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How the Principle of Risk Management Can Be Applied to Different Types of Projects?

Yuanyuan Zhang
Department of Economics and Related Studies
The University of York
E-mail: Yz564@york.ac.uk

Abstract

Project risk management is a process which combines the analysis and management of the risks with a project and the principles of risk management include two key points which are risk analysis and risk control and arrangement. The case studies clarify the principles of project risk management can be used in different types of projects, and also when doing risk management it should be followed by right steps, choosing the right analysis methods, quantifying the risks precisely and formulating appropriate plan for risks control.

Keywords: Risk management, Principles of risk management, Risk analysis, Risk control, Risk arrangement

Introduction

Making the project achieve success requires many factors to be got right simultaneously. Project failure, however, may result from only one slight problem. It is obvious how important to adopt risk management principles for the whole process of project management.

Project risk management is a process which combines the analysis and management of the risks with a project. The purpose of risk management is to reduce future damage and loss, to minimize the total cost of risk and identify, control and limit the impact of the risks *(*Hamilton, 1996*)* it is a process designed to eliminate or limit the risks which threaten the achievement of project objectives. Properly undertaken it will increase the successful completion of a project for cost, time and performance objectives.

There are a lot of kinds of risks may be generated in projects. Dealing with risks in projects is therefore different from situations; even two identical projects still can produce different risks.

For this question: “Explain how the principles of risk management can be applied to different types of projects?” I will divide it into two parts as follows:

- What are the principles of risk management?
- Case studies for how the principles can be applied to three different types of projects.

1. What are the principles of risk management?

Project risk management includes two following key points:

1.1 Risk Analysis

Risk analysis comprises the following activities:

- Identification of possible risks
- Quantification of the probability of occurrence and consequences if the risks occur
- Calculating the risk and prioritizing in order of importance.

1.1.1 Identification of possible risks

These may comprise:

- Physical or material safety risks during the construction phase of the project, loss due to fire, corrosion explosion, war etc
- Consequential: loss of profits following fire, following theft etc
- Legal liabilities to the client and end-users of the project from physical failures arising from quality failures during the project

- Industrial disputes, strikes ,wage and other cost increases during the completion of the project
- Social risks: changes in public opinion, expectations of work force, grater awareness of moral issues
- Changes in the value of the final output of the project, because of the technological changes, changes in market prices, or changes in consumer preferences
- Changes of government policy or in legislation on environmental requirements, export or import regulations, tariff levels, exchange rates, tax rates etc
- Financial risks: inadequate inflation forecasts, incorrect marketing decisions, credit policies
- Loss of key project inputs such as raw materials, key personnel probability of occurrence equipment, or essential data, due to computer system failures, sickness, death or resignations amongst staff, fire or theft in own or supplier's organization or insolvency of suppliers.

1.1.2 Quantification of the probability of occurrence and consequences if the risks occur

The probability and consequences need to be identified because they decide the effects on the whole project arising from the risks. We need to know if the potential loss are serious or not and then to make the plan for next stage.

The methods for quantification of the probability and consequences include:

- Analysis of available records and data
- Detailed forecasts of weather conditions and financial conditions
- Available techniques of decision trees, sensitivity analysis, Monte Carlo simulation etc
- Subjective assessments
- Hazard indices, e.g. Explosion Index
- Monetary and utility estimates of the consequences.

1.1.3 Calculating the risk and prioritizing in order of importance

Once the risks probability and consequences have been identified, the order of priority can be set up by following formula:

Risk = Potential Loss × Probability of Occurrence (Leslie Edwards, 1995)

Table1 shows the risk ranks revealing the priority when the probability and consequences have been known.

1.2 Risk Control and Arrangement

After identifying the risks probability and consequences .It obviously that we need to devise some useful way for controlling the risks, eliminating or reducing. The controlling lever between internal and external risks can be illustrated in a risk map at figure 1 and all risks we talk about above can be deal with by following basic methods:

- Reducing risks
- Transferring risks
- Self-insurance
- Residual risks.

1.2.1 Reducing risks

Reducing the risks probability and minimizing the consequences by:

- Adding expenditure on some related equipment
- Increasing staff training and supervision
- Drawing up contingency plans once the risks occur
- Improving safety procedures and observance of Health and Safety regulations and recommendations.

