



IDENTIFYING AND MANAGING MOST COMMON RISKS IN CONSTRUCTION INDUSTRY FOR ROADS. (An Overview)

Author: okpalaku-nath Vivian

Email: okpalakunath@gmail.com

Dept. of Civil Engineering, Cyprus International University, Nicosia, Northern Cyprus

ABSTRACT: *Risk in relation to road construction can simply be defined as an inevitable event in Engineering construction projects or works. Risk management in road construction can be said to be a way or method to plan, detect and manage those already existing risks or future risks that is most common in construction of roads. My research work is based on identifying these risks, knowing the best method to manage the risks which simply start by identifying the hazards, assessing the extent of the risks and managing residual risks if any, solving the risk and even a possible avoidance of the risk in a well-defined manner. It is usually a big loss to the road construction companies when they fail to meet up with the deadlines given for a particular project or when the budget given was mismanaged by the contractors. The outcome of risk mismanagement in construction includes a financially unsuccessful project that significantly weakens the company's financial stability. To avoid this occurrence or company instability, construction companies should disengage from profitless construction works by being able to point out from the start of the project works. The aim is to have an active managerial skill of handling risk in the pre-selection phase. This can only be attained if the parties involved in the contract are able to understand their major risks, the risk conditions, risk events and take proper responsibilities in handling them. Data collection, use of questionnaire and physical interviews can serve as the primary data for a particular study area. The result obtained will help show the risk encountered previously or the future possible risks and the major causes of these risks. Finally, a proper method should be drafted out and carried out by the companies or parties involved to prevent and manage these risk problems efficiently and effectively.*

Keywords: *Data collection, Risk events, Risk management, Contractors, Road construction project.*

1.0 INTRODUCTION

Risk in relation to road construction can simply be defined as an inevitable event in Engineering construction projects or works. Risk management in road construction can be said to be a comprehensive and systematic way or method to plan, detect and manage already existing risks or future risks that is most common in construction of road with the goal of achieving a successful project [1]. My review will be based on first, identifying these risks, the risk hazards, accessing the extent of the risk, managing the residual risk if any, knowing the best method to manage these risks, solving the risks and even finding the best way to avoid the risk in a well-defined manner. From my research it been said that it is usually a big loss to the road construction companies when they fail to meet up with the deadlines given for a particular project or when the budget given was mismanaged by the contractors, therefore the earlier these risks are identified and avoided before the start of the project, the more profitable and successful will the outcome be. It has been noted that there has been frequent number of serious accidents that has claimed the lives of humans and destroyed infrastructures which are known as economic losses. Different preliminary and tertiary approaches should be taking in consideration to help reduce these risks in road construction or to avoid the risks completely. This involves collecting the needed data from the area, use of questionnaires and the WWR among road users and professionals which will help in proper risk analysis. The parameters information will be documented to carry out the calculations. To enable proper management of these risks (CCPS, 1995) suggested that it will be preferable to create subdivisions of this route into a number of segments, where all the taken or recorded parameters might be considered as content [2]. These segments will serve as the basis for the transportation network, population distribution, population frequency, and the accident frequency. To acquire a more accurate data analysis, the geographical information system is relevant. The geographical information data base does not contain all the required Information for the risk analysis like accidents rates, population data, and weather conditions of the area or the traffic flow, therefore this information can be gotten from other sources and arranged in a compatible format with route segmentation. Information related to weather conditions can be evaluated using the consequences analysis. This analysis uses a reliable mathematical model to speed up the process of the transportation modalities. It helps to save the results which include the product database, angles, distances and impact areas. The transportation risk analysis for a product contained in the data base is usually facts and can be carried out even a non-professional in the field. The construction industry is one of the most technical, risk challenging and dynamic fields because the industry has been exposed to so many risk factors and the principle to control these risk factors is to avoid,

