

The Research on the behavioral risk conduction mechanism of principal participants in Water Conservancy Project

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Abstract. Our country is in the key period of modernization construction. In 2011, the Central issued Documents 1, which furthered the strategic status of Water conservancy project. Then, the water conservancy project construction entered a rapid growth stage. However, in recent years, many consecutive dam safety accidents occurred in our country. The water conservancy project is a complex system engineering which involves multiple principal participants. The behaviors of them have great impact on the construction project, and the misconduct of principal participants has become the main reason for the failure of the water conservancy project. Firstly, this paper analyzes the general regulation of the risk conduction mechanism in water conservancy project. Secondly, discusses the behavioral risk conduction mechanism of principal participants in water conservancy project, especially it researches on the behavioral risk conduction mechanism of principal participants in the whole life-cycle of water conservancy project. Finally, analyzes the case of the dam collapsed in Quting reservoir. This research contributes to helping the project manager realize the nature of the participants' behavioral risk, and keep the subject behavioral risks away from the risk blocking side.

Keywords: Water conservancy project; Behavioral risk of principal participant; Risk conduction mechanism.

1. Introduction

However, in recent years, many consecutive dam safety accidents occurred in our country. Many of these accidents caused by poorly managed and violation of water storage. Water conservancy project subject involves owners, survey and design units, contractors, supervision units, the relevant government departments etc. It is the most dynamic element in the project. It runs through the whole life-cycle of the project. Any behavior of principal participant will have a significant impact on the project. At the same time, the principal participant is a benefit body, they must be driven by profit, and then from their own point of view to seek maximum benefits. Resulting in adverse selection and moral hazard [1-2]. With a special "Chinese situation": collective decision-making is no corresponding punishment, collective crime not to pursue personal, low cost of crime, a small punishment. In the background of high speed development of social economy, Value distorted, reckless to maximize the benefits in the choice of benefit and cost problems. Eventually led to the occurrence of water conservancy accidents. Subject behavior has become a major factor in the failure of water conservancy projects, behavioral problems occupy an increasingly important position in project management, and behavioral problems have become the focus of project management research. The core of project risk management is the management of the participants' behavior. Research and reduce the behavioral risk of principal participant is conducive to the construction of a harmonious project management,

Foreign scholars studied the behavioral risk of principal participant in the first place. American scientist Heinrich (1959) developed his famous domino theory of accident causation (domino accident theory) during research on the risk of subject behaviors, that is the basic factors of the accident is due to unsafe behavior of people implied that management should be responsible for the accident [3]. The findings of the study on the causes of project failure which was conducted by Cleland (2002) shows that there are 9 belong to the subject improper behavior among the 19 reasons in his summary [4]. Au and Chan (2005, 2007) found that the subject risk behavior patterns and their

attitudes are highly correlated [5-6]. Verma et al (2005) proposed a dynamic project management thinking based on the principal-agent model [7]. Muller et al (2005) analyzed the type of contract and agency relationships, as well as their impact on the communication between the project manager and the project owner's [8]. Another scholar analyzes the behavior of mutual interest in the allocation of risk relative to the target when the conflict through the framework of the game [9]. In our country, the behavioral risk of principal participant are also beginning to attract some attention of scholars. Yang Baojun (2003) put forward the concept of risk of project subjects behavior for the first time, analyzed the importance of it [10]. Pengcheng Xiang (2007, 2012) analyzed the project risk of subject behavior, established risk evaluation index system and comprehensive evaluation model, and studied the risk conduction mechanism among the project subject behavior through introducing the theory of asymmetric information engineering to project risk management research [11-12].

Although the behavioral risk of principal participant caused wide attention of scholars at home and abroad, it is still in the initial stage compared with the traditional risk research project. But also a lack of research on the behavioral risk of principal participant of specific projects, the behavioral risk conduction mechanism of principal participants has not been studied. Therefore, the study on the mechanism and movement rules of water conservancy projects between the behavioral risk of principal participant risk factors, and the behavioral risk conduction mechanism of principal participants in the whole life-cycle of water conservancy project is not only of theoretical significance, but also has important practical value.

2. Risk Conduction Mechanism

As shown in Figure 1, the risk cannot be spread under vacuum condition, sources of risk need to spread the risk to the risk recipient through risk conduction carriers. In vivo of risk communication, risk conduction carrier itself also has change, it can not only enlarge risk and can reduce the risk. Conduction carrier still exist many nodes close contact with the outside world, risk will be released or gathered here, risk release is the internal risk release or transfer to external. No release risk continue to accumulate in the internal, risk aggregation is the external risk into the internal system, it will eventually spread to the risk of the recipient [13]. When the risk is beyond the tolerance range of the recipient, the risk event occurs. Risk can also conduct through its recipient further to the other acceptor, resulting in a wider range of risks.