1.2.2 Transferring risks

Transferring risks include insurance transfer and contractual transfer basically.

- Insurance transfer may involve various kinds of insurance, such as public liability insurance, product liability insurance, employer's liability insurance etc.
- Contractual transfer may involve transferring to contractors or sub-contractors, financial guarantees, bonds, options contracts etc.

1.2.3 Self-insurance

Self-insurance usually means some self finance methods through internal pooling of risk, internal or external fund, arranging external borrowings etc.

1.2.4 Residual risks

Risks which cannot be totally eliminated, substituted of contractually transferred to others are residual risks. (Leslie Edwards, 1995)

If the project cannot take any effective measures to influence the risk, they may choose to accept it and try to reduce its damage in other ways as much as possible.

To sum up: the principles of project risk management can be described as a whole complex process through the Figure 1 as follows:

2. Case studies for how the principles can be applied to three different types of projects

Some experienced users of project risk management always say it can be applied to any or all projects and experience does show that is true. All projects contain risk and risk management is an integral part of project or business management. As long as there is a project, there must be risks no matter what kind of it, public or private, big or small, construction or IT etc.

It is better to cite some typical examples to analysis the application of project risk management in different types of project.

2.1 China Three Gorges Dam Project (big project, public project, construction project and development project)

Three Gorges Dam is a Chinese hydroelectric river dam**,** which is also the biggest dam in the world. Think of It in terms of a project, it is a very big project, a public project, a construction project and a development project as well. We cannot easily judge "Three Gorges Dam" project is successful or not since there have been a lot of debates over the dam's costs and benefits for a long time.

The problems the objectors suspected can be considered as the risks of the project. We cannot jump to the conclusion that: Three Gorges Dam Project is a failure because some risks can be eliminated, or at least can be reduced in terms of project risk management.

2.1.1 Risk Analysis

Three Gorges Dam Project is a huge project which cost estimated 25 billion U.S. dollars.(Data Sauce: Wikipedia, Three Gorgers Dam) Therefore there are lots of risks about it ranging over a variety of aspects, including physical risks, financial risks and society risks etc.

Let's pay attention to following main risks:

- Physical risks: the earthquake and geology experts have identified that the dam is located in the influenced area where might occur earthquake at 6 magnitude at highest level. Once the earthquake take place and the dam may collapse the consequences would be even worse than if the dam had not been there
- Inputs risks: The dam wall is made of concrete and is about 2,309 meters long and 185 meters high. The wall is 115 meters wide on the bottom and 40 meters wide on top. The project used 27,200,000 cubic meters of concrete, 463,000 metric tons of steel and numerous workforces. (Data Sauce: Wikipedia, Three Gorgers Dam)If these necessary inputs cannot be in place, the time limit for the whole project would be badly affected
- Society risks: the relocation of local residents is the central part of the Three Gorges Dam Project. It is considered as important as the construction of the dam. 1,400,000 citizens have been displaced, which is about 1.5% of the total population of Hubei Province (60.3 million) and Chongqing City (31.44 million) where the reservoir is located. About 140,000 residents will be relocated out of Hubei province to eastern provinces and some central provinces, and the majority of the remaining people will be relocated within Hubei Province. (Data Sauce: Wikipedia, Three Gorgers Dam) The government needs to consider two serious problems that moving out the inhabitants and their economic reconstruction simultaneously. It will result in some very bad society effects if the two problems cannot be solved well and smoothly
- Financial risks: the dam will be entirely completed in 2009 lasting 15 years with a budget of $20 billion and the costly resettlement plan amounts up to $4 billion. (Data Sauce: Wikipedia, Three Gorgers Dam). For such a long time, the government has to consider carefully for any influencing factor on the final budget, such as inflation, changes of inputs price and some contingency. There are a lot of examples of projects were abandoned for lack of enough funds. (e.g. The financial crisis in Asia in 1997 caused a lot of projects failure).

2.1.2 Risk Control and Arrangement

Following the principles of project risk management we mentioned before, after risk analysis, we should do risk control aiming at all the risks above, eliminate them or at least reduce them.