control and minimize it. The TRA (target risk assessment) tool has been technologically formulated to work with the GIS (geographical information system) application, which already contains relevant zones information and the product data base that contains the probabilities of accidents occurrences in these areas [3]. The second principal tool apart from the WRR (weekly risk register) is TRHAZGIS (transport hazardous GIS) software which was also technologically formulated to carry out fast and accurate risk analysis for transportation of hazardous materials and help in the road risk management. Contractors should be able to use more than one tool or methods to get the best results. The outcome of risk management in construction includes a financially unsuccessful project that significantly weakens the company's financial stability [4,5]. To avoid this occurrence or company instability, construction companies should disengage from profitless construction works by being able to point out from the start of the projects works and should have a regular evaluation of all the company activities. This review article will show companies the importance of having a good and active managerial skill in handling risk in the pre-selection phase of a road project. This can only be attained if the parties involved in the contract are able to understand their major risks, the risk conditions, past and recent risk events for better comparison and take proper responsibilities in handling them. Data collection, use of questionnaire and physical interviews can serve as the primary data for a particular study area. The result obtained will help in showing the risk encountered previously or future possible risks, the major causes of these risks and long-lasting solutions which will help the company embrace a brighter vision and a successful project. Lastly, the proper method that will be drafted out in this research proposal paper if adhered to by companies or parties involved will prevent and manage these risks problems efficiently and effectively.

It has been noted that there has been frequent number of serious accidents that has claimed the lives of humans and destroyed infrastructures which are known as economic losses. In the past, hazardous damages has been caused during transportation of construction materials and machines by road, therefore it is a safer and more sophisticated alternative awareness is being created recently (Mazzarotta, 2002). Different preliminary and tertiary approaches are been taking in consideration to help reduce these risk in road construction or to avoid the risks completely. This involves collecting the needed data from the area and use of questionnaires among road users and professionals which will help in proper risk analysis. The parameters, information will be documented to carry out the calculations. To enable proper management of these risks (CCPS, 1995) suggested that it will be preferable to create subdivisions of this route into a number of segments, where all the taken or recorded parameters might be considered as content. These segments will serve as the basis for the transportation network, population distribution, population frequency, and the accident frequency (Bubbico Dicave &

Mazzarotta, 2004a). To acquire a more accurate data analysis, the geographical information system will be relevant. The geographical information data base does not contain all the required Information for the risk analysis like accidents rates, population data, and weather conditions of the area or the traffic flow, therefore this information can be gotten from other sources and arranged in a compatible format with route segmentation. Information's related to weather conditions can be evaluated using the consequences analysis. This analysis uses a reliable mathematical model to speed up the process of the transportations modalities. It helps to save the results which include the product database, angles, distances and impact areas. The transportation risk analysis for a product contained in the data base is usually facts and can be carried out even by a non-professional in the field. The construction industry is one of the most technical, risk challenging and dynamic fields (Mills, 2001) because the industry has been exposed to so many risk factors and the principle to control these risk factors is to avoid, control and minimize it. The TRA (target risk assessment) tool has been technologically formulated to work with the GIS (geographical information system) application, which already contains relevant zones information and the product data base that contains the probabilities of accidents occurrences in these areas. The second principle tool is TRHAZGIS (transport hazardous GIS) software which was also technologically formulated to carry out fast and accurate risk analysis for transportation of hazardous materials and help in the road risk management. These major risks are outlined in the research questions below.

1.1 Statement of Problem

1. Unknown site conditions
2. Poorly written contracts
3. Unexpected increases in material costs
4. Labor shortages
5. Damage or theft to equipment and tools
6. Poor project management

1.2 Research Questions

1. Does lack of safety hazards in the construction site cause risk in road construction?
2. Does incomplete drawing and poorly defined scope cause risk in road construction?
3. Does an unknown site condition cause risk in road construction?
4. Does a poorly written contract cause risk in road construction?

5. Does unexpected increment of material cause risk in road construction?
6. Does natural disaster cause risk in road construction?
7. Does unavailability of building materials cause risk in road construction?
8. Does poor project management cause risk in road construction?
9. Does a labor shortage cause risk in road construction?
10. Does damage or theft to equipment and tools cause risk in road construction?