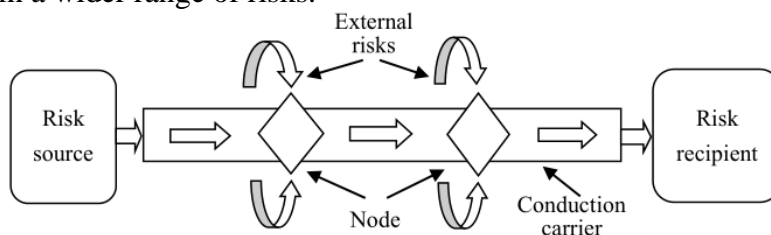


Fig 1. Risk Conduction Mechanism

3. The behavioral risk conduction mechanism of principal participants in Water Conservancy Project

3.1 The definition of the behavioral risk of principal participants in Water Conservancy Project

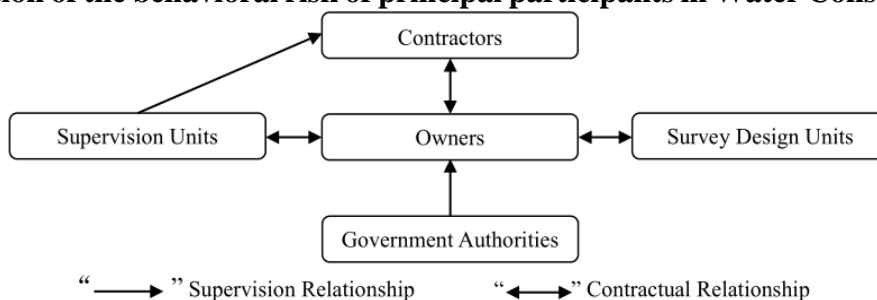


Fig 2. The Relationship of principal participants in Water Conservancy Project

Water conservancy project subject involves owners, survey and design units, contractors, supervision units and the relevant government departments. The behavioral risk of principal participants in Water Conservancy Project refers to the possibility that causes losses to the water conservancy project by principal participants involved in these projects [14]. The relationship between principal participants of water conservancy project in whole life-cycle as shown in figure 2.

3.2 The law of the behavioral risk conduction mechanism of principal participants in Water Conservancy Project

Risk source, Conduction carrier, Transmission node, Risk recipient are four important factors of risk conduction. On the behavioral risk conduction of principal participants in water conservancy project, the risk sources are the improper act that principal participants in water conservancy project want to protect their own benefit but harm the interests of other parties. Conduction carrier is among the relationship of interests involved in the parties, the related technology of water conservancy project, funds and related information. Conduction node are as follows: water conservancy project investment decision, survey and design selection, delivery the design results, bidding, the signing of the contract, material acceptance, project payment, the completion of acceptance etc. The internal and external risk accumulation release at a node until the risk event occurs. Risk event may cause quality safety accident, produce economic loss, delay the construction period.

The law of the behavioral risk conduction mechanism of principal participants in water conservancy project are as follows: The improper behavior of water conservancy engineering project subjects make each construction stage of whole life cycle in the project as conduction path, with interests, technology, capital and information as transmission carrier. Gathered at each node conduction, risk constantly enlarged in the transmission process, ultimately resulting in risk events, produce the safety accident [15].

3.3 The analysis of the behavioral risk conduction mechanism of principal participants in Water Conservancy Project of whole life cycle

The classification of the behavioral risk of principal participants in Water Conservancy Project.

(1) Behavioral risk factors of owners

Poll organization and management ability, Change the goal of the project or program, Breach of contract and refused to compensate the owners, Not provide the equipment and materials timely, Erroneous instruction or interference, The construction time is tight, Drag pay for projects, Plan is not sufficient.

(2) Behavioral risk factors of contractors

Lack of management capacity, technological backwardness, under the guise of qualifications, vicious competition, revises construction unauthorized, building construction errors, down quotes, shoddy work, programs or plans error, contract risk, liability risk, less goodwill.

(3) Behavioral risk factors of Supervisions

Poor management and organizational skills, Poor sense of responsibility and ethics, sense of service is poor, instruction error, cannot perform their duties properly.

(4) Behavioral risk factors of survey and design side

Parameter prediction of cost schedule, design changes, site investigation is not sufficient.