- Physical risks control and arrangement: because the earthquake and geology experts have identified that the dam is located in the influenced area where may occur earthquake at 6 magnitude at highest level. The whole construction of dam is built at the defensive lever of magnitude of 7. Additionally, China Three Gorges Project Corporation has entrusted China Earthquake Administration to develop and set up Three Gorges Dam Project earthquake monitoring system which adopts advanced digital remote controlling technique for constructing earthquake monitoring networks. Finally, even if the dam will collapse for earthquake or other reasons, it has the ability to discharge all the water in three days, impossibly makes any grave consequence
- Input risks control and arrangement: In the past, the construction and management of a project are separated. However, the mode that China Three Gorges Project Corporation is in charge of all process of the construction, management and payment of the loan. It has avoided wasting and made a clear division. What's more, it introduces bidding and tendering, supervising, contract management system, sighed contracts with different qualified material company to make sure the fully inputs. These systems transfer the input risks to various companies through contractual
- Since 1993, the project has covered equipments, labors and the whole construction in People's Insurance Company of China for ¥15.2 billion. It also invites American Daxin insurance consultant company as the project insurance adviser to prevent contingency. It is also a very useful way for transferring risks through insurance
- Society risks control and arrangement**:** the project adopts the mode of "Developmental Immigration" which is moving out the inhabitant, in the meantime taking the infrastructure construction and industry construction. China Three Gorges Project Corporation allocates the funds to local government for the inhabitant arrangement annually and all the other provinces have been called on to support every district of three gorges
- Financial risks control and arrangement: since 1994, the profits of Gezhouba Hydroelectric Station have transferred into the Three Gorgers Project construction fund directly. Till the foundation of "China Yangtze Power Co. Ltd" in 2002, which based on the Gezhouba Power Station, it has controlled all the assets of Gezhouba Dam and Three Gorgers Dam. The corporation's IPO were issued in Shanghai Stock Exchange in 2003. Its collected money and profits became the main resource of construction fund. Besides, China Three Gorges Project Corporation has issued domestic bonds periodically to collect money
- What's more, sources for funding also include the Three Gorges Dam Construction Fund, policy loans from the China Development Bank, loans from domestic and foreign commercial banks, corporate bonds, and revenue from Three Gorges Dam before and after it are fully operational, with additional charges for electricity contributing to the Three Gorges Construction Fund. The additional charges are as follows: Every province receiving power from the Three Gorges Dam has to pay an additional charge of ¥7.00 per MWH. Provinces that will not receive power from the Three Gorges Dam have to pay an additional charge of ¥4.00 per MWH. Tibet does not have to pay any additional money
- Residual risks: It is obvious that Three Gorges Dam Project still have some residual risks that can not be totally eliminated, substituted of contractually transferred to others, such as the bad effect on ecological environment and historic interest around three gorges, a lot of people have to leave their hometown etc.
- From the process above, we know that project risk management is a very huge project by itself. From risk analysis to control, it still needs large numbers of works to do for the risk arrangement and supervision. The whole process can also be illustrated simply as follows in Figure 2.

2.2 Beijing 2008 Olympic Games Network Construction Project (IT project)

Olympic Games network construction is the prerequisite and basic condition of success of Olympic Games. As a international sports show, it will refer to massive important information .On the one hand, the network is used for guaranteeing the competition real-time information can transmit to background for data statistics in time, and on the other, it is used for the reporters from different countries can broadcast events to their countries.

Beijing 2008 Olympic Games Network Construction Project is taken by Sunny Information Technology Service, Inc. which is the subsidiary of Legend Group.

When preparing the project, they considered the main risks they would face carefully and then drew up some relevant plans.

2.2.1 Risk Analysis

- Network safety: Olympic Games Network includes five main networks: Beijing Olympic Games Organizing Committee Network, Sports Competition Network, Olympic Official Network, and Olympic Games Tickets Network. All these websites are facing various risks that may cause the whole network collapse, such as venomous interpolation

of websites, hostile attack on websites and computer viruses. Especially, the collapse of the sports competition network will lead to the competition data can not be recorded on time and then have a bad influence on the competition

- Lack of network talents: Olympic Games Networks construction is not an easy project which needs a lot of IT talents to do much high technology work for the network maintenance. Lack of professional staff still cannot make the project operate properly.

