 1) This is one of the most widely quoted lists.

<table>
<thead>
<tr>
<th>Success Factor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Project Mission</td>
<td>Clearly defined goals and direction</td>
</tr>
<tr>
<td>2. Top Management Support</td>
<td>Resources, authority and power for implementation</td>
</tr>
<tr>
<td>3. Schedule and Plans</td>
<td>Detailed specification of implementation</td>
</tr>
<tr>
<td>4. Client Consultation</td>
<td>Communication with and consultation of all stakeholders</td>
</tr>
<tr>
<td>5. Personnel</td>
<td>Recruitment, selection and training of competent personnel</td>
</tr>
<tr>
<td>6. Technical Tasks</td>
<td>Ability of the required technology and expertise</td>
</tr>
<tr>
<td>7. Client Acceptance</td>
<td>Selling of the final product to the end users</td>
</tr>
<tr>
<td>8. Monitoring and Feedback</td>
<td>Timely and comprehensive control</td>
</tr>
<tr>
<td>9. Communication</td>
<td>Provision of timely data to key players</td>
</tr>
<tr>
<td>10. Troubleshooting</td>
<td>Ability to handle unexpected problems</td>
</tr>
</tbody>
</table>

**Table 1: Project success factors** (Pinto & Slevin, 1988)

From those factors, we find that project’s success is greatly influence by the “soft issues” that listed: Top Management Support, Client Consultation, Personnel, Client Acceptance, Monitoring and Feedback and Communication. This raises our concern how the current megaproject deal with these “soft issues”?

- **Project Success Criteria**

Defining project success is probably one of the frequently discussed topics in the field of project management, yet it is the least agreed upon. The basic criteria of cost, time and quality, the so called “Iron Triangle” or “Golden Triangle”, have been traditionally used as project success criteria. However, these criteria have been criticized for being inadequate for many reasons (Pinto & Slevin, 1988; Shenhar et al., 1997; Wateridge, 1998; Atkinson, 1999; Gardiner & Stewart, 2000). Over the years, various attempts have been made in overcoming the perceived inadequacies.

Among them, Baccarini (1999) brought forward a different method to define project success – the logical framework method (LFM). Using LFM, four levels of project objectives are identified: goal, purpose, output and input. And he proposes that project success consists of two components - product success and project management success.

Product success deals with goal and purpose, and it has three components: (1) meeting
the project owner’s strategic organizational objectives (project goal); (2) satisfaction of
users’ needs (project purpose); and (3) satisfaction of stakeholders’ need where they
relate to the product. Project management success deals with outputs and inputs, and also
has three key components: (1) meeting time, cost, and quality objectives (project outputs
and inputs); (2) quality of the project management process; and (3) satisfying project
stakeholders’ needs where they relate to the project management process. (Baccarini,
1999)

Inspired by his idea while acknowledging the complexity of project type, some authors
try to cluster criteria to cover the whole issue of project success. For example, Westerveld
(2003) summarized the previous research on project success criteria to help people define
project success. (Table 2)

<table>
<thead>
<tr>
<th>Result Areas</th>
<th>Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project results:</td>
<td>The original golden triangle of project goals.</td>
</tr>
<tr>
<td>Budget</td>
<td>Almost all projects will have specific scheduling, budget and quality constraints.</td>
</tr>
<tr>
<td>Schedule</td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td></td>
</tr>
<tr>
<td>Appreciation by the client</td>
<td>The client initiates the project to fulfill a specific need.</td>
</tr>
<tr>
<td></td>
<td>What aspects and factors does the client value in judging the success of the project</td>
</tr>
<tr>
<td>Appreciation by project personnel</td>
<td>The workers of the project will be concerned with reaching their personal goals as well as a good working atmosphere.</td>
</tr>
<tr>
<td>Appreciation by users</td>
<td>Users are concerned with their overall influence in the project and the functionality of the end product.</td>
</tr>
<tr>
<td>Appreciation by contracting partners</td>
<td>Contracting partners try to make a profit at the project.</td>
</tr>
<tr>
<td></td>
<td>They are also concerned with getting new orders and learning possibilities.</td>
</tr>
<tr>
<td>Appreciation by stakeholders</td>
<td>Those parties that are not directly involved in the project but have a large influence.</td>
</tr>
<tr>
<td></td>
<td>For example environmental groups, citizens and government agencies. These parties manage their specific interest.</td>
</tr>
</tbody>
</table>

Table 2: Project success criteria categories (Westerveld, 2003)

Anyway, although not too many people focus on the approach with fewer dimensions,
this approach is still supported by some empirical research, e.g., Baker et al. (1988)
suggest that client satisfaction is important while time and cost are less so, Odusami
(2003) also concludes that “contrary to expectation, construction cost and time are not regarded as highly important”. Lipovetsky et al. (1997) conclude that some dimensions of success are more important while others are “negligible”. From their research, it is clear that project will be evaluated differently or even oppositely from different perspectives.
As the consequence, the different success criteria will generate heterogeneous expectations for the project. Later we will show in our case study that such varied expectation will impose confusion in project scope. Before further discussion, it is time to introduce what megaproject is?

2.2 Megaproject and its Public Feature

With the concerns raised in the literature review above, here we present the definition and implication of megaproject. In order to generalize the common feature of megaproject so later we can apply our findings to all megaproject, we also conduct the literature review of public project feature as we believe public feature is the only common feature in all megaprojects. Based on the review, we introduce the term “externality” and “transaction cost” to describe what the impact of public feature is during project scope definition process and project implementation phase.

- Megaproject

Flyvbjerg (2002) first acknowledged that megaproject is “very large investment project”, then he described it as “a new political and physical animal: the multi-billion dollar mega infrastructure project”. According to his series of Megaproject (Megaproject, accessed on 11-18-2007), the US Federal Highway Administration defines megaprojects as “major infrastructure projects that cost more than US$1 billion, or projects of a significant cost that attract a high level of public attention or political interest because of substantial direct and indirect impacts on the community, environment, and budgets”. Following his idea, Altshuler and Luberoff (2003) summarizes megaproject as “physical, very expensive, and public”. Typical megaproject includes bridge, tunnel, airport, dams, power plans, and other public building.

Besides the large scale investment implication, Flyvbjerg (Megaproject, accessed on 11-18-2007) also links the word “mega” to “the size of the task involved in developing, planning, and managing projects of this magnitude”, with the effort to prove that megaproject tends to own the feature that more complex management process involved than ordinary project. In his book (Flyvbjerg, 2002), he acknowledges the diverse impact of megaproject on the society such as environmental, economic, political, aesthetic and psychological.

- Public Feature in Project Management View

According to a survey of public capital project (Baldry, 1998), public sector projects have several features which distinguish them from other commercial ones:

- Project design, implementation and completion will require the authorization of the senior administration body, which remains the power of veto even sometimes the administration may not be the project owner, sponsor or a stakeholder;
- The objective of the project is supposed to provide certain non-exclusive product or service to certain community or general public;
The project is executed used as a way to achieve investment return unless the value of project will be realized with commercial partner; Usually the project serves more for a non-financial benefit, consequently the risk impact on the project includes not only financial damage but also other problems such as social dissatisfaction, credibility of authority, and disruption of strategic planning; Diversified procurement methods are adopted, and under certain condition commercial contractor may be involved in the funding or resource provision; Project success criteria are varied and often subject to stakeholders’ perspective, such qualitative evaluation measure may includes functional satisfaction, aesthetic merit, environmental improvement, or hazard removal; The project life cycle evolved in the public domain is formally evaluated by statutory bodies and informally by other stakeholders and interested parties.

Moreover, the ability and capacity of public organizations to effectively manage project risks also depend upon a range of factors which are derived from the cultural orientation of the organization and the dynamics of the environment in which it operates. And these factors are as follows: (Baldry, 1998)

- Risk awareness that the risk will generate broad impact on other activities and may bring long term affect;
- The knowledge of generic risks that popular in all projects with similar technologies, and specific risks that due to its specific features;
- The competency in evaluating risks and the management skills to coordinate project owner, sponsor and other stakeholders;
- The degree of expertise in procurement initiatives and partner selection, contract evaluation, novel risks identification and benefits from appropriate contract;
- Effectiveness of stakeholder management that requires the fully understanding of the role, influence and source of their power, and their impact on the project design, implementation and objectives.

From above two lists, we could find multi-stakeholder is actually one of the significant factors that has great influence to risk management in public project. For instance, the progress of project needs not only the approval from the execution body but also from the higher level authority which is not directly involved in the project implementation, the purpose (at least nominal) to serve the public rather than certain commercial organizations, and the broad range procurement which definitely involve more stakeholders. If we agree that project success criteria are highly dependent on certain stakeholder’s perspective, from the discussion of risk management, we can conclude that successful risk management is also determined by certain stakeholder. However, due to the modern political practice, other non-decisive stakeholder may exert their influence through vote or lobby. It is expected that in a public project where multi-stakeholder may have conflicting interests, the decision making and risk taking activity may be an outcome of compromise.

Juliano (1995) defines stakeholders as “… an individual, individuals, team or teams
affected by the project.” The PMBOK Guide (2004) defines stakeholders as “… individuals and organizations who are actively involved in the project, or whose interests may be positively or negatively affected as a result of project execution or successful project completion.” Typical project stakeholders can include clients, end users, contractors, consultants, labor unions, line organization, public authorities, financial institutions, insurance companies, controlling organizations, media, third parties, and competitors” (Karlsen, 2002). It is no doubt that involving stakeholder is a crucial component of the project managements, and it is important to understand stakeholder requirement and concerns to better facilitate the development of a project. (Cleland, 1986 and Jergeas et al, 2000). However, it is always easier said than done, as there will be always conflicting interests among the stakeholders, and results from earlier research have identified that “in many projects, management of stakeholders lacks strategies, plans, and methods” (Karlsen, 1998). It is especially true in public project, where more stakeholders are involved and most of them are not professionals.

First, people in different disciplines may have various perceptions of risks. For instance, in economics, the risk analysis is introduced to explain the individual behavior in an uncertain environment to pursue the maximization of utilization/satisfaction. Furthermore, based on the attitude towards risk, people can be hypothesized as risk seeker, risk neutralizer and risk disliker. While the sociologists will argue that economic rationally is just only one way to explain the attitude towards risks, other factors such as social structure, culture, personality, education and personal history will also contribute to forming the perception of risks. In biology, risk is interpreted as a demonstration of certain gene. In statistics, risk will be divided into quantifiable and those unquantifiable. Consequently, it will not be surprising that risk will be identified and evaluated differently by various stakeholders in the same project. How to coordinate their different perception becomes a crucial part of successful risk management, since some stakeholders may don’t agree or even fight against certain policy. A research (El-Gohary et al, 2006) already showed that stakeholder opposition is a main reason for project failure. In this sense, public project will require significant more communication and negotiation process, which will lead to considerable “transaction cost” (Williamson, 1985). In some extreme conditions where frequent meetings are required, the cost will be too high to reach consensus.

Second, generally speaking, public project is usually designed to serve the public rather than certain groups. However, since the “general” public actually have tiny direct influence on the decision making process of project management but a great impact on the decision makers after project completion, those stakeholders focus more on the human rather than the technical factors in the project process, such as policy of local employment and reliability of administration, which will equally lead to project failure as technical problems. These “soft issues”, unfortunately, cannot be easily measured and managed mechanically. Baldry (1998) lists some “soft issues” that may influence project risk:

- degree of influence related to status and political power rather than project relevance;
- pursuant of limited range of personal objectives with little concept of total project aspirations;
varied agenda of performance criteria make agreement upon success factors, and therefore identification of risks, difficult to achieve;

subject to irrationality and inconsistency as stakeholder participation changes over project life cycle and displays varying standards of expertise and informed capabilities.

Take cost overrun for example, public project stakeholders may intentionally underestimate the cost to start the project soon, which may generate political benefits such as voting rate and power allocation. Based on a sample of 258 public transportation infrastructure projects “worth US$90 billion and representing different project types, geographical regions, and historical period”, Flyvbjerg et al (2002) discovers overwhelming statistical significance that “the cost estimates used to decide whether such projects should be built are highly and systematically misleading. Underestimation cannot be explained by error and is best explained by strategic misrepresentation, which is, lying”. He also explains the prevailing cost overrun in public transportation projects from a political perspective that “The use of deception and lying as tactics in power struggles aimed at getting projects started and at making a profit appear to best explain why costs are highly and systematically underestimated in transportation infrastructure projects.” Here the technical issues that may lead to cost overrun can be considered only an excuse for the “strategic misrepresentation”.

Third, the public project is usually financed by the public fund, which in fact can be claimed ownership by nobody. Therefore, it is inborn unclear that who will assume the ultimate responsibility for risk taking activities. Vincent (1996) acknowledges this peculiarity and points out that, “private sector firms are accountable to their shareholders, who have voluntarily entrusted the firm with their capital on the expectation of a reasonable profit return, public sector bodies are entrusted with funds appropriated from the general public on a non-voluntary basis. This situation leads managers of public sector bodies to face far closer scrutiny than their private counterparts – a situation that is widely accepted in most democracies”. “It is clear, then, that management in the public sector involves fundamentally different responsibilities from those in the private sector; and thus that the management of risk and the variables concerning risk taking differ in the public Managing risk in public services sector”. Therefore, “in both Public Sector and Optimum, accountability tends to be viewed more as an obligation on public officials to justify and be judged on their actions…which is made more difficult by becoming more risk taking”.

In addition, Vincent (1996) also notices that “in public sector services elsewhere in Europe, constitutional rather than strictly managerial issues appear to prevail. As such, public servants are more concerned with chains of command and responsibility than with the workings of the market and their application to public services. Accordingly, personal liabilities may seem attractive in the quest to curb official corruption and mismanagement, barring extreme cases of malpractice In reality, however, such personal liability from misjudged risk taking are more likely to lead public servants to “cover up” mistakes. Hence, a fundamental conflict exists between granting freedom to take risks and ensuring accountability and control”.
In a summary, the risk management policy in public project tends to be influenced by its “public” feature, which involves too many stakeholders to compromise an unbiased decision. On the other hand, it is also the “public” feature that hinders the effort for managing risk, partly because of the authoritative structure, and partly because of the risk taking activities may cost too much to the individual than the risk itself. Our case study later will demonstrate the individual tends to choose risk acceptance and avoidance policy, while less respects risk reduction and mitigation method. Therefore appropriate risk transfer and contingency allowance will play as key success factors.

- Externality

Such impact on the society is named “externality” in economics (Pigou, 1920). Externality can be positive or negative. Externality occurs when certain decision will bring additional benefit or impose unexpected cost on the third party, especially when the decision is related to the use of, though not confined to, public product. For example, in dam project, the project owner (usually the government) will be responsible to the overall results, and the local community citizen may have to move from the site. But other citizen will also be influenced as the dam project has occupied the limited public finance resource, which other third party also has the right to claim. Given the great size, large scale investment, and more public demonstrated in Megaproject, the externality is expected to be stronger than ordinary project.