1.3 Aim and Objectives of Study

1. To help analyze and manage the possible or future risks in road construction projects.
2. To enable the use of a proper risk managerial practice in road construction project based on the contractor and client's perspective.
3. To identify and analyze risk factors with their severity and allocation in road construction projects.
4. To analyze the risk response strategies of various risks factors in road construction projects.
5. To comprehend the current practices of managing the possible and future risks in road construction projects.
6. To understand the impact of risk factors and impact for the severity and allocation of risk in road construction projects.
7. To enlighten and draw the attention of construction companies or professionals for better evaluation of risk factors in road construction projects.

2.0 REVIEW OF LITERATURE

The following related literatures were with respect to some books and some journals.

Lots of risks is being associated to human lives. Notwithstanding this fact, the complex nature of the work involved in the road construction makes the future more exposed to so many risk [6]. The kinds of risk seen in a road construction works is a bit different from other industries because of its nature of technicality and complexity [7]. Recent studies by scholars and researches have given a lot of definition to risk, these definitions were given based on the aims and objectives of the different projects works they came in contact with at that period of time. So many authors' reviews on the research topic concluded that risk was really an inevitable occurrence and an unforeseen event that has a huge effect on any road construction work but nevertheless could be avoided if managed and controlled efficiently. The effect of ineffective risk management in a road construction project includes: company financial loss,

injury to the masses, high rate of accidents, loss of lives and property and the addition of all these [8], [9] shows any incompetent project work, poor quality performance, poor managerial guide and monitoring, and company financial loss with these risks. According to [10], road construction works phases includes project planning, developing design and consideration of the environment factors or activities. Road construction contract projects are therefore carried out in a well-defined environment by understand the risk sources from both known and unknown conditions [11]. Certain risks encountered are based on personal perspectives and can be classified in various ways; class A based on the probability of risk occurrence; class B based on impact implication of the risk during the construction activities. Nevertheless, these different classifications, they are both aimed at providing a more comfortable managerial risk-free system [12] [13]. [14] also showed and added that road construction risks should not only be classified based the risk impact on the road project but also the main source risk, [15] stated that construction risks are grouped into two major sections in accordance with the main sources of the risk which includes; the internal and external sources. There are also 3 groups of risk; unknown risks, known unknown risks, known risks [16]. We also have risks which are associated with time, the environment, cost and safety. Other sub-categories of risk associated with human or individual impact in most construction projects include cultural, political, managerial, health, legal, financial, economic, social and political risks. [17] stated that risk identification is important for proper risk assessment. [18] [19] said that risk assessment the second important step of in the risk managerial process. According to [20], risk assessment is a method of making use of the data collected or gotten to determine and estimate the risk occurrence frequency and the level of implications of risk in the risk managerial system. According to [21], after risk identification comes qualitative and quantitative risk assessment which must follow additional examination and inspection through estimating as well as accessing the likely expectation of the risk event or occurrence and its impact on each risk. Several other factors are also examined which includes; the degree of risk impact on project aim, the timing of an occurrence, managerial skill, future or possible occurrence and their relationship with other risks. These factors are necessary because they will help provide a proper comprehension and idea to tackle each risk encountered. The two methods are used for analyzing risk are the qualitative and quantitative methods [22] [23]. Risk analysis and control is another important step after a proper risk identification and assessment and helps the companies, parties or organizations involved to learn about the areas in the project that are exposed to different levels of risks. According to [24], Risk responses are the different methods used to eradicate, reduce, avert and transfer future and possible or already existing risk in a road project. According to [25], Risk response can be defined is the “method of developing, identifying and usage of the risk

response options to determine the best options available in handling the risk, targeting enhancing opportunities and reduction of any possible threats prior to the road project aim". Lastly, these listed corrective measures can help in handling the certain risks associated with road construction projects [26] [27]: 1). Adjusting project plans, having a defined the scope of work and estimate the counter risk consequences. 2). Keep all data information about recent, future and possible risk recorded. 3). Monitor the risks regularly, always try to develop alternatives plans to manage predictable risks when necessary.