2.2.2 Risk Control and Arrangement

- Network safety risk control and arrangement: establish the model of "PDAC" for the information safety, include: Safety management center (Plan), System safety operating maintenance center (Do), safety assistant center (Action), and Safety supervision center (Check). Additionally, a network emergency response team which is made up of 30 anti-virus experts was set up, taking responsibility for the Olympic Games network safety directly
- Talents risk control and arrangement: Sunny Information Technology Service, Inc. signed contract with "Beidaqingniao" IT training center for providing professional staff. It guarantees that there will be enough qualified staff during the Olympic Games for the network supervision and maintenance
- Now, this network construction was completely certified as a very successful project and project risk management also put into fully play for the risks supervision to limit and reduce the risks occurrence possibilities in 2008 Olympic Games.

2.3 Risk management in small project (small project and private project)

Two cases above are risk management in big project, especially the Three Gorges Dam Project. The general guidance is that the bigger the project the more risks the project will have. On small projects, the risk management will probably have only a low level of application. Even though it is, the principles of risk management can still be used in small project.

A well-established general contractor won a very competitive three-year contract for extending a public sewage treatment plant. Mechanical and electrical work were subcontracted and represented about 15% and 2% respectively. Construction proceeded well until the electrical contractor suddenly went bankrupt. The cost of recovery added another 2% to the cost of the main contract, substantially eroding the general contractor's profit margin.

2.3.1 Risk analysis

Investigation of the bankruptcy revealed that both the electrical and mechanical subcontractors were involved in another large contract that had apparently gone sour. This gave rise to a significant probability that the mechanical contractor might also find itself in trouble, although there was no indication of that at the time. f use the formula: Risk = Potential Loss × Probability of Occurrence, the result reveal that the risk would be very dangerous.

2.3.2 Risk control and arrangement

The response plan consisted of making the necessary union arrangements to enable the main contractor to protect all materials and equipment on site that would be otherwise sequestered by the bankruptcy receiver. The main contractor also made plans to take over the work instantly should the mechanical contractor collapse.

About a year later, the mechanical contractor went under. The early warning paid off, work crews were immediately transferred to the main contractor's payroll, and work continued with less than an hour's interruption.

3. Conclusion

From the three cases above, we can conclude that the principles of project risk management can be used in different types of projects, big project, small project, construction project, IT project, public project, private project and development project etc. The general guidance is that when doing risk management it should be followed by right steps, choosing the right analysis methods, quantifying the risks precisely and formulating appropriate plan for risks control.

The last thing should be mentioned is even the principles of project risk management can be used on any type of project, but it is more beneficial for some projects than others. Some examples of projects which would benefit more from Project Risk Management are: (John Perry and Peter Simon)

- innovative, new technology projects
- projects requiring large capital outlay or investment
- fast-track projects
- projects which interrupt crucial revenue streams
- unusual agreements (legal, insurance or contractual)
- projects with sensitive issues (environment/ relocation)

- projects with stringent requirements (regulatory/safety)
- projects with important
- Political/economic/ financial parameters.

Therefore, the principles of project risk management can be applied to every type of project, the only problem is just some projects may benefit more from it and some are less.

References

CSD Major Groups. (1996). [Online] Available: http://www.un.org/esa/sustdev/mgroups/casestudgermany.htm (3 May)

CSDN News. (2007). [Online] Available: http://news.csdn.net/n/20070418/102977.html (18 April)

Dale F. Cooper and C. B. Chapman, *Risk Analysis for Large Projects*. (2nd ed.)

John Perry and Peter Simon. The Association for Project Management. [Online] Available: http://www.eurolog.co.uk/apmrisksig/publications/minipram.pdf

Leslie Edwards. (1995). *Practical risk management in the construction industry.* (1st ed.).London

Preston G. Smith and Guy M. Merritt. (2002).Dealing with project risks successfully. *Product Development Best Practices Report.* October.

Professor David Mayston. (2008). *Project management*. (Lecture 6). The University of York.