Based on our previous discussion, we have noticed that megaproject is usually very complex both in physical and management view, and as in project management the success factors are greatly influenced by those soft issues, we expect that those soft issues will not be easily addressed in such a complex project. Therefore the risks associated could be high. Flyvbjerg (2002) proves in his survey that 50% cost overrun is common and 100% cost over is not uncommon.

Peculiarly, the greater externality of megaproject determines that more diversified success criteria will be applied to project evaluation. For instance, if we adopt single project success criteria such as project owner, the megaproject will still face different evaluation criteria, as the usual project owner-government actually is made of different political groups whose interests tends to more conflicting than coherent. As a consequence, the project owner will show varied expectations and therefore different valuation to megaproject. And if we adopt multi project success criteria such as take the stakeholders into consideration for example, it will be more complex to unify the success criteria as the stakeholders of megaproject actually means “public”, and it is hardly possible to generate a popularly accepted success criteria. Therefore whatever project success criteria have selected, the variance in megaproject expectations tends to be larger. The ultimate consequence from such externality is to provide the excuse for excessive stakeholder intervene, especially those who owns the authority such as the various politics group to intervene the project management process.
- Public Feature in Economics View--Transaction Cost

In the previous discussion we have noted that “public” in project management actually implies the numerous stakeholder involvement. Hence the project success criteria is substantially varied, and therefore there will be conflicting project expectation, which will raise trouble when defining project scope. In relation to the public feature in project management view, we also introduce its economics meaning here as we believe the public feature will also lead to the difficulties during the project implementation process, being transaction cost.

Transaction cost is used by economists (Williamson, 1985) to describe both the visible and invisible cost occurred during each transaction. Popular transaction cost includes search and information costs, bargaining and decision costs, policing and enforcement costs. And in nowadays transaction cost economics pioneered by Williamson, transaction is not confined to the obvious selling and buying process, but also can be referred in our daily activities such as information exchange and emotion sharing. Under such framework, therefore each negotiation and discussion in the project implementation process can be regarded a transaction to achieve census. If the efficiency to coordinate with other stakeholders is low, then it can be interpreted that the transaction cost is considerably high.

According to Williamson (1985), the major causes for transaction cost includes Transaction Frequency, Asset Specificity, Uncertainty, Bounded Rationality, and Opportunism Behavior. Each of them actually provides us the key to understand the transaction cost in megaproject.

The transaction frequency refers to the frequency of similar transaction. In project management, if we take each negotiation as a transaction, then we expect that the transaction cost will be lower if such negation happened many times. It is understandable that if the participants began to understand each other and grasp relevant information by many times’ negotiation, then gradually they will be acquainted with the situation and therefore it is easy for them to start new negotiation. But as project is only temporary activity according to its definition, therefore it is expected that transaction cost tends to be higher in the each new project. This may explain why project manager tends to select the same subcontractor in the new project.

Asset specificity refers to the scarcity of certain resource such as human resource or finance resource. As an economics principle, the more scarce, the higher price maybe charged. In project management, some key resources are always scarce such as time and architecture in construction project for example. Therefore it is not easy to negotiate on those resources as the owner (e.g., the project owner that decides the deadline) will charge a high price (Punishment for time delay).

Uncertainty refers to the variance in each transaction. In project management, such variance can be referred to the variance in project expectation. Similar with the idea of externality, if the variance is high, then it will be also difficult to achieve consensus in
project implementation process, therefore the transaction cost will be accordingly high.

Bounded rationality refers to our knowledge in each project. Since no one can expect all the condition in the project implementation, therefore no one is capable of identifying all the possible risk related. Bounded rationality is a common human mindset, therefore we believe it won’t be much different in megaproject and other project.

Opportunism behavior refers to the behavior that may harm others’ interest by taking advantage of the incomplete binding constraint. In public project, as no one really owns the project from the property ownership view, therefore all political groups may scratch their interests by this ambiguity. If the rights and responding obligation is not clearly clarified, there will be more private interests involved in the public project management. The transaction cost under such condition will be high due to the difficulty to compromise the conflicting interests.

2.3 Risk & Risk Management

From the above literature review, we know that project success criteria vary from project to project. (Westerveld, 2003) And whether a project is successful or not, it actually depends on how big the variance in the end is from original expectation. If the variance is small or almost has no variance, then the project usually is considered as a success; on the other hand, if the variance is big, then that project is very likely to be regarded as unsuccessful. Therefore, the essential issue for achieving project success is to manage variance. If the variance in a project can be controlled under certain level, that project has high chance to achieve success. And according to Fone & Young (2005), “risk is the variation in outcomes around an expectation”, so in this sense, we could also say, to large extent, managing risk is managing variance. In fact, how to manage variance does be the main task of risk management.

- Risk

Before continuing to review, we’d better know what risk and risk management really are. PMI and APM have adopted a board view of risk, and they have very similar definitions of risk:

Risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on a project objective. (PMI, 2004)

Risk is an uncertain event or set of circumstances that, should it occur, will have an effect on the achievement of the project’s objectives. (APM, 2000)

Both definitions emphasize the effect of risk to project objective(s), which is the baseline to judge project success. And both definitions refer “variation” by using “uncertain”, which basically means potential differences between result and plan or expectation.

- Risk Management
Similarly, PMI and APM also provide definitions for project risk management, but the way of expression is different:

The systematic process of identifying, analyzing, and responding to project risk. It includes maximizing the probability and consequences of positive events and minimizing the probability and consequences of adverse events to project objectives. (PMI, 2004)

A process whereby decisions are made to accept known or assessed risks and/or the implementation of actions to reduce the consequences or probability of occurrence. (APM, 2000)

The biggest difference between these two definitions lies in whether considering positive risk, which people usually regard as opportunity, in project risk management or not. The traditional view think risk management is only about taking actions to minimize the probability and consequences of negative events, whereas, many people disagree with this view. (Jaafari, 2001; Perminova et al, 2007) They argue that since positive events (opportunity) are uncertain and have big impact on project as well, therefore, maximizing the probability and consequences positive events should also been included in risk management. Actually, some author even put forward the conception of uncertainty management which includes managing positive events (opportunity) and negative events (risk). (Ward & Chapman, 2003) For the purpose of our paper, PMI’s definition will be followed, meaning that we will use risk management conception to manage both risk (may have negative impact on project) and opportunity (may have positive impact on project).

According to PMBOK, project risk management includes the processes concerned with identifying, analyzing, and responding to project risk. It of course includes maximizing the results of positive events and minimizing the consequences of adverse events. Appendix III provides an overview of the following major processes (PMI, 2004:111):

- Risk Identification - determining which risks are likely to affect the project and documenting the characteristics of each.
- Risk Quantification - evaluating risks and risk interactions to assess the range of possible project outcomes.
- Risk Response Development - defining enhancement steps for opportunities and responses to threats.
- Risk Response Control - responding to changes in risk over the course of the project.

Although PMI’s processes are widely used in practice, some authors (Fone & Young, 2005; D. van Well-Stam et al, 2004) point out that this process is not comprehensive and the total project risk management should include more activities or steps. For example, Fone & Young (2005:15) mentioned that risk management substantively consists of five activities:

- risk management mission identification (goal- and policy-setting);
- risk and uncertainty assessment (identification, analysis and measurement);
- risk control (eliminating, avoiding, reducing, preventing or managing risk);
risk financing (measures to address the financial consequences of risk); and
program administration (implementation measures, including review and monitoring)

And similarly, these activities are demonstrated by D. van Well-Stam et al (2004:90) as well. (Figure 1)

![Figure 1: Project Risk Management Processes](D. van Well-Stam et al, 2004:90)

Anyway, look into literature, risk management has already been a major feature of the project management of projects, especially for large construction, engineering and technological projects, in an attempt to reduce uncertainties and to achieve project success. (Chapman, 1997) Particularly in recent years, with the increasing complexity and dynamics of projects, many industries, such as construction, engineering and technological, are plagued with considerable hazards and losses. Project risk management, therefore, become much more critical for these industries to improve their performance and secure the success of projects. (Zeng et al, 2007)

Furthermore, from a survey carried out by Whittaker (1999) among 1,450 companies in the public and private sectors, the main conclusion was that lack of risk management was the most highly ranked factor contributing to project failure. Another survey was accomplished by Elkington & Smallman (2002) in order to examine project risk management practice in the British utility sector. Findings also indicated a strong link between the extent of risk management undertaken in a project and the level of project success.

Since risk management involves modeling the project's objective functions against
project variables, if the project variables could be identified and characterized well in advance and provided that these were to remain basically unchanged during the currency of the project then it would be possible to estimate the risks and or variances of the objective functions. However, not all of the project variables are always identifiable at the outset or new variables surface during project life or their probability of occurrence may shift over time. Their impacts (both positive and negative) could also change as would their inter-relationships. (Jaafari, 2001) Besides, new risks can be encountered during the currency of the project and seemingly unimportant risks pose new threats. All of these will then make the task of risk management extremely difficult.

- Risk Response Strategy

Here we feel more important to focus on Risk Response Strategy, as we believe that due to bounded rationality, there is no possibility to identify all the potential risks in each project, as “Risk is ubiquitous and no human activity can be considered risk free” (Royal Society, 1992), and “there always exists a probability that an unexpected variable will enter and somehow alter the scenario” (Vincent, 1996). Therefore the risk response strategy becomes crucially important as it emphasizes on “what to do when risk happens”. A general risk management strategy formulated by Webb (2003) summarizes 6 popularly cited principles.

(1) “Risk acceptance - acknowledging that the risk exists without taking any specific action other than to note it.” This may happen when i) there is no other mitigation or reduction method available but the risk should not jeopardize the project, or ii) the impact of risk is not significant or the possibility of occurrence is low.

(2) “Risk avoidance - choosing a course of action in which the risk is not encountered”. This must always be the first solution as it serves to eliminate all the perceived risks. The risk avoidance action may include the direct counter effort on the risk or the way to eliminate its causes. However a too rigorous risk avoidance policy may degrade the project as the quality demand may generate certain indigenous risks such as a new product development incorporates high risk, while rigorous risk avoidance policy may eliminate such new features.

(3) “Risk reduction - taking some action in advance to ensure that either the potential effect of the risk is reduced, its likelihood of occurrence is reduced or both”. Reduction strategies demonstrate various forms according to risk situations. It often implies that some residual risk may still remain after counter action. The best practice for risk reduction is to take some work on those amenable risks to favor the project in the project planning phase.

Another way to reduce risk could rely on the contracts that agreed among participants. The contract may specify the terms and conditions that will facilitate risk sharing. But bear in mind such effort may reduce the risks in the intended risk while increase risks in other forms or in other fields.
(4) “Risk mitigation - taking some action after the effect has occurred to lessen its impact”. Risk prevention could be costly as sometime the consequence of risk is fierce but the occurrence possibility is low. Therefore, risk mitigation is actually a wait-and-see strategy; the difference with risk acceptance is some action will be taken under such strategy. Though sometimes the action may be is only a notional plan, it will be pursued when the risk materializes.

(5) “Risk transference - placing the risk or its effects with some person or organization better able to deal with it”. There are two reasons for this option: the first is that other participants may be more competent to deal with certain type of risk; the second is other participants may better to finically secure or rapidly bring resource to solve the problem. One example for risk transfer is to sign contract with insurance company, who will often demand risk reduction measures implemented before granting cover. Other practices such as fixed-price contracts with supplier or others will transfer the risks associated with cost overruns to counter-contractors.

(6) “Contingency provision - setting aside or providing some time or resources that can either be called upon in the event of the risk materializing or used to avert a risk materializing”. Contingencies are often formalized in the cost estimation process, probably with a structure defining who has control of each level of contingency. Contingency will facilitate risk reduction and mitigation.

2.4 Risk and Risk Response Strategy in Megaproject

After reviewing fundamental knowledge in project management, megaproject and its feature and general risk management practice, here we provide a more close examine of risk and risk response strategy in megaproject, the gap we find from current literature will further justify our choice of research topic.

- Risk in Megaproject

As discussed before, in project management (PMI, 2004), any deviation/variation that may change the expected outcome can be regarded as a risk, hence we can always find certain specific risks in each public project. But just as Fone and Young (2005) has pointed that “the major challenge of risk management… is identifying and managing attitudes to and perceptions of risk, rather than just dealing with the objective side of probability, frequency and severity”. It is suggested that certain characteristic of public project may denote to the prevailing unsuccessful deviation/variance control, put the conventional risk management skill in vain. In addition, we should bear in mind that the risk taking activity is not a free lunch; there is very chance that the cost of risk taking is even higher than the risk itself, especially under certain conditions such as the lack of risk accountability in public project. To verify our hypothesis, we resort to an international literature review to exam the megaproject worldwide, but only find a gap in current study.

Indeed, recent years many megaprojects have been surveyed to identify the risks that may significantly affect the project performance such as completion time and cost control

However, most of these researches were based on certain condition such as given culture, government policy or financial environment; therefore, they offer the experience only applicable to those with similar situation. It is hard to generalize the major risks in all public projects since those literatures tend to focus on the specific risks in certain project (Flyvbjberg et al, 2002, 2003) or nations (Al-Khalil and Al-Ghaflly, 1999, Aibinu, 2002, Dlakwa and Culpin, 1990, Frimpong et al, 2003), rather than generalize to the worldwide megaprojects. Consequently, risks identified in those literatures are typically grouped into various categories in terms of project life cycle, such as design, logistical, contractual, financial, construction and operational risks. And the failure to manage these risks is usually linked to serious consequences in project itself, such as “poor quality, programming delays, budget over-runs, environmental pollution and prolonged contractual disputes” (Shen et al, 2006), the externality of a public project is overlooked. Though few researchers (Flyvbjberg et al, 2002) notice the political feature of public project can actually pose a real threaten to the cost estimation, the risk management policy tendency indigenous to the public project is greatly ignored.

<table>
<thead>
<tr>
<th>Risks</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project-related</td>
<td>These risks include cost and time overruns, poor contract management, contractual disputes, delays of tendering and selection procedures, poor communication between project parties.</td>
</tr>
<tr>
<td>Government-related risks</td>
<td>These risks consist of inadequate approved project budgets, delays in obtaining permissions, changes in Government regulations and laws, lack of project controls, administrative interference.</td>
</tr>
<tr>
<td>Client-related</td>
<td>These risks include inadequate project budgets, poor project brief, variations in project specifications, delays in the settlement of contractor’s claims, lack of project control.</td>
</tr>
<tr>
<td>Design-related</td>
<td>These risks represent inadequate soil investigation, delays in design, ambiguities and inconsistencies in design and design changes.</td>
</tr>
<tr>
<td>Contractor-related risks</td>
<td>These risks include inadequate estimates, financial difficulties, lack of experience, poor management, difficult in controlling nominated subcontractors.</td>
</tr>
<tr>
<td>Consultant-related risks</td>
<td>These risks represent lack of experience, performance delays, and poor communication with other project parties.</td>
</tr>
<tr>
<td>Market-related</td>
<td>These risks include increase in wages, shortages of technical person nel, materials inflation, shortage of materials, shortage of equipments required.</td>
</tr>
</tbody>
</table>

Table 3: Risk in megaprojects (Shen et al, 2006)
- Risk Response Strategy in Megaproject

Based on Webb’s idea, Baldry (1998) further concludes four main strategies for public project. As his research also focuses on the “public” feature of project, his outcome can also be applied in megaprojects. And the significance of these may be seen as: (Baldry, 1998)

- Risk retention: Public organizations, such as governments, normally do not arrange insurance cover but rely upon their substantial resources to underwrite any financial loss which may arise. The most significant risks which are retained, and which are incapable of transfer in most circumstances, are the disruption risks arising from postponement, cancellation, or non-performance of projects which have a damaging effect upon operational activity or service delivery.

