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Risk Management of Transportation Projects of Tien Giang Province In Climate Change Conditions

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ABSTRACT

The investment in construction management of road works in particular and traffic works in general is difficult and complicated in addition to the usual specification factors such as construction works, construction process, mining operation, etc. Waterfall, also greatly affected by natural disasters and climate change. On the other hand, the characteristics of road construction works are usually constructed for a long time, influenced by nature, construction conditions, quality of materials, construction people, technology and methods of construction organization. ... That does not avoid the risks of insecurity or deterioration in quality, ... in all stages of the investment process that managers need to predict, identify possible risks. out for the appropriate prevention and management solutions. The article focuses on methods of managing road construction risks to improve investment efficiency in Tien Giang province in the context of climate change.

Keywords : Climate Change, Risk Management, Roads, Construction Projects.

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I. INTRODUCTION

Climate change is the change of the current and future atmospheric, hydrological, biosphere, and lithosphere system due to natural and man-made causes. The main causes of the earth's climate change are increased activities that generate greenhouse gas emissions, overexploitation of sinks and reservoirs of greenhouse gases such as biomass, forests, other terrestrial, coastal and marine ecosystems.

In Vietnam, according to a study by the Research Institute of Hydrometeorology, within 50 years, the average temperature has increased by 0.70C and the sea level at Hon Dau hydrological station has risen about 20cm. Climate change makes sea level rise, and droughts and floods occur with increasing frequency. Along with sea level rise, climate change is also a source of storms causing droughts, with rivers depleting alluvium that is the agent bringing saltwater from the sea to penetrate deeply into the mainland.

Evaluate the impact of sea level rise, on agriculture, and sea level rise affects the growth, yield of crops, planting season, and threatens to shrink agricultural land. For fisheries, sea level rise, causing changes in water quantity and quality, especially in estuarine and coastal production areas. In forestry, sea level rise will reduce the area of mangroves, adversely affect planted forests on acid-contaminated soil, and increase the temperature and degree of drought also increase the risk of forest fires, developing pests disease, etc.

For irrigation systems, sea level rise will affect the system of canals, of which mainly inland canals, canals of grades I and II.

For the transport system, the road system will be inundated, especially when there are storms and high tide, this number increases significantly, especially riverside roads, which are very prone to landslides. For houses, residents, sea level rise will affect households in different degrees.

After efforts to promote investment, up to now, the road system in Tien Giang province has been relatively complete with nearly 7,000 km and distributed evenly and reasonably with the North-South vertical axis and the East-West horizontal axis. . In recent years, many important traffic routes in the province have been completed and put into use, especially the city expressways. Ho Chi Minh City - Trung Luong, National Road 1, National Road 50, National Road 60. Provincial roads have been built, upgraded and expanded, completed 430 out of 432 km of asphalt, district roads are asphalted, and More than 70% of the total, rural roads are invested in association with new rural construction over 60%, so far in the province, the number of communes basically met the traffic criteria for building a new countryside. 15/144 communes reached 15.27%... According to statistics, the transport infrastructure in the province in the past 5 years has been invested more than 10 thousand billion VND, contributing to the effective promotion of natural geographical advantages, promote trade development to become an important "lever" in the province's socio-economic development.

However, due to the impact of climate change, it has affected the design, construction and operation of roads in the province, causing economic damage, living, transportation of people and transportation. agricultural product transfer, etc.

This paper focuses on road construction risk management approaches in Tien Giang province in the face of increasing climate change.

II. THEORETICAL BASIS

A. Overview of road project risk management

Damage to road works is a matter of great concern of construction designers and operators. The problem is how to minimize the damage, ensure the permissible level, safety in traffic, do not have a great impact on the operation of the project as well as how to prevent the damage caused by the Lack of understanding and inadequacies in design, construction as well as maintenance and operation when exploiting traffic works, because it is impossible to completely prevent damage to traffic works.

The concept of risk management: Risk in road works is understood as an unexpected event or situation that, when it happens, can lead to the possibility of not meeting the set objectives. The cross-cutting goal in all projects is the project's effectiveness, including financial performance and socio-economic efficiency.

Traffic road project risk management is carried out throughout the project implementation from project preparation to project implementation and finally operational operations.