Robert Tusler. (1996). *Project Risk Management Principles*. [Online] Available: http://www.netcomuk.co.uk/~rtusler/project/principl.html

Wilipedia. *Three Gorgers Dam*. [Online] Available: http://en.wikipedia.org/wiki/Three_Gorges_Dam

Table 1. Use of the risk formula to determine hazard priority

Hazard no.	Loss potential	Probability	Risk	Ranking
1	£1m	1 in 100	£10 000	3
2	£0.5m	1 in 20	£25 000	1
3	£1.5m	1 in 200	£7500	4
4	£0.20m	1 in 10	£20 000	2

Source: Practical risk management in the construction industry, Leslie Edwards.

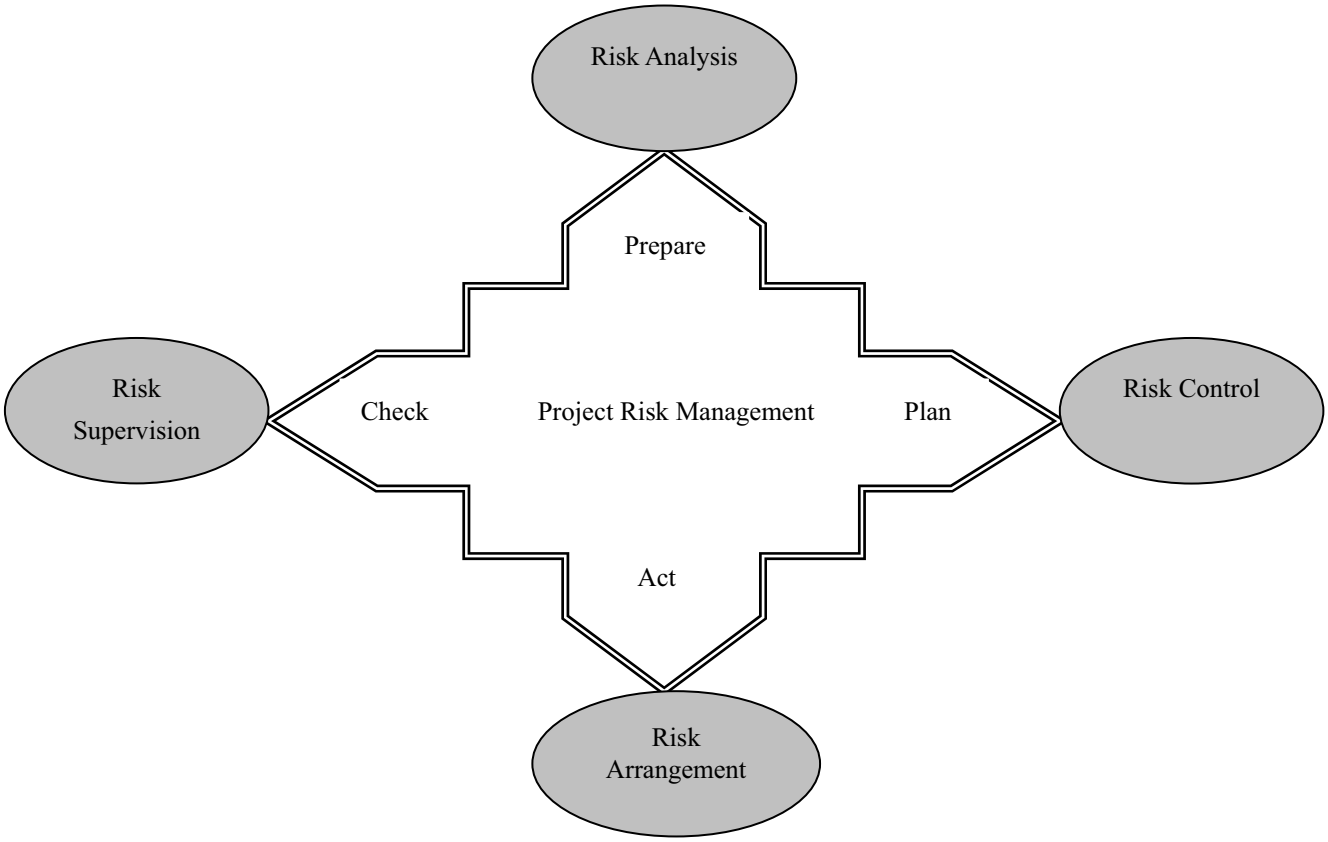

Figure 1. Project risk management process

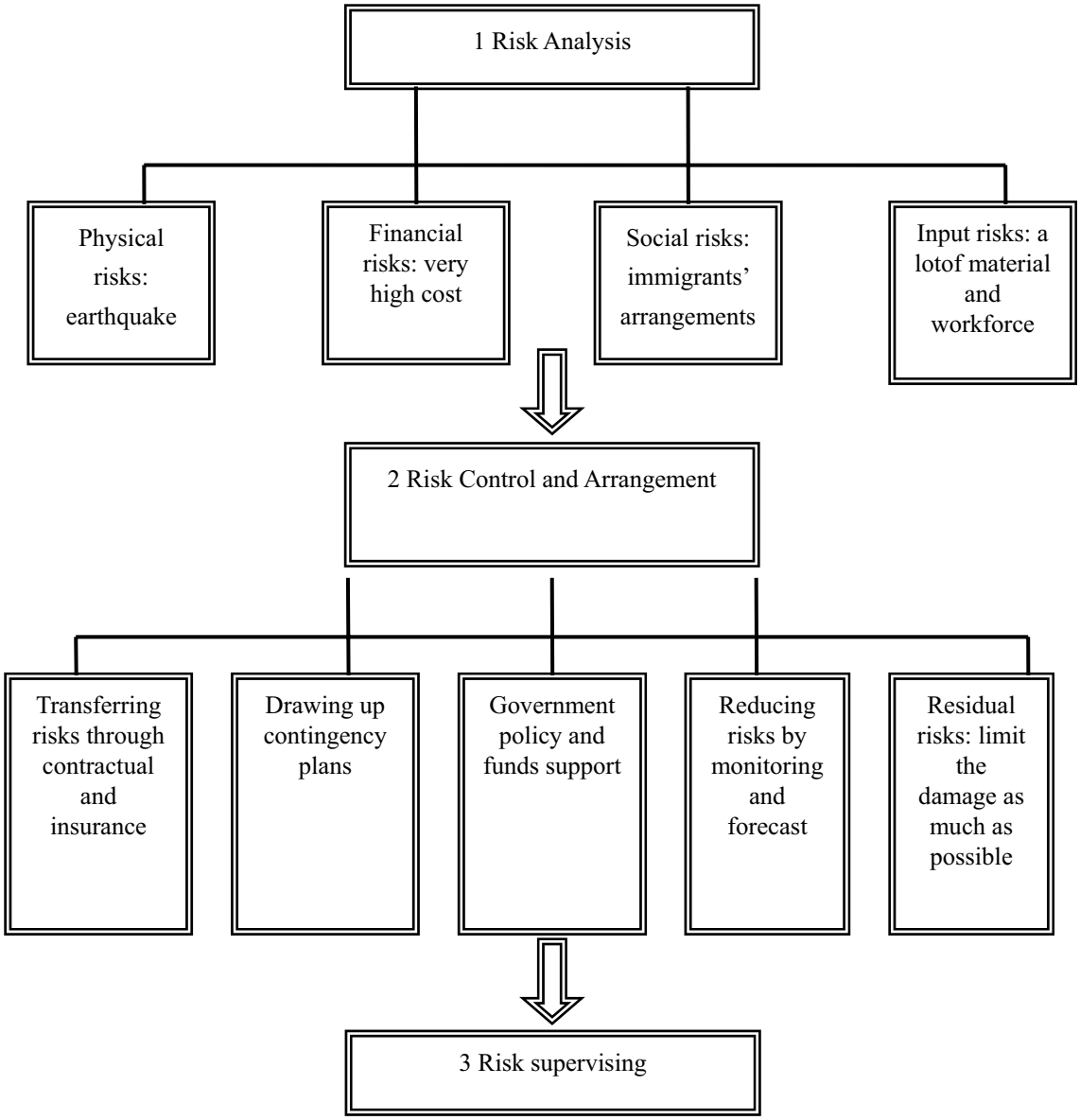

Figure 2. Three Gorges Dam Project risk management process chart