- Risk reduction: For public sector organizations, the careful selection of contractual form and terms will establish the relationship culture with the main contractor to avoid a risk exposure which arises from such relationships as cost-plus contracts. In terms of reducing the impact of risk upon operational activities, a high risk project may be compensated for in terms of contingency provision of alternative sources of service delivery or the development of alternative strategic plans to be followed according to the unfolding of events.

- Risk transfer. The commonest form of risk transfer is arranging insurance but for many public organizations the potential scale of financial risk and the indeterminate nature of the range of risk impact make this an impracticable proposition resulting in the adoption of a self-insurance approach. The result is a limited capacity of the public sector to consciously transfer project risks other than of a financial nature within the terms of contractual arrangements though this is highly constrained in practice, and likely to produce undesirable side effects.

- Risk avoidance: Although the public sector may be considered to be risk averse in behavior, it is compelled to be risk-accepting, a condition which it attempts to mitigate by defensive procedures and contingencies. However, recent developments in the adopted approach to project management, the increased involvement of commercial operators, and the encouragement of a more entrepreneurial approach amongst government or local authority agencies, has created a differing culture and attitude towards the acceptance of a reasonable degree of risk.

A survey of megaprojects performance (Flyvbjerg et al, 2003) reveals that cost overruns and striking poor performance in terms of economy, environment and public support are prevailing in such public sponsored projects, whether in industrialized or industrializing countries. Based on their research of hundreds of megaprojects all over the world, the authors further attribute the poor record for megaproject performance to the overlook of probabilistic nature of project planning, implementation and operation. In another word, the public project shows a tendency to overlook the complex and dynamic nature of risks ingrained in these projects. However, the reason why the overlook happened is not fully exploited in their research. The puzzle still remains that what on earth hinders the public
project to recognize the probabilistic nature if it is the central cause for public project failure? To answer such question, we will conduct a research to confirm our hypothesis. So we go step to our next chapter- Methodology, where we will introduce our way to access data, the rational for the case selection and the way to analyze the case.
3. Methodology

In this section, we are going to discuss the following main issues:
- research philosophy and research approach;
- the choice of research methodology;
- the choice of data collection techniques
- how to collect data and the sources of data
- how to conduct the analysis
- limitation of chosen methodology
- the reason of choosing Scottish Parliament Building project

As mentioned in Introduction, the general idea of how to conduct this research is through a study on one particular case, try to find the indigenous factor in megaprojects which will impact the risk management, and explore how the factor exert its influence, then in the end, attempt to find out what methods could be applied to handle these influence.

Therefore, interpretivism is adopted in our study as the research philosophy, because it seeks to discover the “details of the situation to understand the reality or perhaps a reality working behind them” (Remenyi et al, 1998), while the positivism seeks to simply describe the phenomena, so it not suitable for our study.

Moreover, according to Saunders et al. (2003), the deductive approach is usually attached to positivism while the inductive approach to interpretivism. Deductive research works from the general to the specific: the researcher begins with thinking of a theory, and then narrows down this theory into more specific hypotheses that can be tested. This finally leads to testing of the hypotheses with specific data. As for inductive research, it moves from specific observations to broader generalizations and theories: the researcher commences with specific observations and collecting data, interprets them, starts to detect patterns and regularities, formulates some tentative hypotheses that can be explored, and finally ends up developing some general conclusions or theories. Therefore, considering our general idea of conducting research, we think that inductive approach is the most suitable basis to develop our research strategy.

Furthermore, with regard to research methodology, there are several approaches that are commonly used, namely action research, case studies, experiments, and surveys. The advantages and disadvantages of each method approach are shown in Table 4: (Loraine Blaxter et al, 2006:67-79)

<table>
<thead>
<tr>
<th>Research approach</th>
<th>Main advantages</th>
<th>Main disadvantages</th>
</tr>
</thead>
</table>
| Action research   | • Research can be set within a specific context or situation;  
|                   | • Researchers can be participants – they don’t have to be distant and detached from the situation;  
|                   | • Involves continuous evaluation and |  
|                   | • Findings not generalisable  
|                   | • Depends on collaboration  
|                   | • Difficult to achieve and sustain change |  
|                   | • Change hard to measure and feedback can be threatening |
modifications can be made as the project progresses;  
• There are opportunities for theory to emerge from the research rather than always follow a previously formulated theory.

| Case studies | Data is drawn from people’s experiences and practices and so it is seen to be strong in reality;  
• Generalization from a specific instance to a more general issue;  
• Explore alternative meanings and interpretations of the complexity of social life;  
• Can be linked to action and their insights contribute to changing practice etc. | The very complexity of a case can make analysis difficult;  
• While the contextualization of aspects of the case strengthen this form of research, it is difficult to know where ‘context’ begins and ends.

| Experiments | The design of experiments could permit great flexibility, efficiency and powerful statistical manipulation;  
• Control over the introduction and variation of the ‘predictor’ variables clarifies the direction of cause and effect;  
• The only research design which can, in principle, yield causal relationships etc. | Difficult to design experiments so as to represent a specified population;  
• Cannot capture the diversity of goals, objectives and service inputs which may contribute to outcomes in natural settings;  
• Contriving the desired ‘natural setting’ in experiments is often not possible.

| Surveys | With an appropriate sample, surveys may aim at representation and provide generalized results;  
• May be repeated in the future or in different settings to allow comparisons to be made;  
• With a good response rate, surveys can provide a lot of data relatively quickly. | The data, in the form of tables, pie charts and statistics, become the main focus of the research report, with a loss of linkage to wider theories and issues;  
• The data provides snapshots of points in time rather than a focus on the underlying processes and changes;  
• The survey relies on breadth rather than depth for its validity.

Table 4: Advantages and disadvantages of research approaches (Blaxter et al, 2006)

Basing on the analysis to advantages of disadvantages of each research approach along with the feature of our research, we found that in general, case studies are the preferred strategy to answer our research question are being posed, as this approach allow us to “explore alternative meanings and interpretations of the complexity of social life” and
have our “insights contributing to changing practice”. (Loraine Blaxter et al, 2006:72) Moreover, according to Rolf Olsson (2007), when the investigator has little control over events, or when the focus is on a contemporary phenomenon within some real-life context, case studies will be an appropriate methodology, and our research is just in this kind of situation.

For Action Research, it is usually time-consuming, because in order to get satisfactory results, researchers have to carry out cyclic process in which research, action and evaluation are interlinked. Besides, it mainly deals with individuals as members of social groups, but for our research, we focus more on different groups rather than individuals. As for Experiments, it needs to be carefully manipulated by the investigator under known, tightly defined and controlled conditions, but in our research, we didn’t have enough capability to create such kind of situation to launch experiments. With regard to Surveys, it “relies on breadth rather than depth” and generally doesn’t focus on the underlying issue of a problem (Loraine Blaxter et al, 2006:79), therefore, it’s not appropriate to answer our research question. In addition, with the constraint of time and financial resources, we wouldn’t finish research within constraints if using this methodology.

Therefore, considering the applicability as well as the feasibility of different research methodology approaches, **case study is chosen as our research methodology in this thesis.**

So after the methodology is chosen, the next step is the selection of proper techniques for collecting data. Blaxter et al (2006) mentioned four common techniques for collecting data, and they are Documents, Interviews, Observations, and Questionnaires:

- **Documents**, all research projects involve, to a greater or lesser extent, the use and analysis documents. Especially sometimes when it is difficult to approach respondents or hard to get some firsthand data, documents will be a very good channel to obtain necessary information. The documentary sources for research could be government surveys, government legislation, historical records, as well as media documents, personal documents, and international organizations. In our research, it is hard to approach respondents, so using documents can let us get relevant data. Besides, there are already many studies regarding to the case we chose, hence, we can save a lot time and energy in terms of exploring the case, but just pick up the relevant information from these secondary data, and use them in our analysis. Therefore, considering constraints, the accessibility of data as well as benefits, **documents are our major way to collect data.**

- **Interviews**, if have access to some interviewees, this is a useful technique to collect data which is sensitive or can let interviewees disclose more details about some particular issue. Besides traditional face to face interview, with the popularity of internet, interview can be conducted at a distance through using email or web communication tools, such as Skype. And the purpose of interviews is to find out more detailed and sensitive information which cannot be gotten from documents. In our study, due to the incompetence to access to the key interviewees, so the interview cannot be carried out.
- Observations, it is quite time-consuming technique of collecting data and the researchers usually need to participate or present in the observation place. This is not suitable for our research, since we don’t have access to observe the project, and our focus is on the project which is already finished, moreover, because of time constraint, we could not have enough time to carry out observation.

- Questionnaires, it is one of most widely used social research techniques. But like observation, usually, it needs plenty of time to prepare questionnaires, send them out, get responses, and analyze data. Although it is good techniques of collecting data for our research, considering our capability as well as some constraints, it is not so possible for us to use this technique.

So far, in short conclusion, the procedure of data collection in our research will be as follows. First of all, a pre-writing study is carried out to analyze a set of data which could be found from numbers of documents regarding to the case (Scottish parliament project) we chose. Most of these documents can be obtained from the official website of Scottish parliament. The purpose of pre-writing study is to get deeper understanding to Scottish parliament project, make the direction of our research clear and to set up sound framework for further analysis. Although large part of these documents provides only secondary data, the information in them is apparently reliable given that all the published information on the website is guaranteed by Scottish government.

Secondly, after starting writing, besides the data we get from previous stage, we also look for additional information based on our need. Most additional information are from two aspects: on one hand, we refer to some previous studies which are relevant to our research, such as the studies on megaproject, risk management etc., the purpose of doing this is to get the academic view on relevant issue in our analysis. The sources of these previous studies are from the books in Umea University library as well as University’s database, so the reliability can be guaranteed. On the other hand, we seek for some trivial information which we ignore during the pre-writing study period, such as the information from newspapers, magazines, because we realize that sometimes this kind of information are also quite important to analyze the problems in the project. The source of this part’ information is again from the Scottish parliament website, because this website includes most of the reports which are related to Scottish Parliament project from newspapers, magazines and other media. And the reliability of information can also be guaranteed.

Before we continue, we would like to take a bit time to clarify that what main documents are included in the Scottish Parliament website, because these are sources where we get many data from. In the website, there is a wide range of material related to the Scottish Parliament Project, and the main ones are as follows. Moreover, we also want to mention that in the latter analysis in our thesis, we don’t make references to all documents that we list below, one reason is because some information is overlapped, then we just need to refer to some of documents; while another reason is because some parts of our analysis are based on the data that we integrated from large number of documents, therefore in this case, it is quite hard for us make references to all of them.

- Press Releases – information released by newspapers, magazines or other media
After the data are collected, our analysis is carried out in the following way: First of all, Fone & Young’s risk management process is chosen to be the basic framework of our analysis. And the purpose is to conduct our analysis in a systematic way. Fone & Young’s theory is already mentioned in Literature Review part, and the reason we select their theory is because it is a quite comprehensive process, as we analyzed earlier. Next, basing on the framework, we begin our analysis step by step: start from risk assessment (including risk identification and risk analysis), then risk response, and finally to programme administration (review & monitor). This process actually is not exactly the same as Fone & Young’s process, that’s because some steps in their process are not suitable for this case, hence, we make a bit change. Anyway, after this step, the main part of analysis is done, and the last step is to provide some recommendations.

Moreover, in view of the characteristics of our research, we carried on qualitative research, because “it tends to focus on exploring, in as much detail as possible, smaller numbers of instances or examples which are seen as being interesting or illuminating, and aims to achieve ‘depth’ rather than ‘breadth’”. But quantitative research “tends to involve relatively large-scale and representative sets of data, and is often presented as being about the gathering of ‘facts’”. (Loraine Blaxter et al, 2006:64) So it is not suitable for answering our questions in the research.

In addition, we should mention that there is some limitation in our research methodology. Although the approach we use to collect data is enough to accomplish our study, we still believe that more premier research, such as interview and questionnaire, could help us understand and probe into the problems more deeply. Unfortunately, as mentioned several times, due to time and resources constraints, we could not apply these approaches in our study.

In the end, we would like emphasize the reasons for us to choose Scottish Parliament building project as a case to study:

(1) After looking for data of several megaprojects, we found that there are a lot of materials talking about Scottish Parliament project, which can ensure us get basic amount of data to carry on research.
(2) After analyzing the data, we found that Scottish Parliament project is a typical megaproject, and it can be a representative of megaprojects. Therefore, the findings from the case could be generalized to other megaprojects.
4. Findings & Discussion

Based on our methodology, we have accessed data and are going to present our main findings in this chapter. The chapter is divided into two sections, the first section serves the function to present findings including the historical context of the project, the project progress and the controversial issue in the project. In the second section, we analyzed our findings under the general risk management framework, namely risk identification, risk analysis and risk response. Due to our ex post case study, we summarize the problems that we find in the first section as the risk identification, then we compare the risk happened with the risk analysis and risk response practice in the project. By such comparison, we are trying to reveal what factor may greatly impact on the risk management practice, and by which way the influence is exerted.