B. Traffic risk management

RTS risk management is the process of identifying, analyzing risks, planning responses and making necessary decisions to systematically and effectively control project risks.

It can be generalized that there are 5 stages in the risk management process:

• Inception phase.
• Determination stage.
• Analysis phase.
• Reaction phase.
• Stage management.

The risk management process should consider implementing the following processes:

• Research to identify features (regions, river systems, coastlines), domestic and foreign standards/ regulations.

• Collect data on climate change (high temperature, sea level rise, salinity level, frequency of rain and flood, etc.) that can adversely affect transport works.

• Quantitative risk assessment of technical factors that can affect the quality of the project. Compile monographs on risk analysis of technical means. Apply a safety risk management system to technical facilities. Applying to the compilation of Technical Regulations based on risk analysis; improve the knowledge of the management team and project participants.

III. METHOD OF ROAD PROJECT RISK MANAGEMENT

The risk management process is a comprehensive system that includes all the work required for risk management to be ordered, interrelated and repetitive and repetitive in process.

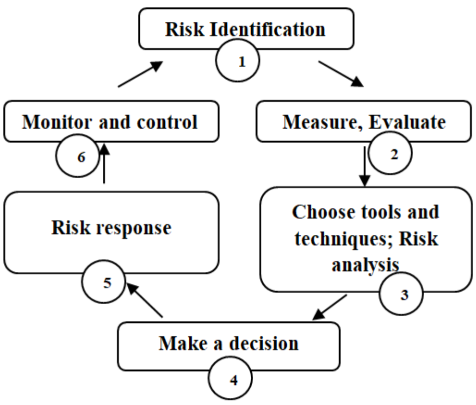

Figure 1. Risk management process

Source: [5]

A. Identifying road project risks

Risk identification is the process of reviewing the environment inside and outside the project to look for possible incidents.

The purpose of risk identification is to define a detailed list of risks that the project is likely to encounter throughout the life of the project. For traffic road works, it is possible to use the integrated method to identify risks according to each management level derived from the causes of risks.

B. Risk measurement

1) Risk measure

Risk is assessed on the basis of the following basic standards:

Expected Value (EV):

When analyzing a project, usually two extremes occur:

• Or overly optimistic: Only positive results happen.

• Or too pessimistic: There are only but bad things happen.

There are two extremes above are not objective. To be able to evaluate objectively, people use "expected value - EV"

Fomula:

$$E(NPV) = \sum_{j=1}^{m} p_j . NPV_j$$

In which: E (NPV) The expectation of the NPV (E (NPV) of the project is as large as possible); m - Number of events (status); P_j - Probability of event j (P_j = 0,1); NPV_j - Net present value of the event j.

Standard deviation: The standard deviation determines the degree of variation around the project average. The larger the standard deviation, the greater the risk.

Fomula:

$$\sigma(NPV) = \sqrt{\sum_{j=1}^{m} p_j [NPV_j - E(NPV)]^2}$$

In which: σ (NPV) The standard deviation of NPV The larger the standard deviation (NPV), the greater the dispersion of information, the higher the project risk.

Coefficient of variation: Coefficient of variation is the ratio between the standard deviation and the expected NPV of the project; represents the level of risk per unit of expectation.

Fomula:

$$COV = \sigma(NPV)/E(NPV)$$

In which:

COV - Coefficient of variation

E (NPV) - NPV expectation

2) Risk measurement method

• The collective expert approach: This is the most common method of determining risk. The goal is to build a list of possible risks, as the basis for qualitative analysis and risk quantification.

• The Delphi method: This is the way to get the consensus of project risk experts through a secret ballot process. The project team often uses questions about project risks to consult experts. It can be summarized through the schema as follows:

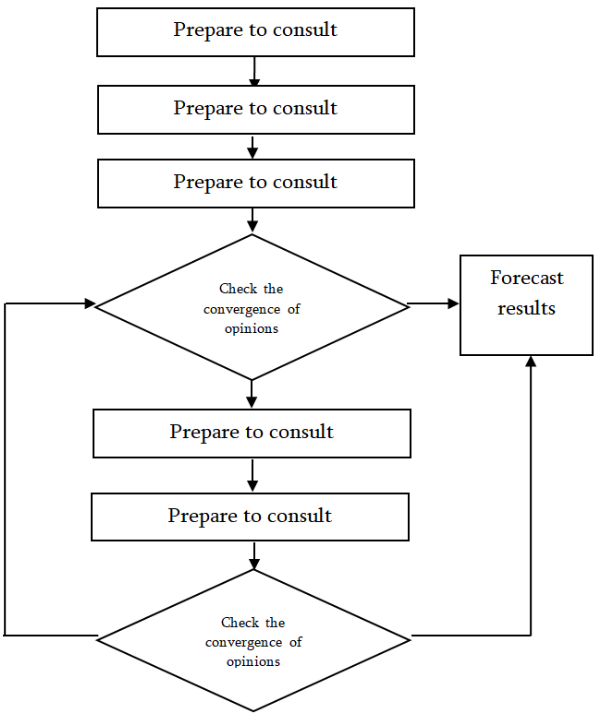

Figure 2. Schema of applying Delphi method

C. Analysis of risk assessment

Risk assessment analysis is the foreseen, consideration of the likelihood of occurrence of risk and its impact level in different good and bad situations, which helps in the decision-making process.

Risk analysis methods in the form of presentation include two groups of methods: qualitative analysis and quantitative analysis.

• Qualitative risk analysis

Qualitative risk analysis is the process of assessing the effects and likelihood of risk identified in the previous step. The qualitative analysis allows to rank the probability and the likelihood of a risk's potential rating.

Bases for qualitative analysis:

- Risk identification: Risks identified in step 2 are assessed for their occurrence and potential impact on the project. (Delphi schema can be used).

- Project status: The uncertainty of risk often depends on the implementation of the project over its life cycle.

- Project type: Conventional projects or recurring projects tend to more easily and more accurately identify probability of occurrence and extent of impacts.

- The accuracy of the data describing the scope of risk identification, including the size of the data series available, as well as the confidence level of the data to define the risk.

Qualitative risk analysis tools and techniques:

Step 1: Determine the frequency of the risk

The frequency of risk exposure is the likelihood that that risk is likely to occur. The frequency of risk exposure can be qualitatively described as very low, low, normal, normal, very high, high.

Step 2: Determine the level of risk impact The degree of impact of risk is the outcome that changes the project's goal when a risk occurs. The degree of risk impact can also be qualitatively described as very high, high, normal, low and very low.

Step 3: Develop a matrix to evaluate frequency of occurrence and impact level of risks.

The matrix is constructed to identify the levels of risk (low, normal, and high) on the basis of a combination of frequency and potential impact. Risks with a frequency of occurrence and severity of impact often require in-depth studies (including quantitative analysis and integrated risk management). Qualitative risk analysis is completed using a matrix and scale to assess the impact level of risks.

Qualitative risk analysis requires knowledge and experience of the risk, and requires complete and reliable data. Risks are not properly understood or due to the use of inaccurate data that can lead to ineffective qualitative analysis. Ranking the orders correctly will help the analysis to be more effective.

TABLE I. MATRIX OF EVALUATION OF FREQUENCY OF OCCURRENCE AND IMPACT LEVEL OF RISKS

Frequency	Impact level				
	Very low	Low	Normal	High	Very high
Very low					
Low					
Normal					
High					
Very high					

Symbol	Risk level
	Low risk
	Normal risk
	High risk

* Results of the qualitative risk analysis process:

- Overall risk rating for each project: Ranking the project's position in terms of risk when compared to other projects by calculating the score of risk. List of risks in order of priority: Risks and conditions can be ranked in order by a number of criteria. These include ratings (high, medium, and low) or in order of structure analysis. Risks can impact in varying degrees on the cost, duration and quality of a project. Significant risk should be described on the basis of frequency of occurrence and its impact.

- Risk portfolio that requires special analysis and management: Risks with high or moderate impact are risks that should be analyzed further, including quantitative risk analysis and a risk management plan. risks to this type of risk.

Quantitative Risk Analysis: Quantitative risk analysis tools are used to help administrators draw a clear picture of the risk they are considering. Each risk analysis tool is well positioned, managers can use each method under specific circumstances. Below are some commonly used quantitative risk analysis methods.

* Scoring Method: Using a scoring method to rank risks. The scale is optional, but usually we choose a 10 or 5 scale.

Risk Score = Score of frequency of occurrence * Level of impact.