The following related literatures were with respect to some books and some journals. In accordance to PMBOK handbook guide (project management body of knowledge) the risk management process is comprised of six vital procedures which are : (1) recognizing the risk (2) qualitative examination of the risk (3) quantitative examination of the risk (4) managing of the risk (5) detecting the risk source (6) risk reply planning. As earlier mentioned in chapter one, the first step to be taken when trying to manage a project risk is recognizing the risk type which will help you comprehend the future and possible risks that can affect the construction project and also help in data documentation. There are different methods for identifying these common risks in a road construction project, these includes the use of questionnaires, prompt list, interviews, check list, workshops etc. this review of literature will show various strategic methods used in risk assessment and there rankings in a project. These methods are divided into 2 groups which are the qualitative and quantitative methods. The qualitative method is more subjective because it focuses mainly on the risk level, the quick and easy way to perform the project, the subjective evaluation of the impact and the probability of the project. The quantitative method focuses more on the project level, the estimated time and cost of the project, the time consumption of the project. Therefore, one can say that it is an objective method. When deadlines or allocated finances for a construction project are not met, it becomes a big problem to the Construction Company or parties involved. This could cause a profitless breakdown of the company's financial performance and can weaken the company negatively. Therefor to avoid these unnecessary damages earlier, the companies or parts involved must point out the profitless projects at the initial stage. Road projects always have risk factors either in the financial aspects, scheduling or the qualitative and quantitative scheduling. Risk factors can either be external or internal and will affect the goals of the parties or companies involved either positively or negatively (Migilinskas et. al, 2008). Over the years, the main target was only on the negative aspects of a construction risks buy recently it has changed, a lot of construction companies has realized the importance of also doing a proper risk assessment on the positive aspect on a project work (Difi, 2019). Managerial risk can also be said to be the attempt made to keep the risk in a project work within acceptable limits (Bonnema et. al, 2017). The managerial aspect of these risks is all

about its identification, assessment, control and keeping in check with the events which can affect the construction or project work. All project phases are important but some phases seem to be more valuable to the success of the project. The works that comes the first phase of the project has seemed to be more important and vital. Hussein and Klakegg stated four important concept that are very vital and essential the initial stages which are (1) admitting and allowing all standard success (2) dodging clashing terms to meet all collaborators, avoiding the use of optimistic or pessimistic selection for the articulation of beneficial criteria and communicating concrete basis that cannot be comprehended properly (Hussein, et. al, 2004). The initial aspect of the project is essential because it is the preparatory stage for market studies, clients, competitors, laws and regulations, resources, assignment type and organization (Austeng et. al, 2010). With the knowledge of this, it gives a better and stronger base for the final conclusion of the project settlement. Assessment of the type of contract is additionally a middle part of the activity because it structures the legal and fundamental aspect of the contract construction (Tryti, 2012). Utilizing unreliable analysis in forecasting cost for a construction project is conventional, in spite the fact that the strategic methods used are difficult with obvious risks. (Johansen et. al, 2004) differentiated the five primary difficulties that can be encountered when using the uncertainty analysis. Firstly, the price of the base case when checked at the initial or beginning phase of the project, most times is not the accurate cost at the end of the project. Secondly, looking further in a detailed examination can mislay the general comprehension of the uncertainty. Thirdly, recognizing the actual standard deviations of the projects phase are strenuous and usually within the initial stage of the project it displays an unrealistic and uncertainty that is very low. Fourthly, evaluating the uncertainty requires handling the human errors or shortcomings in making the group work as a team both in decision making to enable a proper understanding of the unwavering evaluation. Lastly, being able to differentiate opportunity risk from the start to the finish through risk analysis. With these the uncertainties and risks are often reduced and lesser. Lichtenberg (2016) portrays four variables to realize an effective analysis of uncertainty which Incorporates namely; (1) Tolerating the unknown risks (2) Evaluating the target performance (3) recognizing the comprehensive common impact (4) getting the uncertainty top-down. This action is usually done by experts or state related companies for instance, Norwegian public roads organization and Bane NOR). (Klakegg, 1994) brought about the step-by-step principle for managing risks and they are subdivided into 7 steps namely (1) scope and purpose (2) structure (3) External and internal impacts (4) Evaluation (5) Calculation (6) Emphasis (7) Conclusion. The subdivision is classified into a fixed and unfixed framework organization framework. Another measure is organizing the problem from the general point of view or aspect a vital level. Bufaied (1987) cited Akintoye and Macleod,