4.1. Background of the Scottish Parliament Project

4.1.1 The reason of building Scottish Parliament House

Before 1707, the Kingdom of Scotland was a sovereign independent state. It had its own government - the Parliament of Scotland - which met at Parliament House on the Royal Mile in Edinburgh. In 1707, the Act of Union was passed, and this Act created an incorporating political union between the Kingdoms of England and Scotland. Then the Parliament of Scotland and the Parliament of England were merged into the Parliament of Great Britain which was housed at Westminster in London. As a result, Scotland was directly governed from London for the next 292 years without a legislature or a Parliament building of its own. Held on 11 September 1997, a referendum of the Scottish electorate approved the establishment of a directly-elected Scottish Parliament to legislate on most domestic affairs. At that time, Donald Dewar was the Secretary of State for Scotland, and he led the Scottish Office to decide that a new parliament building should be built in Edinburgh to house the Scottish Parliament. That’s the origin of Scottish Parliament house project. (Wikipedia, access on 2007-12-12)

4.1.2 Progress of the Scottish Parliament Project

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>December: Choosing a Site: Short-listed sites published</td>
</tr>
<tr>
<td>1998</td>
<td>January: Site Selected: Holyrood announced as site for new building</td>
</tr>
<tr>
<td></td>
<td>April: Davis, Langdon &amp; Everest was appointed as cost consultants</td>
</tr>
<tr>
<td></td>
<td>May: Designer Competition: 5 practices invited to prepare conceptual ideas</td>
</tr>
<tr>
<td></td>
<td>July: Designers: EMBT-RMJM appointed as architects</td>
</tr>
<tr>
<td></td>
<td>Decision taken to adopt construction management</td>
</tr>
<tr>
<td></td>
<td>October: Demolition work started on site</td>
</tr>
<tr>
<td></td>
<td>December: Departure of Bill Armstrong as Project Manager</td>
</tr>
<tr>
<td>Year</td>
<td>Month</td>
</tr>
<tr>
<td>------</td>
<td>-------</td>
</tr>
</tbody>
</table>
| 1999 | June  | Responsibility for the project transferred from Secretary of State to SPCB (the Scottish Parliamentary Corporate Body)  
1st Parliamentary debate on the project – MSPs (Member of Scottish Parliament) vote to proceed with Project with a budget of £109 million |
|      | July  | Main construction work began on site |
|      | September | Revised chamber design agreed |
| 2000 | March | Spencely Report, which is about the Holyrood Project costs and programme, published |
|      | April | 2nd Parliamentary debate on the project – MSPs vote to continue with Project subject to cap on costs at £195 million |
|      | June  | Holyrood Progress Group established |
|      | July  | Death of Enric Miralles, Designer of the Scottish Parliament |
|      | September | First Auditor General reports on Holyrood |
|      | October | Death of Donald Dewar, First Minister |
|      | November | Appointment of Alan Ezzi as the Holyrood Project Director |
| 2001 | January | MSP building topped out |
|      | June  | Sarah Davidson replaces Alan Ezzi as Project Director |
|      | November | Estimated final cost reported to Finance Committee at £241 million |
| 2002 | March | Estimated final cost reported to Finance Committee at £266.4 million |
|      | October | Estimated final cost reported to Finance Committee at £294.6 million |
| 2003 | January | Estimated final cost reported to Finance Committee at £323.9 million |
|      | June  | Appointment of Lord Fraser to lead investigation into cost of the Holyrood Building Project |
|      | July  | SPCB started monthly progress reports for Finance Committee |
|      | September | Estimated final cost reported to Finance Committee at £401 million |
| 2004 | February | Estimated final cost reported to Finance Committee at £431 million |
|      | June  | Second Auditor General’s Report on management of project published |
|      | August | Staff move in to Holyrood Building |
|      | September | Holyrood Inquiry Report published  
Scottish Parliament met for first time in Holyrood |
|      | October | Official opening of the Building |

**Figure 2: Timeline of the Scottish Parliament Project**

(The Scottish Parliament, accessed on 07-12-12 & Peter Fraser, 2004)
4.1.3 Is the Scottish Parliament project a Success?

From the progress of Scottish Parliament (SP) project, you may already detect that there existed some problems in the project, for example, the continuous increase of budget, the change of project director etc. But whether this project is a success or a failure, different people may have different opinions. Here in order to make it clear in our thesis, we would like to define Scottish Parliament project based on Westerveld’s (2003) project success criteria which mentioned in the Literature Review. They reason of choosing this model is because compared with other criteria, Westerveld’s is more comprehensive and befitting to public sector project.

Before going to make definition on Scottish Parliament project success, we would like to mention that the information we use in ‘Evaluation’ column are all based on the information that we get from the Scottish Parliament website. As mentioned before in the Methodology part, this website includes many kinds of information sources, such as auditing report, individual report, official documents, newspapers and magazines etc. And in order to get enough information to make objective evaluation, we referred to the large number of sources, and here we decide not make any reference, because all the information are integrated together already.

<table>
<thead>
<tr>
<th>Success Criteria</th>
<th>Explanations</th>
<th>Evaluation</th>
<th>Success / Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project results: Budget Schedule Quality</td>
<td>The original golden triangle of project goals. Almost all projects will have specific scheduling, budget and quality constraints.</td>
<td>• The final cost estimate is almost ten times higher than the original budget. • The finish date is three years later than the schedule. • The final project maintains high quality and met the requirement as designed.</td>
<td>Failure</td>
</tr>
<tr>
<td>Appreciation by the client</td>
<td>The client initiates the project to fulfill a specific need. What aspects and factors does the client value in judging the success of the project</td>
<td>The client is Scottish Parliament, and their need is to have a house which can accommodate the MSPs. And this building should reflect the spirit of Scotland with high quality and appropriate cost. Therefore in this case, except the cost, the SP project met the client’s requirement.</td>
<td>Success</td>
</tr>
<tr>
<td>Appreciation by project personnel</td>
<td>The workers of the project will be concerned with reaching their personal goals as well</td>
<td>Because of many changes required from the client during the project, the project personnel did suffer from it, especially for project management team. The best example is the change</td>
<td>Failure</td>
</tr>
<tr>
<td>Appreciation by users</td>
<td>Users are concerned with their overall influence in the project and the functionality of the end product.</td>
<td>The users, mainly are MSPs, had some complains about the security and lighting of the SP house, but on the whole, the new SP house is appreciated by users.</td>
<td>Largely Success</td>
</tr>
<tr>
<td>Appreciation by contracting partners</td>
<td>Contracting partners try to make a profit at the project. They are also concerned with getting new orders and learning possibilities.</td>
<td>Under construction management, each subcontractor finished its own section within the budget, so they should more or less gained profits from the project. For the main contracting partner, because of the contract type, it will anyway gain certain profit. As for the issue of getting new orders in the future, not enough information is available.</td>
<td>Success</td>
</tr>
<tr>
<td>Appreciation by stakeholders</td>
<td>Those parties that are not directly involved in the project but have a large influence. For example environmental groups, citizens and government agencies. These parties manage their specific interest.</td>
<td>There are many stakeholders who are not directly involved in the project, and it is difficult to meet all their expectations. For instance, the project is appreciated by some Scottish citizens because they say the new SP building really reflects the spirit of Scotland. But some of them criticize the huge cost of the project and even doubt the ability of new parliament in managing public project in the future.</td>
<td>Partly Success</td>
</tr>
</tbody>
</table>

Table 5: Evaluation of Scottish Parliament Project by using Westerveld’s success criteria

So far, based on the analysis, we can basically define the Scottish Parliament Project as a success. But we should bear in mind that this is a success with some disasters. And largely because of the occurrence of these disasters, the project failed in terms of cost and schedule and so on.

What is usually the cause of project disaster? If we could find them, we can take actions to prevent them. Besides, it also helps identify the risks, because the causes of project disaster are the sources of many risks. (the relationship between sources of risk and causes of disasters can be seen from Table 6) According to Nickson (2005: 26-39), there are six categories of the causes of the disaster for a project, namely inadequate information, external events, unclear/wrong goals, unproven technology, inadequate...
resources and failures of communication and management. (more information can be found in Appendix IV).

- **Inadequate information**

Take the case of unclear goals or incorrect requirements; it could be argued that these are simply examples of the project team not being in possession of sufficient accurate information to be able to deliver the desired product. However, there is a limit to what can be known, so perhaps this cause of failure is a risk inherent in any human enterprise. You can never know everything.

As for Scottish Parliament Project, during the preparation period, quite a lot research had been done to determine the size of the parliament house. At that time, as the client, the Scottish Parliament thought they had already considered enough space for the parliament house, but what happened in the latter was that the previous size was not enough because of some newly added functions, therefore, the design team had to redesign and the project management team had to reschedule, which took up plenty of time and finally caused big delay in the project.

Moreover, the project also had inadequate information in cost estimation. As you can see in project’s progress, the cost estimation changed several times, and finally increased from the initial £40 million to the end £431 million. The part reason behind this huge difference was because some information was only available till certain period. For example, the increased security needs because of more serious terrorist attack issue.

- **External events**

These include politics, natural disasters, takeover / change of ownership, company failures, and international crises and so on. By their very nature, they are outside the control of the project team and any sponsoring organization. This does not mean that there is nothing that can be done about them.

As just mentioned, the external events are usually outside control of the project team. And the most obvious and also the most influenced external event which occurred during the project was the political issue from the client - Scottish Parliament, or in a clearer expression way, changes from top. Look back to project history, there are several big changes as well as some small changes that were required by the Scottish Parliament during the project. And the project team had to listen to the client in order to meet its need. Therefore, such kind of external event caused many difficulties to the project team, which gradually became a disaster.

- **Unclear / wrong goals and requirements**

Many projects fail because they do not have sufficiently clear goals. Some fail even more spectacularly because they have the wrong goals. Having unclear goals can easily lead to problems, but to get a first-class disaster, having the wrong goals wins hands down every time.
On the whole, the Scottish Parliament had a very clear goal about the project, but it didn’t have clear requirements. During the project, as a client, the Scottish Parliament changed its requirement of the project several times, which caused many difficulties for project team, and finally led to the project delay as well as budget overrun.

- **Unproven technology**

  The use of unproven, or leading-edge technology (or the use of proven technology in a new field) carries with it significant risk. When doing something for the first time, or even being in the vanguard of early adopters, there are two sources of increased risk. Firstly, there are a higher than normal number of unknowns, and, secondly, there is no pool of in-depth expertise on which to draw when things go wrong.

  The design of Scottish Parliament house is quite complicated due to the high demand of Scottish Parliament, but it is not the big problem regarding to construction techniques. What really caused the big problem was the use of construction management as a way of managing contracts. This is a relatively new contractual method, and according the research done by Lord Fraser (2004), the drawbacks of using this contractual way to manage Scottish Parliament project are: the complexity of administering many different trade packages (around 60 in the case of Holyrood); the relative difficulty of managing delay; and most important of all, the absence of any overall contractual program or contract sum. Just as one of project team member said “If you are a client who is dependent on having a fixed price before you start, you do not choose to go construction management, because it does not deliver that”. (Fraser, 2004: 81)

- **Inadequate resources**

  Lack of resources emerged as a main or contributory cause for many of the project disasters. Resources for projects come in three favors: funding, people and equipment.

  For funding, any project that has serious shortfalls in this area will inevitably fail - there will not be enough money to pay for the delivery resources of people and equipment. There are many possible causes for this including inaccurate estimates, changes in the project environment, changes in requirements and so forth. For Scottish Parliament Project, though having some fierce quarrels in parliament debate, the Scottish Parliament every time decided to continuously provide enough funding to the project, even if the project budget increased hugely. For people and equipment issue, similarly, there was no any information showing that the project was short of people or equipment.

- **Failures of communication and management**

  Failures of communication and management include misunderstandings, failure to check understanding, false assumptions, cultural mismatches, lost messages, poor planning and poor setting of objectives.
Now looking back to Scottish Parliament Project, there existed a serious communication problem. First of all, the lack of communication between design team and client, which lead to constant changes from clients during the project; secondly, the project management team and design team had different working cultures, and this difference (the different between Spanish style and Scottish Style) caused conflict during the project.

Although the six general categories cover most things that can cause a project to go off the rails, it is also clear that there are specific causes that rate a mention, and these are stress, legal disputes, and the butterfly effect. (Nickson, 2005: 45-46)

- **Stress**

  Though usually an effect of a project disaster on a team member (or even the whole team), stress can be a causal factor. People who are genuinely suffering from stress (as opposed to just being tired or overworked in the short term) are less efficient at doing their job and can also make the rest of the team ineffective because of their behavior.

  According to the project report, the project team member, especially design team and project management team, suffered high pressures because of many changes from client. The design team had to change design in order to meet the new requirement, and the project management team had to modify the schedule to implement the new design. Therefore, although no direct information shows that stress lead to project disaster, from the interview of project team, the high work burden in the course of project did cause some problems for them to work efficiently.

- **Legal disputes**

  Once legal specialists get involved in a dispute between a supplier and a client, then this can be a cause of a disaster in itself. This is because lawyers are briefed to protect the interests of their respective clients, and this tends to become a defensive situation. Of necessity, this leads to a significant overhead on the project; often the first step is to halt everything or insist that the legal experts give the OK for every new step, and this makes progress very difficult. In addition, once battle lines are drawn, it becomes increasingly difficult to get cooperation from either side.

  With regard to Scottish Parliament project, basically, there is no issue related to this factor, probably mainly due to the characteristic of public project. The supplier in most cases can get money from the government, and in order to keep long-term relationship with government, even if there are some problems between supplier and government, they always seek for other solutions rather than go to legal dispute. But even if so, project team still need to pay enough attention to avoid this cause, because once it occurs, it will bring the severe hit to the project.

- **The butterfly effect**

  The ‘butterfly effect’ grew out of Chaos Theory. In this effect, a very small event,
such as overlooking a minor assumption, can lead to a major, unpredictable, effect further down the line. There is little that the project manager or team can do to stop this. The butterfly effect is a chaotic one; it happens in complex systems, where starting from the same point and doing exactly the same things will not result in the same outcome. You are more likely to be the victim of this in a very large project. It was so called because the idea was that a butterfly flapping its wings in one place could, eventually, lead to a tornado somewhere else in the atmosphere.

With data we have so far, there is no enough information showing that any disaster in Scottish Parliament project is caused by the butterfly effect. Anyway, as just mentioned, the project manager can do little to stop this factor; therefore, in most case, the project team is likely to accept it.

<table>
<thead>
<tr>
<th>Causes of disaster</th>
<th>Sources of risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate information</td>
<td>People, process, change</td>
</tr>
<tr>
<td>External events</td>
<td>Political, change</td>
</tr>
<tr>
<td>Unclear/ wrong goals</td>
<td>People, process, change</td>
</tr>
<tr>
<td>Unproven technology</td>
<td>Technical, change</td>
</tr>
<tr>
<td>Inadequate resources</td>
<td>People, commercial, technical, change</td>
</tr>
<tr>
<td>Failures of communication and manage</td>
<td>People, process, political, change</td>
</tr>
</tbody>
</table>

Table 6: Relationship between sources of risk and causes of disasters (Nickson, 2005)

4.2 Risk management application in Scottish Parliament Project

4.2.1 Risk assessment (Identification & Analysis)

- Risk Identification

  The objective of risk identification is to outline the risks from ex post view, from which basis we can compare the difference of the risk management policy and the counter-party risk. Identifying risk is to identify uncertainty. And there are two types of project uncertainty - internal and external. (Chin, 2003) Each kind of uncertainty has its own characteristics, which requires different actions to deal with.

  - Internal uncertainty involves those things under the project umbrella that can be more or less controlled by the project manager, including scope, schedule, and cost.
  
  - External uncertainty involves those factors not under the project umbrella, such as the industry’s business environment, the competition, and high-level, business strategy decisions.