TABLE II. QUANTITATIVE RISK MATRIX

5						Risk A: Impact level = 3 Occurrence = 5 Risk score = 3x5 = 15 Risk B: Impact level = 4 Occurrence frequency = 3 Risk score = 4x3 = 12 Risk C: Impact level = 2 Occurrence = 4 Risk score = 4 x 2 = 8
4			(B)12			
3					(A)15	
2				(C)8		
1						
Level / Frequency	1	2	3	4	5	

Occurrence Frequency: The scale of the frequency of risk occurring is usually between 0.0 (not happening) to 1.0 (likely happening). Evaluating the frequency of risk occurrence can be difficult due to the lack of actual data, in addition we can use a similar scale, representing the rare, the probability of it happening.

TABLE III. EVALUATION OF FREQUENCY OF RISK OCCURRENCE

Evaluation	Order scale	Quantitative scale (%)
1	The frequency of risks is very low	1 - 19
2	The frequency of risks is low	20 - 39
3	The frequency of risks is medium	40 - 59
4	The frequency of risks is high	60 - 79
5	The frequency of risks is very high	80 - 99

Impact level: This is a quantitative scale that determines the specific value for those impacts. The quantity scale is intended to determine the relative price of the target's ability to impact if a risk arises.

Results of quantitative risk analysis:

• The list of quantified risks includes risks that have both negative and positive impacts on the project.

• Frequency of project execution on time and on budget: Frequency of project execution on time and on budget in current plan and under current conditions. In the quantitative research methods mentioned above, in this thesis, the author only uses a number of methods suitable for researching risks in investing in the construction of roads by method. scoring and frequency method.

TABLE IV. ASSESSMENT OF THE RISK IMPACT ON THE MAIN OBJECTIVES OF THE PROJECT

Level impact		1	2	3	4	5
Target	Time	Do not guarantee the plan or the plan is inappropriate	Delayed milestones resulted in project progress less than 6 months late	Delayed milestones resulted in project progress from 6 months to 1 year late	Significant milestones are delayed leading to progress 1-2 years later	Significant milestones were delayed leading to project progress more than 2 years late
	Cost	The cost increase is not significant	Cost increase <10%	Costs increase by 10-20%	Costs increase by 20-50%	Cost increase >100%
	Quality	The quality of the project is reduced but it is difficult to detect	Reduced construction quality increases costs <10%	Reduced construction quality increases costs by 10% -20%	Project quality does not guarantee the objectives and requirements	Project quality does not meet standard requirements

D. Risk research tools

Build the Scale

Scale is a tool to convention (encode) the conditions or levels of units of investigation according to the characteristics under consideration. In the study, the nominal scale will be used to measure qualitative variables about the survey object and the 5-level Liker scale to measure the respondents' perception of the factors in the quantitative research stage.

Each risk factor will be determined through two criteria: level of risk impact and frequency of risk occurrence. In which the impact level is assessed from 1 to 5 (very little impact on very strong impact), each level will be based on the impact on the time, cost and quality of the project. And the frequency of occurrence is also rated with 5 levels from 1 to 5 (lowest occurrence frequency to highest frequency).

Test the scale

• Examine the correlation between questions themselves (characterized by Cronbach's Alpha coefficients)

• Check the correlation between the total score of each person and the total score of each question (characterized by the total variable correlation coefficient).

Cronbach's Alpha coefficients

Cronbach's α coefficient is a statistical test of the degree to which question items on the scale are correlated. One of the methods of testing the uniqueness of the scale is tested in the split reliability. The formula for calculating the alpha coefficient is:

$$A = N.\rho/[1 + \rho(N-1)]$$

Inside:

ρ: average correlation coefficient between questions

N: total number of respondents

By convention, a well-evaluated set of questionnaires must have a coefficient $\alpha \geq 0.80$ under certain conditions where a value of 0.7 is acceptable.

Some researchers think that Cronbach's Alpha coefficients of 0.80 to 1 are the best scale, with 0.7 to 0.8 being usable.