1997) said that risk in construction can be seen as “a variable within the process of a construction project whose variation ends up in uncertainty as to the final cost, time and quality of the project”. Dey (2001) said that disparity of a project that leads to risk is because of the lack of proper managerial skills. Toakley (1989 cited in, Toakley, 1999) that risk management is a strategy to control the level of risk and reduce its impact on project work. Researchers, scholars and experts proposed definition of risk management (Chapman and Ward, 1997, Hartak and Shaked 2000; Jaafri et al., 1995, Boehm, 1991, Kerzner 2001; Edward and Bowen, 1998, Lyons and Skitmore, 2004; Extend Hazard Administration Handbook, 2003). Experts in project management must realize the impact and contents of all options prior making choices regarding a suitable procedure for risk control (Wang and Chou, 2003). Risk control or handling implies choosing the appropriate technique to avoid the bad effect of the risk (Mill Operator and Lessard, 2001). Risk control or handling is said to be the primary step in risk management (Bread Cook et al., 1999). In addition, Risk management techniques are grouped into four namely: (1) risk retention (2) Risk reduction (3) Risk transfer (4) Risk avoidance (Dey 2001; Flanagan and Norman, 1993; Carter and Doherty, 1974; Raftery, 1994; Wang and Chou, 2003; Bread Cook et al., 1999b).

2.2 Methods and tools

We have different tools for managing and controlling risks in road construction. Bonnema et al. (2017) stated that there are two types of risk management tools namely: 1) risk register for tracking the project number and also the area of risk in a road project. 2). Decision tree for quantifying risk, evaluating risk and comparing differences causes of the risk. The decision tree tool will enable a proper planning phases by giving a visual representation and overview of the possible outcomes required in a project work. Therefore, this tool can be said to aid in accurate decision making. The risk register tool will give information within the period the project is starting or will be carried out. This tool helps in risk identification, cost regulation, knowing the level of the project and the project description. The preliminary source of this methodology is the use of questionnaire or paper interview. This technique will help in the collection of important data from a number of participants on the project topic stated (Kristoffersen, et. al, 2004). The questionnaire or interview is solely aimed at helping to identify the possible work uncertainties. We will conduct an unstructured and structured interview to help understand the challenges in selecting a project work. The topic will be established in advanced and the questions given will be gotten from the risk problems or situations. The interview will be among B.sc holders, primary certificate holders, secondary certificate holders, cost estimator, company managers and project developers on the

construction site. The purpose of this is to have a more elaborate and visible understanding on the project and the uncertainties. The estimated time for the completion of this questionnaire will be within a period of two weeks, therefore this questionnaires' will be sent out prior to the interview. A likert scale survey will be used for the solution validation to help with the time limit response. This survey will help in controlling the amount of data to be collected (Kristoffersen, et.al 2004). The questionnaire will contain 10 questions with the type of informants needed. The data was collected from different professionals, project managers, students, workers and contractors from the year 2015 till date. the data was recorded with a WRR (Weekly Risk Register) which is a special risk management tool used for updating the weekly activities for a particular road project. The project managers handling the road project were in charge of confirming the validity and constituency of every data entered on the register. The collection of data also included organizing a weekly meeting between the team of project workers, project manager in charge, the contractor manager, structural engineer, the architect and the board of research team. The project managers were in charge of making sure the meetings are held weekly from the first phase of the project till the last phase. The WRR worksheet enabled the team of researchers note the feedback gotten from all participants. This worksheet contains 3 main tabs which are the risk, innovation and award tabs, then it also has 2 secret tabs which are the transfer risk and transfer project tab. The award tab contains information like the project number, project type, project owner, project title, project manager, project award date, project delivery method, project start period date, duration of the project, project end period date etc. This information was inputted at the initial phase of the project and this will help the research team to focus on the deadline, scheduling and cost estimation during the time frame of the weekly meeting. The innovation and risk tab was used majorly for computation of the different individual risks when identified by the project research team members, contractor or client etc. This tab helped to track and show all risk events that will be experienced at the cause of the project, cost and the individual risk. The tab will also contain the serial number, date entered, and the description of the risk source. The project summary tab usually contains the summary of the number of risks encountered based on the risk source, project cost, schedule delay rate, change order etc. The information on this tab is a combination of all other tabs. Mathematical formulas were used to calculate the relevant information like, the change in schedule of the road project, project cost, change in order rate and delay rate of the project. The 2 hidden tabs were used in sorting the collected data information on the other unhidden tabs. The data information collected were sorted out by the research team and used for the statistical analysis. The WRR was then distributed to every team member or parties involved through email every week to make the required adjustments and take the corrective measures or actions needed. After the completion of the