Moreover, there are many ways to approach risk identification. Two possible approaches are (1) to identify the root causes of risks - that is, identify the undesirable events or things that can go wrong and then identify the potential impacts on the project of each such event - and (2) to identify all the essential functions that the project must perform or goals that it must reach to be considered successful and then identify all the possible modes by which these functions might fail to perform. Both approaches can work, but the project team may find it easier to identify all the factors that are critical to success, and

38
then work backward to identify the things that can go wrong with each one. (Committee for Oversight and Assessment of U.S. Department of Energy Project Management (CB), 2005)

All in all, based on the above theory, the analysis of project disaster causes, as well as the investigation to the case, the following main risks are identified.

(1) Cost estimation

In 1997 after site selection, Mr. Wyllie, Civil Servant, also Head of Building Division Construction and Building Control Group, estimated the cost between £35-40 million, assuming a building with an area of 15,000m$^2$ gross (11,250m$^2$ net — a net to gross ratio of 25%) including 1,000m$^2$ for the Chamber, 3,000m$^2$ for Committees and Ministers and 11,000m$^2$ for the remainder. Admittedly, Mr. Wyllie had proceeded by “using very broad assumptions about the likely cost required for different types of accommodation, and assuming a gross floor area that might be appropriate for a Parliament complex”. Mr. Wyllie himself, however, did not think that range of figures had emanated from Building Division and was "surprised" that his figures might have found their way into the White Paper. (Fraser, 2004).

We also notice from the Parliament Inquiry Report that “...what can be stated clearly is that at the time £40 million was included in the White Paper, there was no clear understanding whether that was a total cost including professional fees or only a construction cost. It was certainly not explained to the Scottish public what the figure was anticipated to cover.”

According to Mr. Wyllie’s response (Fraser, 2004), his estimation was primarily a rough idea for the option between refurbishment and a new building, therefore could not be regarded as basis for further project cost elaboration. And he insisted that he was not involved, directly or indirectly, in the cost estimation presented in the white paper. From the limited information, we cannot infer the reason how an unverified figure can appear in the white paper exposed to public, which later becomes the attack target when the actual cost reaches 10 times higher. But we did find the original cost estimation is by no means a scientific figure that went through rigorous calculation. As a consequence, the cost deviation will be too high to be accepted.

In our case, we are not going to criticize the unrealistic budget, though the validation or the assumption of the calculation is not convincing, instead we focus on the correlation between cost underestimation and public project, which tends to be a positive one. From current literature (Flyvbjerg et al, 2002, 2003), we did find there are so many cases favor the positive correlation. Therefore, considering the high frequency of cost underestimation in megaprojects, it can be safely regarded as the first risk in terms of project life cycle.
(2) The change of project scope

On 22 June, 1998, the final interview of 5 short listed candidates for design competition took place by presentations to the panel illustrating their concepts using design boards and models. During this process, the selection criteria has considerably ignored the budget constraints as Miss O’Connor, member of selection board noted “…generally shared by the panel, that the object of the exercise was to choose a winner on the basis of design intent and that it would be for the architect to complete the design in accordance with a final brief and agreed cost constraints. It seemed likely that the brief would change and that as a result the costs would also do so” (Fraser, 2004).

According to Scottish Construction Industry Board report (June, 1997) “Briefing is the process by which a client informs others of his or her needs, aspirations and desires…The outcome of any project relies on the quality of the briefing provided…” In other words, brief will outline project scope in terms of cost, time and quality expected from the client, therefore, “Brief is critical to how architects work” (Fraser, 2004). Davis, Langdon & Everest (DLE), Quantity Surveyors and Cost Consultants for Holyrood Project, also concluded that “…The brief must be understood and adhered to in order that the risks inherent in undertaking such a project within an extremely tight timescale and a finite budget and be properly managed…” However, in Holyrood project, the selection panel purposely ignored the constraints of brief, while approved the conceptual design has obviously changed the expectation stated in the brief.

There is no doubt about the professionalism of the selection board which comprised Donald Dewar, First Minister of Scotland, Dr Gibbons, Chief Architect to Scottish Office and Architectural Adviser to Project Sponsor, Mr. Gordon, Head of the Constitution Group, Ms Wark, Journalist and Broadcaster, Professor Andrew MacMillan, formerly Professor of Architecture in Glasgow University and Head of the Mackintosh School of Architecture in Glasgow, and Miss Joan O’Connor, a former President of the Royal Incorporation of Architects in Ireland.

Then how the selection panel disregarded the professional practice in project management? It could be out of the fact that cost was not a consideration in designer selection, as illustrated by Ms Wark’s answer to the inquiry why the decision was not economically the most advantageous tender: “…Because, that was not what it was about. It was getting a building which was the most exciting, innovative building – a modern building – so therefore the most advantageous tender as the very, very first thing you were looking at is not right. I mean all three taken together, the design ability, relative experience, fine; but we would never have begun simply with the most… I mean you would not have gone through all that process to rely on envelopes…” (Fraser, 2004).

According to the research (Flyvbjerg et al, 2002, 2003), 64% project cost overrun is originated in the change of project scope. Therefore, a stated and well respected project scope is a crucial factor in successful project control. In megaproject, the project scope tends to be more valued in documentation rather than in practice. The popular awareness with poor action to define project scope constitutes the main risk in megaproject clearly.
(3) Risk Transfer Strategy

During the course of Holyrood project, one of the significant decisions was to adopt construction management. According to the Inquiry Report, construction management is fast track methods for construction procurement. Distinguished with traditional contracting method, where contract is agreed with contractor after design is completed; construction management will divide the construction work into packages that will be contracted with different suppliers, overlapping construction and tender process. The advantage is to accelerate the construction speed, while the disadvantage is the cost uncertainty as the total price will remain unknown until the last package is contracted. As a result, it leads to the difficulties in cost control.

In project management practice, contracting is not only a way to clarify the obligations or responsibilities, but also an important way to transfer risk exposed to the client. Obviously, different contracting strategy will deliver different risk exposure to the client. According to the Inquiry report, however, construction management actually was the worst choice with other available options in terms of risk transfer, as illustrated in the following table.

**Figure 3: Risk Allocation of different contracts** (Fraser, 2004)

From Figure 3, we can clearly see the client under construction management approach have to undertake major risks by themselves. As later the case shows, indeed the client which is Scottish Parliament project Board suffers great critics for their unsuccessful cost control.

We are not here to criticize the adoption of construction management method as each approach may have its own advantage and disadvantage; however, it is worth mentioning that there was no any risk associated evaluation report presented to the decision maker such as first minister. Personal responsibilities may be claimed in this case, but at the same time we notice that there are quite a number of cases already showed the considerable risk evaluation failure in megaproject.

Considering the frequency of unsuccessful risk management, especially failed pre-risk evaluation in megaproject, it would be safe to say risk evaluation itself poses a major risk in those projects.
(4) Project management structure and stakeholder management

Figure 4: Project Management Structure 1998 to 1 June 1999 (Fraser, 2004)

When the designer competition runs, the project management structure was formalized as the left table illustrated. Among them, project owner, project sponsor and project manager were put into central position. But later it turned out that project manager can not totally control project progress such as time schedule, cost control, meeting brief requirement, etc, and his idea was not listened to by the design team who was “not replaceable in this case”. He even noted “as long as the design team insists on making every decision on the design of the building, the joint venture problems will not be resolved and the Project will fall further behind program” (Fraser, 2004)

Surprisingly, according to Inquiry Report, decision maker as first minister was not aware of the tension between project manager and design team until the resign of project manager was published in the media. There was no further information to explain, however, the hierarchy indicated from the table may offer some hints. Project manager under this management structure needs to report to project sponsor whose role “…was to act as the client’s representative to deliver the About Holyrood to agreed time, budget and quality…”, while project owner “effectively sat within a Steering Group of senior civil servants who took strategic decisions on behalf of the client”. As a consequence, project manager was not authorized to coordinate other stakeholders, thus unable to lead the project. Noticeably, the claim for significant budget increase from £50 million to £117 million took place immediately after the appointment of new project manager.

Figure 5: Project Management Structure from Late 2000 (Fraser, 2004)

In June 1999, the project was handed over from former Scottish office to SPCB, “a corporate body responsible for ensuring that the Parliament is provided with the property, staff and services it requires.”, as demanded by Scotland Act 1998, section 23. Acknowledging the inefficiency to deal with various stakeholders in the previous management structure, SPCB looked for
someone to perform “a leadership role, using project management, not actually doing the Project managing” And the role of project director is defined as following “It is essential … that all executive decisions are channeled through Mr. Ezzi and that directions and instructions to the Construction Manager and the Design Team are given only by Mr. Ezzi or those at Project Manager level delegated formally by him. The lines of communication should be clarified and understood not only by members of the Project Team but also all consultants and contractors involved in the Project.” (Fraser, 2004)

The new position actually reflects the awareness of SPCB from previous experience to realize the importance of authorizing to coordinate stakeholders. However, the new project director find difficult to develop constructive relationship with the design team mainly due to his cost savings proposal, and felt authority undermined as he noted “I was concerned that the architects in particular were in direct communication with the HPG (Holyrood Progress Group) members and tended to bypass me. John Gibbons maintained an office on site which made it easy for him to be approached directly. This significantly undermined my own authority. My relations with the architects became particularly strained during the period when we were looking at site wide savings and the decision of the HPG not to back up my recommendations further undermined my position. I felt that I had no real personal authority and that the situation was open to exploitation by direct access by the design team to the HPG members” (Fraser, 2004), Mr. Ezzi noted that HPG members owned different interests and the requirement for the project were conflicting. For example, one member had stated that the building should last hundreds of years, while another member in other occasion required the building just be presented. Failed to manage those stakeholders, Mr. Ezzi finally resigned in June 2001. The design team, therefore, could take the advantage of the conflicts and didn’t change the design to reduce cost.

**Figure 6: Project Management Structure afterwards** (Fraser, 2004)

The political conflicts were further confirmed when members of the HPG praised his successor’s abilities and endorsed her appointment by “I think one of Sarah Davidson’s real skills was (understood) the political dimension of the relationships between the Group and the various Committees that existed within the Parliament. There is a very complex web; it is really hard to imagine how someone from outside the system, who is a construction manager – and I use that term advisedly in that sense – or a project manager really could have fulfilled all those roles in writing the necessary papers, say to Finance Committee and the Corporate Body. I think those were done generally – always, in my view – to a very high standard,
and had a real grasp of the issues, sometimes much better than even appeared in our own minutes” (Fraser, 2004)

The inquiry report mentioned that the new project director- Ms Davidson actually didn’t take the role as expected. She didn’t appear to work closely with consultant, or project and design team, but rather spent most her time looking upwards to the “multi-headed client”, which is illustrated by the table above. We may infer from the information that various political groups has great impact on the decision making process of project director, and the focus on their interests turned out be the best the way to minimize their dissatisfaction. But the distance from the operational aspect of project failed project director to resolve the conflict with design team in construction cost control.

- Risk Analysis

The public sector projects, perhaps more than others, has been plagued by various risks often resulting in poor performance with increasing costs and time delay, even project failure. “Risk analysis, especially at the early stages of the project, is intricate because the nature of risk is usually affected by numerous factors. And in many circumstances, it may be extremely difficult to assess the risks associated with a project due to the great uncertainty involved. Many risk assessment techniques currently used are comparatively mature, such as Fault Tree Analysis, Event Tree Analysis, Monte Carlo Analysis, Scenario Planning, Sensitivity Analysis, Failure Mode and Effects Analysis, Program Evaluation and Review Technique.” (Zeng et al, 2007) Nevertheless, for effective applications of these sophisticated quantitative techniques, high quality data are a prerequisite. Regrettably, such data are hard to obtain or even have not existed in public sector projects. Moreover, they are difficult to address the uncertainties and subjectivities associated with public sector projects. It is therefore essential to have other risk analysis methods to identify and assess risks in public projects in an acceptable way where any risk information produced is processed and reliably applied to decision making in the project management. (Zeng et al, 2007)

Hence, rather than using pure quantitative data to analyze project risk, some authors put forward that individual knowledge, experience, intuitive judgment and rules of thumb should be structured to facilitate risk assessment. They point out the potential of using fuzzy set theory (FST) for risk assessment and proposed a fuzzy decision support system for the estimation of cost performance and project progress etc. FST provides a useful way to deal with ill-defined and complex problems in a decision-making environment that incorporates vagueness. It enables the decision-makers to quantify imprecise information and make decisions based on incomplete data. (Dikmen et al, 2006)

Our case - Scottish Parliament project, is a typical example of public sector projects with great uncertainty as well as without high quality data. Therefore, to conduct a good risk analysis became a hard work for project team. Of course, Scottish Parliament project team consisted of experts from relevant fields, and they had done a detailed risk analysis for the Scottish Parliament project before it started. But still, after the project was in progress, some unexpected risk or under-expected risk occurred which caused the project behind schedule, over-budget etc. In this point, we think that the project team should
consider applying fuzzy set theory when analyzing the risk at the beginning. Because as analyzed above, when facing great uncertainty involved in megaprojects, and lacking of high-quality data, fuzzy set theory could be a very useful tool to help project team to detect risk and decide the priority of the risks.

There are several models of implementing fuzzy set theory in practice, such as Zeng et al’s (2007) fuzzy reasoning risk assessment model. It consists of five phases: preliminary phase, measurement of Fl (factor index) phase, measurement of RL (risk likelihood) and RS (risk severity) phase, fuzzy inference phase and output modification phase. (see Appendix V) Similarly, Dikmen et al (2006) also put forward a set of procedure for fuzzy risk rating:

- Step 1. Risk identification and modeling by using influence diagrams.
- Step 2. Definition of variables and selection of a “membership function” for each variable: A “membership function” is a curve that defines how the value of a fuzzy variable is mapped to a degree of membership between 0 and 1.
- Step 3. Capturing the knowledge of experts about relationships between risks and influencing factors using ‘aggregation rules’, where the risk knowledge is explained in the form of IF. . .THEN rules.
- Step 4. Carrying out fuzzy operations for aggregation of fuzzy rules into a fuzzy risk rating.
- Step 5. Determination of project risk level by interpreting the final risk rating.

This procedure is a generic one, however, as the fuzzy rules and risk ratings may change with respect to risk attitudes and organization preferences, different tools shall be developed for different organizations.

Although FST is a very helpful tool to help project team carry out risk analysis, one of the major criticisms of FST is its dependence on subjective judgments. Expert opinions are collected through brainstorming sessions with the contribution of a group of experts. The results generated as a result of group sessions for risk assessment may be biased by the effects introduced through the composition of the group and process they are using. However, effectiveness of the brainstorming sessions may be enhanced by using some strategies. (Dikmen et al, 2006) Keizer et al. (2002) propose that a step-wise procedure of group sessions, briefings by a risk facilitator, kickoff meetings, individual interviewing of experts, designing and answering questionnaires as prepared by the risk facilitator may enhance performance of brainstorming sessions.