Coefficient of correlation of total variables

Total variable correlation coefficient is the correlation coefficient of one variable with the total score of other variables in a scale. Therefore, the higher this coefficient, the higher the correlation of this variable with other variables in the group. According to Nunnally and Burnstein (1994), the coefficients with total variable correlation ≤ 0.3 can be considered as garbage variable and will be excluded from the scale. Therefore, in this study, only variables with total variable correlation coefficients of> 0.3 are selected for selection

Probability matrix of influence

The risk factors are calculated the average value of the impact level and frequency of occurrence, then put into the probability - influence matrix to determine the level of risk qualitatively. Select high and medium risk factors into the quantitative analysis table - calculate the score of risk.

Scoring method

The score of each risk factor is assessed as follows:

Risk Score = score of frequency of occurrence * point of impact level

Specifically, scores of each interviewee are evaluated by the formula:

$$R_j^i = P_j^i * I_j^i (2)$$

Inside:

P_j^i - frequency of risk occurrence i assessed by subject j

PI_j^i - the impact level of risk i is assessed by subject j

The average score of risk is:

$$R_i = \frac{\sum R_j^i}{n}$$

In which: n is the number of risk assessment subjects i

Determine the sample size.

• Sample size: there are many ways to determine sample size such as

+ According to Luck DJ, Rubin R.S, the formula for calculating sample size:

$$N = \frac{(Z * S_x)^2}{E^2}$$

Inside:

N: is the sample size

S_x: is the standard deviation of the sample

E: is the permissible error, the confidence interval of the sample

Z: is the value of the normal distribution determined by the normal distribution

E. Control, prevention, risk financing

Once risk has been identified, measured, assessed, and analyzed, the next step that a manager must take is to control risk management so that this process is always going on.

Risk control measures include the following groups:

• Avoiding risks: Risk avoidance is the elimination of the possibility of damage, which is the refusal to accept a project with too great a risk. This measure is applied in the case of the high probability of damage and the large extent of damage. Risk avoidance can be realized at the very beginning of the project cycle. If the risk is high then discard the project from the start. Certain types of risks that appear early at the start of a project can be addressed by identifying requirements, gathering information, improving communication, or specialization. Reducing scope to avoid high-risk activities, adding resources or time, adopting an old approach instead of an innovative one, or dodging unfamiliar subcontracts can be examples of avoidance.

• Insurrance: In the view of an insurance manager, insurance is the transfer of risk under the contract. From the point of view of insurance society, it is not only the transfer of risks but also reduction of risks because groups of people with similar risks voluntarily participating in insurance have allowed to predict the level of losses before it appear. Insurance is a suitable risk management tool when the likelihood of damage is low but the level of damage can be very severe.

• Prevent damage: Damage prevention is the use of measures to reduce the frequency of occurrence of risks or the extent of damage brought about by risks. To prevent damage, identify the source of the damage. There are two main groups of factors that are factors that affect outside and factors that belong to within the project.

Measures to prevent damage include:

• The measures that impact on the hazard itself to prevent damage.

• The measures focus on the risk environment.

• Measures that focus on the interactions between hazards and the risky environment.

• Risk mitigation: Risk mitigation is to seek to reduce the frequency or extent of the impact of adverse risks to a certain threshold of acceptance. Actions to reduce the frequency of the risk or its impact on the project are more effective than trying to correct the consequences after it occurs and the impact consequences. Damage mitigation includes measures to mitigate risk-induced loss measures including: process compliance, debt transfer, development and implementation of risk prevention plans, contingencies, risk dispersion.

• Risk financing

Risk can come to anyone, anytime, anywhere. Besides the proposed solutions to control the risks, it is not possible to avoid all the bad consequences. So, when risks happen, how should they be solved? First of all, we need to monitor, assess damages, determine damages to assets, resources, legal value ... Then, it is necessary to have appropriate risk financing measures.

• Risk transfer: for assets purchased insurance when a loss occurs, it is natural that the insurer must compensate.

IV. CONCLUSIONS

Any project must be faced with events that have the potential to impact the project's goals. Events can be foreseen or sometimes unpredictable. Once forecasted, the project team will have proactive preventive measures, but if not foreseen, somewhat on the proactive position may limit the possible impact of the risk because because there are risks that are visible before the project starts, but there are also risks that are only visible when they do.

Investors, project management units, consultants and individuals working in the fields related to the implementation of investment projects for construction of roads in particular, need to implement risk management. Risks in the project management process from investment preparation, investment execution to completion of works put into operation and use, will minimize possible bad risks in order to maximize the efficiency of projects.

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