(5) Behavioral risk factors of governments

Irrational decisions, Policy enforcement is not strict, Rulemaking imperfect, Unreasonable charge of standards, Unreasonable adjustment of charges.

Analysis of risk conduction. There are many behavior risk factors of principal participants in water conservancy project in whole life cycle that caused safety accident. The following analysis focuses on larger effects of risk behavior of principal participants.

Risk factors of 1 refers to the government decision-making is unreasonable. By the temptation of economic interests and political, some government departments tend to maximize the interest in the choice of benefits and costs. At the present stage of our country, the collective decision not in individual accountability, the cost of crime is not enough, coupled with the lack of ethics, decision failure phenomenon meet the eye everywhere. Risk factors of 2: In the context of the construction of water conservancy, due to a short period of time in order to build a project, and the lack of technology,

lack of investigation and design time, led to many construction enterprises under the guise of the qualification to participate in bidding. It further led to the vicious competition, lower price, Jerry building, management of adverse situation. Risk factors of 3 refers to the risk because of inadequate planning of project in the whole life cycle by owners. Risk factors of 4 reflects the difference of technical management level by owners or mistake decision by higher levels of government. Risk factors of 5 refers to the owners rush deadlines as driven by the temptation of interest or higher-level government. Risk factors of 6 refers to the lack of responsibility and moral consciousness of supervision in project construction, even if the risks continue to enlarge. Risk factors of 7 refers to such a special Chinese situations, leading to lack of reconnaissance and design time. The behavioral risk conduction of principal participants in Water Conservancy Project as shown in figure 3.

Table 1. Lager factors on behavioral risk of principal participants in Water Conservancy Project of whole life cycle

Principal participants	The factor of the behavioral risk of principal participants	Number of risk factors
Government departments	Unreasonable decision	1
Contractors	Backward technology, Under the guise of qualification, Vicious competition, Quotations down	2
Owners	Inadequate planning	3
	The wrong instruction or interference	4
Supervisions	The construction time is tight	5
Survey and design side	Poor sense of responsibility and ethics	6
	Lack of survey and design time	7

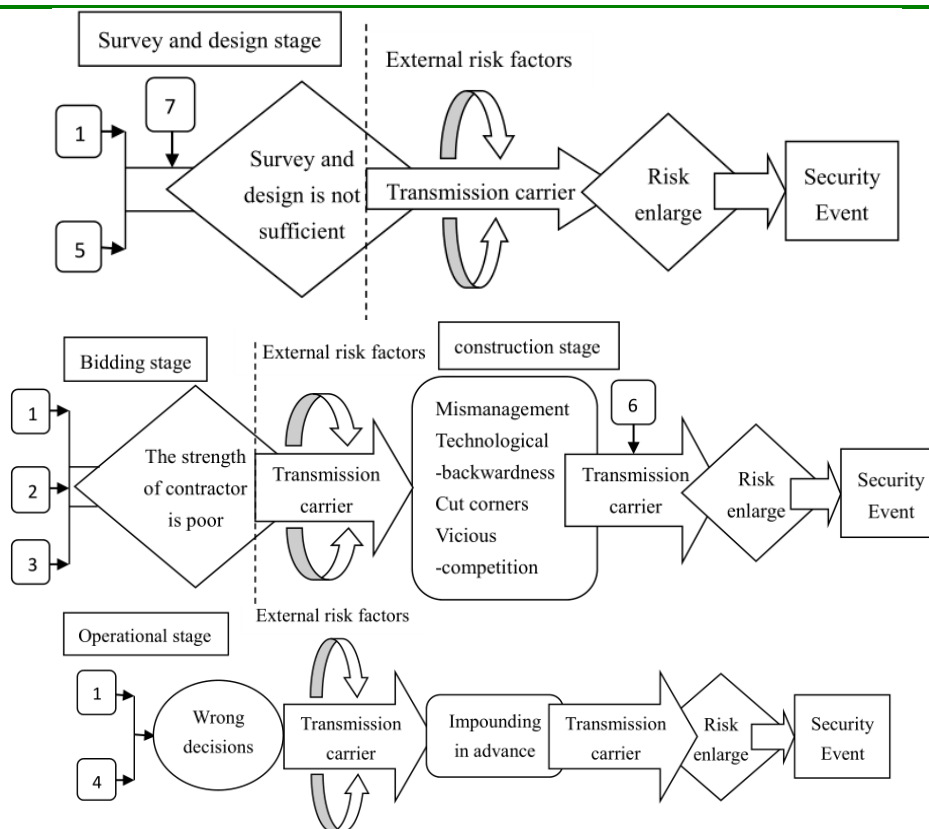


Fig 3. The analysis of the behavioral risk conduction mechanism of principal participants in Water Conservancy Project of whole life cycle

4. Case Study

4.1 General Accident

Quting reservoir collapse was a major safety accident occurs after the Spring Festival of 2013. Quting reservoir in Hongdong County of Shanxi Province Losing irrigation water tunnel ceiling collapsed in February 15, 2013, leading to downstream dam appears piping, full storage reservoir 19000000 cubic meters of nearly dried up, the dam collapse length nearly 300 meters [16].