Looking back to the Scottish Parliament project, the risk analysis was not successful, because of imprecise estimation, the project suffered big trouble in the course. Therefore, on one hand, as mentioned, here we recommend a useful tool for Scottish Parliament project. And based on the comparison among different risk analysis tools, we figure that under the conditions of with great complexity and uncertainty, and lack of high quality data, just like the Scottish Parliament project, the Fuzzy Set Theory could play a better role to help project team precisely assess the risk. On the other hand, according to the risks that we identified earlier, we are going investigate why at the beginning, the project team didn’t estimate the risk that we identified above. Through this analysis, we try to
find out what the obstacles are that block the precise risk assessment in Scottish Parliament project.

- Change of project scope

The Scottish Parliament lacked of experience in deciding the functions and size of parliament house. The new Scottish Parliament was reestablished in 1997, shortly after this, it decided to build its own parliament house. After long time dependence on English Parliament, the new Scottish Parliament seemed not so familiar with the idea of how big of the parliament house should be, though it has studied other parliament houses, such as the British Parliament house, and German parliament house, but different governments have different operation ways. Before it completely knew the necessary functions and size of the parliament house, the Scottish Parliament was already eager to start the project, so with the great uncertainty about the project scope, the project was on the way.

Why did the Scottish Parliament want to start the project so hurriedly without enough preparation? According to our investigation, it related to political issue: the first generation of the Scottish parliament, especially top-leading team, hoped to see the new parliament house finished before the next election, hence, we could say in other words, for political purpose and for personal reason, politicians influenced the decision on Scottish Parliament project.

The political factor continued playing the role in the course of the project. Because of different stakeholders that involved in the project, there were always different voices in the parliament debate. Some representatives put forward the request of adding new functions and extending the parliament house size, in the end, the compromising outcome was that some of the requests were approved and the project scope therefore needed to be changed.

- Cost estimation

One factor caused the project team fail to estimate the project cost precisely was due to the change of project scope. Obviously, the clear project scope was a must for accurate cost estimation. Following Table 7 (Wikipedia, accessed on 2007-12-12) shows all the main changes of cost estimation and the reason why. From this, we can easily detect that some of the changes occurred because of the change of project scope. Fairly speaking, if we focus on only this part, basically, the project team can do nothing to change or improve, because the project scope was out of their control.

<table>
<thead>
<tr>
<th>Date</th>
<th>Cost</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 July 1997</td>
<td>£30m-£40m</td>
<td>The primary cost projection provided by the Scottish Office is for housing MSPs in a new Scottish Parliament. The estimate takes no account of the location or design of any new building.</td>
</tr>
<tr>
<td>Date</td>
<td>Amount</td>
<td>Details</td>
</tr>
<tr>
<td>------------</td>
<td>--------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>6 July 1998</td>
<td>£50-£55m</td>
<td>The design of Miralles is chosen and the revised estimate updates the preliminary figure recognising that the initial projection was based on a cleared site of 16,000 m² (172,222 sq ft) on brownfield land in Leith, Haymarket or Holyrood. The figure does not include VAT or site acquisition costs.</td>
</tr>
<tr>
<td>17 June 1999</td>
<td>£109m</td>
<td>First Minister, Donald Dewar provisionally estimates the costs at £109m. The increased figure takes account of consultancy fees, site costs, demolition, VAT, archaeology work, risk and contingencies.</td>
</tr>
<tr>
<td>5 April 2000</td>
<td>£195m</td>
<td>Cost projections increase by £86m.</td>
</tr>
<tr>
<td>November 2001</td>
<td>£241m</td>
<td>The new figure is officially announced and takes into account increases in space and major design changes resulting from a changed brief over the previous year. Rising costs are also blamed on construction problems ahead of an attempt to try to complete the building project by May 2003. The then Presiding Officer Sir David Steel informs the Finance Committee of the Scottish Parliament that rescheduling work is increasing costs.</td>
</tr>
<tr>
<td>December 2002</td>
<td>£300m</td>
<td>A cost increase to £295m in October 2002, is reported to be due to increased security needs, requiring that bombproof cladding be incorporated into designs for the external fabric of the building. Rising costs are also put down to &quot;hidden extras&quot; in the construction process and by December 2002 &quot;ongoing delays&quot; raise costs above the £300m barrier. The completion date for the building slips again, and plans for a grand &quot;Opening Ceremony&quot; are shelved indefinitely.</td>
</tr>
<tr>
<td>September 2003</td>
<td>£400m</td>
<td>In July, the new Presiding Officer, George Reid produces the first of his &quot;monthly reports&quot; on the cost and schedule of the building, and provides a figure of £373.9m. The new figure comes in the light of reports that consultancy fees for the project top £50m. By September costs break the £400m barrier and are blamed on construction problems in the interior of the building.</td>
</tr>
<tr>
<td>February 2004</td>
<td>£430m+</td>
<td>Costs are revealed to have increased again due to further problems with construction. The official opening of the building is tentatively put back again to sometime in 2005, however the building finally opens in October.</td>
</tr>
</tbody>
</table>

Table 7: Timeline of cost increases (Wikipedia, accessed on 2007-12-12)
From the table, we can also find another factor that blocks the project team to estimate the project cost accurately is again due to political reason. Especially at the beginning, the budget was far below the real cost, we cannot eliminate the doubt that maybe this was purposely arranged by some politicians in order to let the budget plan get approved in the government. Moreover, the imprecise cost estimation is related to the performance of consultant as well. Here I am not saying the consultants don’t have enough competence of making precise cost estimation, but trying to say that these consultants are assigned by the government, therefore, it brings a big doubt on the possibility for them to conduct cost estimation independently. Because they may be influenced by some politician and forced to make imprecise estimation on cost.

- Construction management

First of all, construction management is a relatively new method of managing the contract. So the project team didn’t have enough expertise to foresee all the impact. Without understanding the feature of this kind of contract management method, the project team naturally ignored the potential risk. In addition, the project team was formed by people assigned by government, so once the government has made the decision, the project team usually didn’t argue but accept it. And this time, the government decided to choose construction management, because it wanted some flexibility from this kind of contract-managing method. So as normal, the project team accepted it without too much doubt. Therefore, the hidden bomb was buried. Besides, this risk didn’t be estimated at the beginning also because of the latter development of project was out of the expectation too much, so the construction management faced much more difficulties than people could expect.

4.2.2 Risk Response

After the risk assessment is completed, risk management does not end, actually, the hardest part could be to decide what to do about each of the identified risks; some might be regarded acceptable with no further action while others may require that something should be done. There might, however, be situations that do not involve simple choices between clearly perceived alternatives as a whole series of interrelated issues might have to be faced and a number of options are open. Refer back to Webb’s (2003) theory which we have mentioned in Literature Review, it is generally accepted that there are 6 courses of action that can be adopted in response to perceived risks. And in the following part, we are going to make an analysis based on these six points, and because we already provided detailed descriptions of each point in Literature Review, therefore we won’t repeat them again in this part.

Moreover, before we start analyzing, we want to clarify that our aim is trying to find out what kind of risk response actions that the Scottish Parliament project should adopt, but why at the beginning it didn’t, what the reasons are. Besides, we are also attempting to find out what the megaproject’s preference on the choice of risk response strategy, and why.

(1) Risk acceptance
In Scottish Parliament project, facing the risk of lacking enough funding, the project team seemed to accept this risk. As a public project, one characteristic is the considerable financial resources from the government. Therefore, the project usually can be guaranteed with enough funding. So for Scottish Parliament project, with the advantage of governmental support, the risk of being short of funding was acceptable. But the obvious drawback of adopting this risk response strategy to the risk is that for political reasons, the cost estimation was far below the actual cost at the beginning, which led to the situation that after the project was in the progress, the cost estimation kept increasing. Here we would like to point out the political issue in public project, as we mentioned in literature review, in order to be approved by the government, the cost of a project at the beginning is usually much lower than the actual cost. However, due to the characteristic of public project, once a project is started, the government in most cases will provide enough financial support to the project, so under this situation, even if the estimated cost is far from enough, the project team can still get the fund from the government during the course of the project.

This phenomenon seems become common in public sector project, no one extremely worries about the lack of money, sometimes even for PPP (public-private partnership) project, although the private organizations are within the constraints of contract, still they know once getting problem in funding, they can always ask for help from the government without getting penalization. The seemingly audacity of private organizations also is tightly linked to another characteristic of public project: As a public project, it has large number of stakeholders, and the purpose of many projects is to meet the public or society’s need. So as government, it needs to guarantee the project can be delivered on time in order to satisfy the public. Therefore, once the project gets the problem which the private organization cannot handle by itself, the government has to help them. Otherwise, instead of private organizations, the government will be blamed from the public because of the project delay or abandon. Hence, under such a big pressure, PPP project can always get support from the government. And this is the root of why some public project adopting risk acceptance strategy to response certain risk.

Furthermore, because of the reasons I just mentioned above, in fact, many public projects prefer to use this risk response strategy when facing certain risk, such as cost estimation. Why? Because there is low transaction cost to adopt this risk response strategy. The project team can just simply accept the risk, and latter seek for support from the government during the course of the project.

(2) Risk avoidance

The public sector is obligated to deliver certain functions and to provide certain services. And one of the main objectives of public sector project is to meet public’s need. The same as the Scottish Parliament Project, though it does not serve the public directly. Therefore, the potential risk in public project could be not to meet the public’s need. There are some previous examples showing that because of failure to reflect public’s need, the project was considered failure at least by public. Imagine one main aim of
public project is to serve public, so if public don’t accept the project, it is very hard to define the project as a complete success even if it may be finished on time, within budget etc. Therefore, for public sector project, a very important thing is to involve public into the project in order to obtain their acceptance.

In this point, Scottish government adopted a proper strategy: During the design competition period, the government adequately involved all the Scottish public to choose the model of future parliament house. And latter, the votes from public continued playing main role of deciding the final model. Hence, even if the project actually got many troubles during the whole period, after the project was finished, it still drew the positive appraisal from the public, and the number of visitors increased quickly after it open to public. Therefore, at least in the popularity among public as well as the reflection of their opinions, the government successfully avoided the risk by using appropriate strategy.

Basically, Scottish parliament project did well in adopting risk avoidance strategy. That’s because this strategy is quite optimum for public projects. By adopting risk avoidance strategy, the public project can totally or largely get rid of facing potential impact from the risk. Therefore, whenever possible, the public project always would like to adopt this strategy. The benefit is the relatively low transaction cost as well as the obvious effect.

(3) Risk reduction

Look at Scottish Parliament project. First of all, the response strategy can be used to reduce the risk of changing project scope. Based on the detailed study of the case, we found that the change of project scope did not only cause the project delay but also led to project overrun. Therefore, the change of project scope is a very big risk for the project. When in the face of this risk, what the project team can do? One reasonable strategy is to reduce the likelihood of risk occurrence. But how? One possible way is to set up the meeting among project design team, project management team, the client (Scottish Parliament) and relevant stakeholders before the project starts.

A main purpose of this meeting is via communication among different groups, to help the client clarify what they really need from the project, at the same time, to help the design team as well as project management team know better about the client’s requirement. And through multi-direction communication, the project scope could become much clearer during the discussion in the meeting; therefore, reduce the chance of changing project scope during the project.

Such a good option, why did not the project team choose at the beginning? There is not information directly showing the reasons, but according to our analysis, there are two main reasons: (1) it may be due to the high transaction cost. For example, there are many different stakeholders related to this project, so it could be very difficult to make all the stakeholders agree on the same project scope, and if they insist on holding the meeting till all the people get satisfied, it probably will take quite a long time, or never get result. In this case, the transaction cost will be very high for the project; (2) it is linked to public nature of the project, means no one really owns this project. So no one actually really care about it, and everybody seems to wait for other people to make effort, no one is responsible for organizing the meeting, as a result, everybody chose to keep silent even if
they realized the importance of the meeting.

Secondly, according to our risk identification, another risk existed in the Scottish Parliament project is about the cost estimation. If looking back to the project history, we can easily find that the project budget has been changed for several times, increasing almost ten times higher in the end than at the beginning. This risk could be reduced if the proper strategy has been adopted at the beginning of the project.

We believe that the reason why cost estimation was much lower than the actual cost, one is due to some technical issue, and the other one, mainly because of the political issue. Compared with political issue, technical issue is not so difficult to solve. The real challenge actually lies on the political aspect, which is strongly linked with the characteristic of public project. Frankly speaking, the political issue could be very hard to solve sometimes. For instance, the politician may purposely influence the cost estimation, besides, due to public feature of the project, the government may not treat cost estimation issue as serious as private organization.

Based on the research and our own opinion to this kind of risk in public project, we deem that the Scottish project should use the independent professional consultant to carry out the cost estimation. The functions of the consultant should be: (1) estimate the project cost independently, without the interference from the government or particular politician; (2) estimate the project cost precisely using expertise in this field.

Normally, in order to remain the reputation, the independent consultant will try to estimate the project budget as close as possible to the real cost, but still in some situation, the consultant could be influenced by government or some politician in some way. Therefore, to be secured, besides the independent consultant, there should be independent audit responsible for monitoring the whole cost estimation process.

But here again, the project didn’t choose this option because the project owner didn’t want to lose control on cost estimation issue. This is the typical public project feature. Fairly speaking, if the project owner (Scottish Parliament) doesn’t want to adopt this option, no one else actually has the right or power to force it to do, unless such kind of option is required by law.

In short conclusion, with regard to the risk reduction strategy, through our above analysis, we could find that public project don’t prefer this risk response strategy. One reason is because of potential high transaction cost, and the other is firmly related to the public feature of the project.

(4) Risk mitigation

Regarding to the risk of cost estimation, besides hiring professional consultant to carry out the precise estimation, at the same time, the project management team should set up the cost control plan to mitigate the risk. And the most important component of driving down the cost of risk for an organization is a strategically designed risk mitigation
program that proactively targets core cost drivers. Risk mitigation encompasses loss prevention, loss control, and claims management. Structured effectively, a risk mitigation program will prevent losses and reduce the cost of losses that do occur. This point is easy to be ignored because of the government’s considerable resources, for instance, in Scottish Parliament project, but we think that public project should pay attention to project cost control in order to mitigate part of the risk.

As for the risk of changing project scope, along with the following project delay, the relevant risk mitigation strategies should be used in the course of Scottish Parliament project: whenever the project scope has to be changed, then the meeting among client, project design team, project management team, and stakeholders should be hold again in order to determine the new project scope. The aim of this meeting one is to decide the new project scope as soon as possible, and the other one, which is more important, to decrease the chance that scope being changed again, which to large degree mitigates the impact of this risk to the latter performance of project.

Obviously, the Scottish Parliament project didn’t take any action to mitigate the risk of project scope change. The reason is the same as at the beginning: it exist high transaction cost, and during the course of the project, maybe even higher. Because on one hand, it may take a long time for different participants to come to an agreement, and on the other hand, during the time of waiting for new scope, the project team still need to be paid, which increase the project cost. Although this is just one example existing in Scottish Parliament project, in fact, for many other public projects, they may face the similar puzzledom when trying to adopting risk mitigation strategy. In most cases, considering the possible high transaction cost as well as the trouble that may rise, public projects prefer not to choose this strategy if they have any other risk response strategies to choose.

(5) Risk transference

In Scottish Parliament project, this risk response strategy could be adopted in two ways:

First of all, the government can transfer part of the risk to its contractor(s) by signing up proper type of contract. There are many kinds of contracts and one of the most significant differences between the various forms of contract is the way in which risks are handled and paid for, ranging from those which are price-based to those which are cost-based. (Wideman, 2002: IX - 5) (Appendix VI) In most cases, signing up a proper contract is a quite easy and good way for public project to handle risk, because the government doesn’t need to take care of risk a lot. Therefore, this strategy becomes of significance in public project.

For Scottish Parliament Project, the government could also transfer much of the risk by choosing the appropriate type of contract, such as cost-plus contract, incentive contract. However, using construction management to manage contracts did not help the government transfer the risk but remain most of the risk to itself. If we look back at the risk identification part, in point 3 we analyze the risk allocation between client and contractor by using different types of contract, then we know that under construction management, most of risk is in client side. Why did the Scottish Parliament project choose this type of contract? After our analysis, we think that’s because at the beginning,
the Scottish parliament hoped to finish the project in a relative short time, then they decided to adopt construction management, a kind of fast tracking management, in order to achieve their objective. So they didn’t consider too much about the benefit of transferring risk by signing up other types of contract, and also didn’t have enough consideration about the potential risk when choosing construction management. The decision is unadvisable, but due to political influence, project team accepted this decision.

Secondly, by insurance, the government can also transfer much of risk. The commonest form of risk transfer is arranging insurance in commercial projects, but for many public organizations, they normally do not arrange insurance cover but rely upon their considerable resources to underwrite any financial loss which may arise. So the most significant risks which are retained, and which are not capable of transfer in most circumstances, are the disruption risks arising from postponement, cancellation, or non-performance of projects which have a damaging effect upon operational activity or service delivery. (Baldry, 1998)

Although it is not so common to buy insurance in public sector projects in last few decades, the increasing project disasters attract governments’ more attention to insurance, and in fact, there is a trend in recent years to using insurance in public sector project. The functions of insurance are: (1) in order to insurance the project, the insurance company usually require certain amount of actions should be taken to reduce the project risk, which to certain extent push the government prepare the project carefully; (2) the insurance company can participate the project when there is a problem in the project, and the insurance company can help to solve it, and also in some way, it can play a role of monitoring; (3) when the project get problem, the insurance will take much of the responsibility to handle it, so the government won’t suffer so much pressure from the public as before. Because of these functions, more and more public project prefer to adopt this strategy once they realize the great benefit they could get, so actually, this risk transfer strategy become very important to the success of public project.

Now looking at the Scottish Parliament project, it was self-insurance by Scottish government. One reason is because the government has enough ability in terms of resources, and the other reason is because government may want to have control and freedom on the project, for example they don’t want to be constrained by some requirement from insurance company. However, here we deem that once they realize that the benefit they could get from the insurance, such as suffering less from the criticism of certain stakeholders, is much more than the things they will lose, such as certain amount of freedom, they would also like to adopt this kind of risk transfer strategy.

(6) Contingency provision
It should also be noted that contingency need not be seen as simply a reserve on which to draw when aspects of the project overspend, but also as something to be used to avert a risk situation materializing. (Baldry, 1998) In this case the contingency might be spent speculatively but the case for doing so will have to be well founded. And in terms of reducing the impact of risk upon operational activities, a high risk project may be compensated for in terms of contingency provision of alternative sources of service delivery or the development of alternative strategic plans to be followed according to the unfolding of events.
According to our research, during the estimating period, the Scottish Parliament project team had the contingency plan for some main risks. However, with the development of the project, this contingency plan played limited role to mitigate the risk that occurred during the project. Why? Because the progress of the project was out of the expectation a lot. For example, due to the change of project scope for several times, the budget increased accordingly, but the increasing part was much more than the contingency plan has provided. So in this case, the project cannot rely on contingency provision but have to seek for help from the government.

This is just one example that occurred during the project which shows that the contingency provision didn’t play the expected role to mitigate the risk. It’s not to say that contingency provision shouldn’t be used in public project, in fact, setting up appropriate contingency provision is a quite important strategy to help cure some diseases in the project and lead project to success. Take a simple example: the same public project has two plans on contingency provision, and the minimal estimation of two plans are both 2 units, but plan one has contingency provision of 2 units, and plan two has 4 units. In the end, the project is finished with 5 units, and the project team with plan one will get criticism because they overspend, while if the project team go with plan two, they can even get appraisal because they actually save some from contingency provision. This is just a very simple example to explain the functions of contingency provision could play in public project. We know it seems a bit tricky, but in fact, whenever possible, public project could adopt this risk response strategy, because this put the project team in a quite safe position. However, we still need to bear in mind that good contingency provision plan needs to have some prerequisite, for example, the precise estimation; otherwise, it cannot play its relevant role.

In short conclusion, after our analysis on six risk response strategies respectively, we found that public projects usually prefer to adopt risk acceptance and risk avoidance strategy; and due to the high transaction cost and some political issue, public projects are quite hard to adopt risk reduction as well as risk mitigation strategy; moreover, risk transfer strategy and proper contingency provision are critical to the success of public projects.

4.2.3 Program administration (Review & Monitor)

Having assessed the perceived risks and decided on how to handle them, it is necessary to continuously monitor all changes in circumstances that could affect the risk either by making it more or less likely to materialize or altering its effect. The popular method of doing this is through: (Webb, 2003)

- the maintenance of a risk register which shows the current status of all recorded risks
- demands for risk reporting from responsible staff
- regular meetings among project participants involved in risk issues at which the status of the risk can be discussed.

Reporting on risks is an important aspect and the demands of a formalized process should ensure the position is continuously under review and developing situations do not go unnoticed until it is too late. In this aspect, the Scottish Parliament Project didn’t do very
well, in fact, it can be considered as a big fault. The project team established risk management plan at the beginning, but after the project started, no system was set up to review and monitor the risks. As a result, the impact of some registered risks became worse, and some unexpected risk occurred and caused big trouble for the project as well.

The most obvious example is the project team’s response to the risk of changing project scope. When the Scottish government first put forward the request of changing project scope, the project team should realize that this was an emerging risk, and this risk may occur again latter and cause big problem for the project, and relevant strategy should be found to response this risk. But there was no particular staff who was responsible for reporting these issues; therefore, this risk was ignored by the project management team. In the end, the project team paid high expense for this ignorance. Due to the following changes of project scope, the project cost estimation changed many times as well, and the project was delayed for about three years. From this case, we could detect how important it is to set up the reporting system to review and monitor the risks during the course of the project.

If we investigate the reasons why Scottish Parliament project team didn’t set up effective review and monitor system, we could get the following reasons: first of all, because of high transaction cost, even if they found potential risk during the course of project, they still cannot do many things to handle it, therefore, they lost motivation to make report on project risks; secondly, due to the pubic feature, no one owns the project, so even if there are some problems, people don’t feel they have responsibility to solve it. Therefore, they didn’t pay much attention to review and monitor the risks.

Usually, what reporting demands are made will depend on the organization for risk management, the project complexity, and the general project reporting arrangements. Big and complex projects, like Scottish Parliament project, with a large number of risk issues in a variety of areas may require the identification of specific individuals with responsibility for certain risks and who will be required to report regularly. According to Webb (2003:100), reports will normally demand information against specific risks on such things as:
- actions taken in the reporting period
- changes in risk status (for better or worse)
- actions to be pursued in the next period
- newly perceived risk issues
- overall effects on the program.

As the case has shown, new risk situations can arise at any time in the course of a project. They can result from a sudden and unexpected change in fortunes. These situations lie outside the pre-planned control system but the project reporting system should be sufficiently responsive to bring whatever has occurred to the attention of those in control who need to know. In practice, when serious changes in fortune occur they are usually well perceived and notification quickly finds its way to the top of the management structure. If it does not, there is something wrong with the communication system.
5. Suggestion

Based on our analysis, the failure of risk management in megaproject may come from its public feature that makes risk management vulnerable to intervene or cost too high to implement. It doesn’t mean that we have no choice but to accept such failure. In fact, the appropriate risk transfer strategy and contingency provision may help the project manager more focus on “manage project”.

In the case study, we have noticed that the Holyrood project adopted construction management strategy, leaving the most risks to client. However, due to the reason we discussed above, the project manager failed to manage the risk effectively. It may be wiser for megaproject to entitle the risk management accountability to the contractors. In fact, once the project turned out to be highly deviated from the expectation, whether in public or private project, we can always find the scapegoat of insufficient risk plan. On the other hand, it is not possible to accurately evaluate all the uncertainties. Therefore the best way to handle the risks is to transfer them to contractors.

It is suggested so as the contract has to clarify the expected outcome, and project manager can focus on the overall project progress rather than how to operate the project in every details. Another advantage by such contracting strategy is to leave no space for the political intervene once signing the contract. It is important to notice that some of the risk management approach will generate high cost for project manager to implement by himself; therefore the risk transfer has to focus on such risks that associated with high transaction cost.

In our discussion part we have introduced different contract types and the following risks to the client. The problem is how to select the appropriate contracting strategy. The successful risk transfer requires the better understanding of the project risk, not only the possibility but also the availability and cost of alternative resource. In another word, the more specific the risk is identified, the easier the client can design the contract to transfer the risk. Therefore, risk analysis is the key step for a successful risk transfer strategy.

Surprisingly, according to Flyvbjerg (2003), most megaproject failure is related with the insufficient risk analysis. He further pointed out that the decision maker tends to overlook the dynamic feature of risk evolution, and the according risk mitigation policy is usually based on certain ideal possibility assumption. While a sound risk analysis, according to him, should also includes such information as the cost of alternative choice or the resources required for the mitigation plan.

The insufficient risk analysis popular in megaproject also reflects the fact that there is less motivation for decision maker to pursue excellence in risk management as there is no reward associated with risk management evaluation. Economists have long recognized that contract is good way to mitigate the lack of motivation under public property ownership structure. As a common practice in contract, the personal right and obligation is specified and the personal interest is directly related with project’s success. While unlike the private project that certain people or group actually owns project and share the
benefit from such project, the decision maker in megaproject more that often cannot directly benefit from the project. According to economics (Alchian, 1965), individual will feel motivated to improve public product when the self utility is closely associated with that. Based on the theory, we can suggest if the decision maker can also be awarded the contract as other contractors in the project, their risk awareness may be increased and contribute more on risk analysis.

Another method that may help to reduce or mitigate risk in megaproject is to allow contingency provision when initiating budget. In fact, whenever cost deviation appeared in the project, there are only two possible reasons: the budget control failed or the budget is not appropriate. While in our analysis, the two reasons tend to mix together in megaproject. Firstly, the politician may purposely mislead the information, for example, to accelerate the approval from relevant committee (Flyvbjerg et al., 2002), therefore the contingency provision is intentionally overlooked. Secondly, once the megaproject starts, it will generate “lock in” effect that the project owner will prefer to accept other than avoid risk due to the political concern. While an imposed contingency provision can help the authority to fully aware the risk exposure of the project and reject those high risky ones at the initial stage.

Our main suggestion is that since the externality and high transaction cost is indigenous that prevent the possibility to better define the project scope and more efficiently manage stakeholder by insiders, the appropriate contracting strategy to third parties becomes the crucial factor as it can impose the binding power on each participants and specify the desired outcome, therefore to eliminate the major deviation.
6. Conclusion

From the analysis above, we clearly touch the conflicts, disorder and unconstructive working environment demonstrated in the project. As a consequence, the capability of the project manager to manage risk was greatly impaired. We noticed that project management team was not ignorant of risk, nor incompetent to analyze risk, but simply adopt no action to mitigate risk (Fraser, 2004). The detailed examination of the project reveals that the considerable political intervene greatly impaired the project manager’s authority of decision making, and the effort engaged in risk management was conflicting with politicians’ interests and therefore were not encouraged. So it comes to our first conclusion:

1. Politics intervene is the ultimate indigenous factor that has greatly influenced the risk management process in Megaproject.

In our case study, we have found that the biggest obstacle for project manager to manage risk exactly comes from the tremendous politics intervene. However the politics intervene is not specific in our case, as we found the first reason for such intervene is the externality that provides the excuse for politics group to intervene the project; the second reason is the high transaction cost prohibits the project manager’s effort to adopt risk response strategy of mitigation and reduction.

According to our analysis, the influence is exerted mainly from the following two ways, which will be regarded as other conclusions.

2. The unclear project scope by the politics intervene in the planning process

Admittedly, cost overrun is quite significant in our case. Indeed the large figure of cost overrun has provided the solid foundation for any further sound critics. However, if we evaluate the project from the architecture perspective, the project is absolutely a distinguished one that deserves its awards. And if we take its historical meaning for Scotland into account, maybe the project would be valued more. For such a project that endowed too many implications, it may reasonably charge a high price. In reality, the political or historical meaning is long overlooked by previous economic critics. Economic appraisal is absolutely a key indicator in project evaluation; but, unfortunately, it by no means will cover all the aspects of project.

If we evaluate the project only from economic perspective, it may turn out to be a biased view. The most significant feature of megaproject is the “public product” feature that will have enormous externalities on the society or local community. For instance, the “three gorges dam” project in China has involved large social issues such as the environment protection, the immigration of original habitants, the local economic development and benefit distribution among cities. The focus on only economic return or expense, therefore, may overlook the great impact of such project on the social stability. In Holyrood project, the magnification of cost overrun has caused the public concern about the credibility or capability of the parliament dominating party. Acknowledging the
public feature and the consequent various perceptions of megaproject will not justify the cost overrun in our case, but rather provide the way to interpret the failure of risk management.

On one hand, the great externality of public project determines the project scope cannot be easily specified in project scope as some expectations may come from emotional feelings or hidden political purpose rather than rigorous reasoning. It is a common sense that there is no public product can’t please every member, and it is not possible to incorporate everyone’s expectation when design the public product. From the case, we are aware that the first minister of Scotland expected the building to present the historic and national image to the world. However, the expectation was not clearly stated in the project brief, which defined project scope. We have found that during the process, the project managers were often confused by the conflicting requirement from the various political groups, some expected the “building to be presented”, while others desired the “building that last hundred years”.

Unfortunately, the project implementation requires more detailed specification rather than conceptions. In spite of the specific risk in different projects, normally if the project expectation has not been fully translated into project scope, the project manager has to face more challenges in risk reduction and mitigation as ambiguous scope will lead to insufficient risk identification and analysis, it is likely that the risk of project delay and cost overrun may be higher than usual level. The survey of cost overrun in infrastructure megaproject has already proved that most megaprojects experienced design change that related to enormous cost increase (Flyvbjerg et al, 2003).