4.2 Cause Analysis

From the investigation and handling of the accident situation, this is the responsibility of the accident. The accident was due to the project participants driven by interests and making improper behavior in the reservoir operation stage. The dam collapsed in Quting reservoir due to the improper subject behavior.

Safe operation of reservoir mismanagement. Management personnel in Hongdong Country water conservancy management quality is low, Safe operation of reservoir mismanagement, lax supervision, Security risks exist for a long time in the library especially for the superior department inspection, supervise the handling of questions not cause height to take seriously, not seriously rectification. The reservoir operation has been more than design period, appeared serious aging.

Reservoir reinforcement project department fails to reply the design of reinforcement. Reservoir management driven by interests, poor management, they choose the poor strength of the contractor, resulting in reinforcement project department is not in accordance with the approved design of reinforcement. For the reservoir safety accident of buried seeds.

Reinforcement project management confusion. Quting reservoir reinforcement project management confusion from top to down, ineffective management of water management departments. The reinforcement of the contractor management ability is poor, low quality, profit driven not by design to construct. Supervision departments lack of resumption, are not required on a regular basis reinforcement work inspection, they do not effectively stop the behavior that the reinforcement projects not on the approved design to construct, also indulge its continued construction, resulting in the occurrence of safety accidents.

Reservoir operation management unit fails to find abnormal. Because of the negligence of management unit of reservoir operation, after the reservoir water level appears anomaly decrease, management unit of reservoir operation was not found in time, take targeted measures, lost the favorable opportunity to rescue protection dam.

Based on the above analysis, the main sources of risk of collapse accident of Quting reservoir are as follows: The reservoir operation management ability, choose the poor strength of the contractor. Reservoir reinforcement project department fails to reply the design of reinforcement. Reservoir operation management unit fails to find abnormal. Reinforcement project management confusion, include poor supervision duties. Conduction carrier mainly include information, technology, capital, etc. Quting reservoir dam break accident risk transfer director mechanism as shown in figure 4.

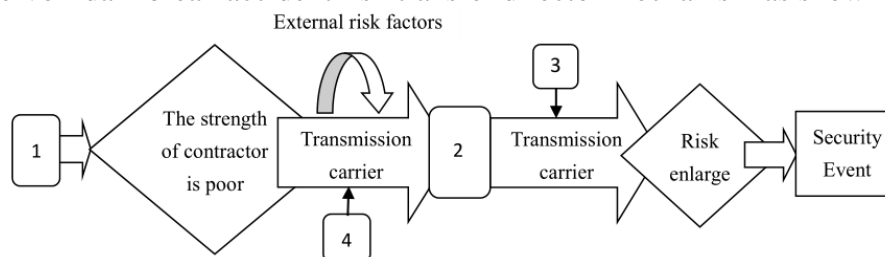


Fig.4 QuTing reservoir evolution of risk conduction mechanism

The risk of subject behavior is dubious and it's hard to manage. Behavior risk is always greater than technical risk [17]. Therefore, increase penalties, raise the cost of crime for engineering ethics education, improve subject participants' consciousness of ethics and moral judgment ability, and strengthen the professional ethical responsibility of engineers is an effective way to solve this problem. Hence it is necessary to draw lessons from the way of registered engineer examinations in United States and add content to the relevant qualification examinations. Meanwhile, it's also necessary to strengthen engineering ethics education for students who are major in engineering, and improve their ethical consciousness and judgment abilities.

Acknowledgements

In the dual background that the government makes every effort to build water conservancy projects and the situation is full of "Chinese characteristics". It is imperative to further strengthen the water conservancy project management. The roots of arising risks of water conservancy project are the improper behaviors of the subject. It's mainly related to surveyors and designers, owners, contractors, supervisors, operators and managers throughout the project. In the transfer process, the subject behavioral risk continues to enlarge, and leads to safety accidents in the end. The study of behavioral risk conduction mechanism of principal participants in Water Conservancy Project helps prevent the occurrence of the subject behavioral risk from the perspective of the risk blocking.

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