On the other hand, the fundamental influence of such unclear project scope is not only the failure to control the cost or complete in time, but also leaving opportunity of intervenes from project owner that the project manager had to follow. As we can see from the report, the conflicting interests of different political groups also impacted on the project such as the design of chair assembly in the hall. Under such situation, the project managers’ authority on project control was greatly impaired, and the former two project managers were forced to resign as the consequence. Contrarily, the last project manager proved to be successful in relation management while other expected roles such as cost/time control and risk management were not significantly demonstrated, but she proved to have met the requirement by work till the project completion. Clearly, the project required more “political” awareness rather than “technical” awareness. Though it remains blank in current research about politics intervene in public project, some researchers (Flyvbjerg et al, 2002) has already noticed that political figure maybe motivated to purposely mislead project information to gain politics benefits.

Our analysis further discovered that indeed there is possibility for political groups to take the advantage of unclear project scope to change the project requirement. It is not disgraceful to acknowledge the politicians may involve their own interests in decision making, but it is quite important to confine such effort in project scope definition process rather than during implementation phase, otherwise once the project started, any change related with project scope will inevitably lead to risks as cost, time or quality deviation.
More crucially, project manager may find difficult to handle their change since such intervene may bring in new round of conflict among political groups. From project management view, the project manager is expected to ensure the project implemented within the given expectation, but not to assume the responsibility to compromise various expectations. It is suggested the project manager should be provided the condition to focus on the project itself rather on politics.

In addition, if the project expectation is not fully demonstrated in project scope, it is quite possible that project evaluation may be not sufficiently comprehensive, especially considering the public nature of megaproject with various externalities. In our case, the cost overrun was over emphasized while the architecture achievement or the historic implication was ignored. Due to the unclear project scope, project manager’s responsibility was not appropriately defined to fully aware the image effect of the project. More than often project manager tends to focus on the tangible outcomes such as cost and time which will prove their competence rather than intangible achievement, while such effort was not appreciated by the architects in our case. Besides the reason of ambiguous project scope, unsuccessful stakeholder management also causes the intension among participants to reach consensus, but in megaproject such management skill may be doomed to be unsuccessful.

3. The high “transaction cost” that influences risk response strategy choice in the project implementation phase.

During our case study, we have noticed that the stakeholder coordination in project management is complex as various politics interests were involved. Every effort regarding project control was perceived the compromise of those political groups. Each of the three project managers were full aware of the situation that they must struggle to achieve consensus among different committee or supervision bodies in the Parliament (Fraser, 2004). If we accept economic rational of individual, then the optimum solution under the time constraints of the high negotiation cost to manage stakeholder is not to manage at all.

This may explain why the risk acceptance or avoidance tends to be more popular than risk reduction and mitigation, as the previous options don’t require management while the latter require tremendous effort to reach consensus among the stakeholders. And quite likely the risk reduction or mitigation process may not be appreciated by those stakeholders. As the consequence, two project managers were forced to resign and the last project manager had almost no direct contact with stakeholder such as consultant and architect at all. Without the involvement of stakeholder, the risk monitoring and controlling activity cannot be successfully implemented.

Theoretically speaking, such high cost may be indigenous to public project. It is already discovered by economists that management under private property ownership tends to be more efficient than that of public property ownership. It is explained that the individual may feel more closely involved in private ownership and therefore more motivated to contribute. On the contrary, no one can actually claim the ownership of public property;
decision makers may not share the economic benefit generated from such property, if any. At the same time, however, the decision maker has to assume the accountability if the public are not satisfied with the economic return or expense.

So the decision makers are not willing to assume risks as those under private property ownership. While in the large investment megaproject, the loss from risk also tends to more significant. Therefore, the critics for the decision makers may be even fiercer, making them less interested in accountability for risk management. While the public feature offers decision maker the opportunity to circumvent such accountability as other public agents are also involved in the decision making process. Given such situation that no one would like to take the accountability, the cost of decision making is considerably high, and the efficiency is significantly low.

Our case study just shows though various political groups were actively in the decision making process, no one actually can be claimed responsible for the final decision making. Under such circumstance, the project manager had to “direct the whole process of the project” rather than “directly manage the project” (Fraser, 2004). And due to the high cost of coordination, the efficiency of project management is considerably low and finally leads to an inevitable project delay and cost overrun. Due to the limited information, it is not clear that every megaproject has encountered the same thing and our case study just demonstrates the possibility that transaction cost may be too high to hinder the project manager’s effort to monitor and mitigate risk. And if we acknowledge such possibility, a risk allocation strategy becomes extremely important to transfer those risks that indigenous in public project.

In a summary, the great externality of megaproject involves conflicting stakeholder interests and therefore increases the difficulty to define the project scope by leaving space for stakeholder intervene. As the consequence, the project manager’s authority is impaired, and has to face high cost for risk reduction or mitigation effort. Therefore, the optimum option under such situation is not to manage, but either accept or avoid risk. Clearly, the conflicts and intervene from political stakeholders that indigenous to megaproject is the dominating reason.

Based on our analysis, it is suggested that certain unsuccessful risk management approach in public project may not result from the incompetence of project management professionals in terms of technical or methodological aspects, but from the cost of risk taking/mitigation activities, which is considerably high in a public project. The cost of managing risks mainly come from the conflicting politics interested involved in the project, which makes the decision making process inefficient and more complicated. The project manager’s authority was greatly impaired by the administrative body intervene. It turned out the most successful project manager is not the one good at implementing project but the one skilled at relation management. In other words, the high cost of risk management indigenous to megaproject hinders the effort to reduce/mitigate certain risks. While the high cost is generated from no other than the project itself.
We acknowledge that due to the limitation of time and data availability, we can only choose one case study to generalize our conclusion. Though our research has focused on the common feature of megaproject, it is suggested more research conducted in this field to verify our findings and the according conclusions.
References


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## Appendices

### Appendix I – Fundamental topics of project management (Wideman, 1998)

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
<th>Including areas</th>
</tr>
</thead>
</table>
| Client Environment           | Determines Area of project management Application; Communicates requirements as Commitment; includes Uncertainty; Has perpetual impact on Real Time; Has goals for success | • Culture, attitudes, and other limitations of the type of sponsoring organization, location and country  
• Vision, business, economics  
• Impacts and limitations of the technology or technologies vested in the project  
• Activity-specific vocabulary |
| Commitment                   | Impacts Client Environment; Responds to Uncertainty; Applies to Management Processes; Imposes constraints on Project Integration | • Project Scope Management  
• Project Quality Management  
• Project Time Management  
• Project Cost Management |
| Project Integration          | Matches Area of Application; Reports progress as Commitment; Affects Management Processes; Has management impact on Real Time; Impacts on Success | • Human Resource Management  
• Managing the work of the project  
• Communication Management  
• Information management |
| Uncertainty                  | Creates opportunity for Client Environment; Is perpetual in Real Time; Creates risk to Commitment | • Opportunity Management  
• Risk Management |
| Management Processes         | Applies to Commitment; Impacts Real Time; Uses Project Integration | • Overviewing and 'Strategizing the project  
• Procurement Management  
• Control management  
• Other techniques and tools |
| Real Time (Life Cycle)       | Imposes management sequence on Commitment; Affects Success; Has sequential impact on Project Integration; Is situational for Management Processes | • Perpetual  
• Sequential  
• Situational or cyclical |
| Success                      | Impacts on Client Environment; Provides goals for Project Integration; Is post-project in Real Time | • Factors implicit in the client's organization  
• Capturing and distinguishing between client or sponsor's needs and wants  
• Identifying measurable indicators of project success as part of the project's Concept  
• Matching management people, style and processes to product production etc. |
Appendix II - The Seven Forces Model for project success (Turner, 1999)
Appendix III – Project Risk Management Overview (PMI, 2004: 112)

11.1 Risk Identification

1. Inputs
   1. Product description
   2. Other planning outputs
   3. Historical information
2. Tools and Techniques
   1. Checklists
   2. Flowcharting
   3. Interviewing
3. Outputs
   1. Sources of risk
   2. Potential risk events
   3. Risk symptoms
   4. Inputs to other processes

11.2 Risk Quantification

1. Inputs
   1. Stakeholder risk tolerances
   2. Sources of risk
   3. Potential risk events
   4. Cost estimates
   5. Activity duration estimates
2. Tools and Techniques
   1. Expected monetary value
   2. Statistical sums
   3. Simulation
   4. Decision trees
   5. Expert judgment
3. Outputs
   1. Opportunities to pursue, threats to respond to
   2. Opportunities to ignore, threats to accept

11.3 Risk Response Development

1. Inputs
   1. Opportunities to pursue, threats to respond to
   2. Opportunities to ignore, threats to accept
2. Tools and Techniques
   1. Procurement
   2. Contingency planning
   3. Alternative strategies
   4. Insurance
3. Outputs
   1. Risk management plan
   2. Inputs to other processes
   3. Contingency plans
   4. Reserves
   5. Contractual agreements

11.4 Risk Response Control

1. Inputs
   1. Risk management plan
   2. Actual risk events
   3. Additional risk identification
2. Tools and Techniques
   1. Workarounds
   2. Additional risk response development
3. Outputs
   1. Corrective action
   2. Updates to risk management plan
## Appendix IV - Causes of Project Disaster (Nickson, 2005)

### Does the project have a defined timetable, budget and set of deliverables?

<table>
<thead>
<tr>
<th>Cause</th>
<th>Yes/ no</th>
</tr>
</thead>
<tbody>
<tr>
<td>As a starting point, have the following generic causes been considered?</td>
<td></td>
</tr>
<tr>
<td>- Inadequate Information?</td>
<td></td>
</tr>
<tr>
<td>- External events?</td>
<td></td>
</tr>
<tr>
<td>- Unclear / wrong goals?</td>
<td></td>
</tr>
<tr>
<td>- Unproven technology?</td>
<td></td>
</tr>
<tr>
<td>- Inadequate resources?</td>
<td></td>
</tr>
<tr>
<td>- Failures of communication / management?</td>
<td></td>
</tr>
</tbody>
</table>

### In more detail, answer the following:

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Would the project goals pass a SMART test?</td>
<td></td>
</tr>
<tr>
<td>Have they been effectively communicated?</td>
<td></td>
</tr>
<tr>
<td>Are the requirements clear?</td>
<td></td>
</tr>
<tr>
<td>Are they still valid - have they changed since they were recorded?</td>
<td></td>
</tr>
<tr>
<td>Do the goals and the requirements match up?</td>
<td></td>
</tr>
<tr>
<td>Have the goals and requirements been effectively communicated? Does everyone who needs to know understand them?</td>
<td></td>
</tr>
<tr>
<td>Have all assumptions been validated and have they been challenged?</td>
<td></td>
</tr>
<tr>
<td>Have the assumptions been documented?</td>
<td></td>
</tr>
<tr>
<td>Have the consequences of key assumptions being false been assessed?</td>
<td></td>
</tr>
<tr>
<td>Is the overall scope clear and well communicated?</td>
<td></td>
</tr>
<tr>
<td>Are there signs of the scope 'creeping' without related changes to plans/ resources/ timetable?</td>
<td></td>
</tr>
<tr>
<td>Have any of these things changed recently?</td>
<td></td>
</tr>
<tr>
<td>Is unproven/ cutting-edge technology an issue?</td>
<td></td>
</tr>
<tr>
<td>Are there enough resources (money, equipment, space, people, etc)?</td>
<td></td>
</tr>
<tr>
<td>Are they the right resources for the job?</td>
<td></td>
</tr>
<tr>
<td>Are channels of communication clear and understood?</td>
<td></td>
</tr>
<tr>
<td>Are communications working on a common basis?</td>
<td></td>
</tr>
<tr>
<td>Is there evidence of ‘group think’ in the team or organization?</td>
<td></td>
</tr>
<tr>
<td>Are objectives clear?</td>
<td></td>
</tr>
<tr>
<td>Is the scale of the project (too large or complex) an issue?</td>
<td></td>
</tr>
<tr>
<td>If the project is very small, does this increase dependency on individual performance unacceptably?</td>
<td></td>
</tr>
<tr>
<td>Is it an IT project? (In which case, answer all these questions again, honestly.)</td>
<td></td>
</tr>
<tr>
<td>Is the risk register and its entries realistic? (If there is not one, ask yourself why not?)</td>
<td></td>
</tr>
</tbody>
</table>

### Explanation:
If your project is in trouble, then start at the top of the list presented in table and carry on to the end; answer every question that applies to your project. Do not be tempted to stop after answering the first question; it is probably not the only relevant one. Once this is done, then expand upon/ analyze each problem item for details. If you are dealing with a disaster and don’t understand the corrective action that will be required, get help from someone who does. You may not have time to learn the relevant skills yourself, but at least you now know the area of ignorance; this is step one to resolving the problem.
Appendix V - A fuzzy reasoning risk assessment model (Zeng et al, 2007)
## Appendix VI - Risk Implication of Different Types of Contract (from Client’s perspective)
(Wideman, 2002: IX – 5)

<table>
<thead>
<tr>
<th>Type of Contract</th>
<th>Lump Sum</th>
<th>Unit Price</th>
<th>Target Cost</th>
<th>Cost Reimbursable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial objectives of client and contractor</td>
<td>Different but reasonably independent</td>
<td>Different and in potential conflict</td>
<td>Considerable harmony. Reduction of actual cost is a common objective provided cost remains within the incentive region</td>
<td>Both based on actual cost but in potential conflict</td>
</tr>
<tr>
<td>Contractor’s involvement in design</td>
<td>Excluded if competitive price based on full design and specifications</td>
<td>Usually excluded</td>
<td>Contractor encouraged to contribute ideas for reducing cost</td>
<td>Contract may be appointed for design input prior to execution</td>
</tr>
<tr>
<td>Client involvement in management if execution</td>
<td>Excluded</td>
<td>Virtually excluded</td>
<td>Possible through joint planning</td>
<td>Should be active involvement</td>
</tr>
<tr>
<td>Claims resolution</td>
<td>Very difficult, no basis for cost evaluation</td>
<td>Difficult, only limited basis for cost evaluation</td>
<td>Potentially easy, based on actual costs. Contract needs careful drafting</td>
<td>Unnecessary except for fee adjustment. Usually relatively easy</td>
</tr>
<tr>
<td>Forecast final cost at time of bid</td>
<td>Known, except for unknown claims and changes</td>
<td>Uncertain, depending on quantity variations and unknown claims and changes</td>
<td>Uncertain. Target cost usually increased by changes, but effective joint management and efficient working can reduce final cost below an original realistic budget</td>
<td>Unknown</td>
</tr>
<tr>
<td>Payment for cost of risk events</td>
<td>Depending on contract terms, undisclosed contingency, if any, in contractor’s bid. Otherwise by claim and negotiation</td>
<td>Depending on contract terms, undisclosed contingency, if any, in contractor’s bid. Otherwise by claim and negotiation</td>
<td>Payment of actual cost of dealing with risks as they occur, and target adjusted accordingly</td>
<td>Payment of actual costs</td>
</tr>
</tbody>
</table>