road project, the project manager verified the risk inputted on the register, to undergo a proper analysis, verification and correction by team, the final data was then transferred to a database spread sheet. The main criteria of this research method was based on being able to complete the data, the accuracy of the risk register submitted by the research team, award cost and duration of the project.

2.2.1 Review on road project activities

1. Identification of the risk.

i. Knowing the potential risks. ii. Assigning a risk owner. iii. Use of the appropriate methods in identifying the risks and their causes in the road project. iv. Making use of the document risk register to record the risks.

2. Qualitative analysis i. estimating the probability of the occurrence of the risk. ii. Knowing and understanding the magnitude of the future impact of the risk to enable getting a qualitative score for every risk item.

3. Quantitative risk analysis i. carrying out the sensitivity analysis. ii. Carrying out the montecarlo simulation. iii. Estimation of the road project cost.

4. Risk control i. Re-assessing both the new, existing and possible future risk. ii. Performing variance. iii. Using trend analysis for estimating potential impacts of the risk to enable a successful road project. iv. Ensuring a proper risk project monitoring.

Fig 1. A detailed sample of questionnaire for data collection.

APPENDIX I

QUESTIONNAIRE FOR THE PROJECT WORKERS- SECTION A

Name _____

Age _____ Sex _____

Education background of parents: _____

B.Sc./B.Ed. Primary certificate Secondary certificate

Project developer Cost estimator Contractor Engineer

SECTION B

Please specify your level of concurrence / difference in opinion with the statements below (tick only)

S/N	(4pts.)	(3pts.)	(2pts.)	(1pt.)	(mean)
	SA	A	D	SD	\bar{X}

1.	lack of safety hazards in the construction site causes risk in road construction					
2.	incomplete drawing and poorly defined scope causes risk in road construction					
3.	unknown site condition causes risk in road construction					
4.	poorly written contract causes risk in road construction					
5.	natural disaster causes risk in road construction					
6.	unexpected increment of materials causes risk in road construction					
7.	unavailability of building materials causes risk in road construction					
8.	poor project management causes risk in road construction					
9.	labour shortage causes risk in road construction					
10.	damage or theft to equipment and tools causes risk in road construction					

This is for an academic purpose. I therefore humbly appeal to you for sincerity in filling this questionnaire. The confidentiality of every information you will give here is assured.

INSTRUCTION

Please tick under any choice below to show how the following sentences apply to identifying and managing risk in road construction project.

The choices are: SA= Strongly Agree, A=Agree, D=Disagree, SD=Strongly Disagree

2.2.2 Assessment of project risk and risk classification frame work

This simply means having the necessary knowledge of the important factors in making a good project before its development. These factors includes

1. Understanding the nature and type of project.

2. Knowing the type of contract.
3. Knowing the competence of the contractor or developers.
4. Having a well detailed structural and project review.
5. Knowing the geographical location and the economic conditions.

In risk management Klakegg method or principle was found helpful but was later reformed by Austeng et. al (2010). These stages were divided into 7 namely: (1) company goal (2). External and internal influences (3). Structure of the project (4). Estimation of the project (5). Calculation and project evaluation 6). Company final say 7). Work action and plan. Austeng, et. al, 2010) also developed a matrix format and an action step to serve as a basis for identifying problems and assessing the analysis basis for the initial phase of the project.

Fig. 2 below shows the risk classification framework for a project'

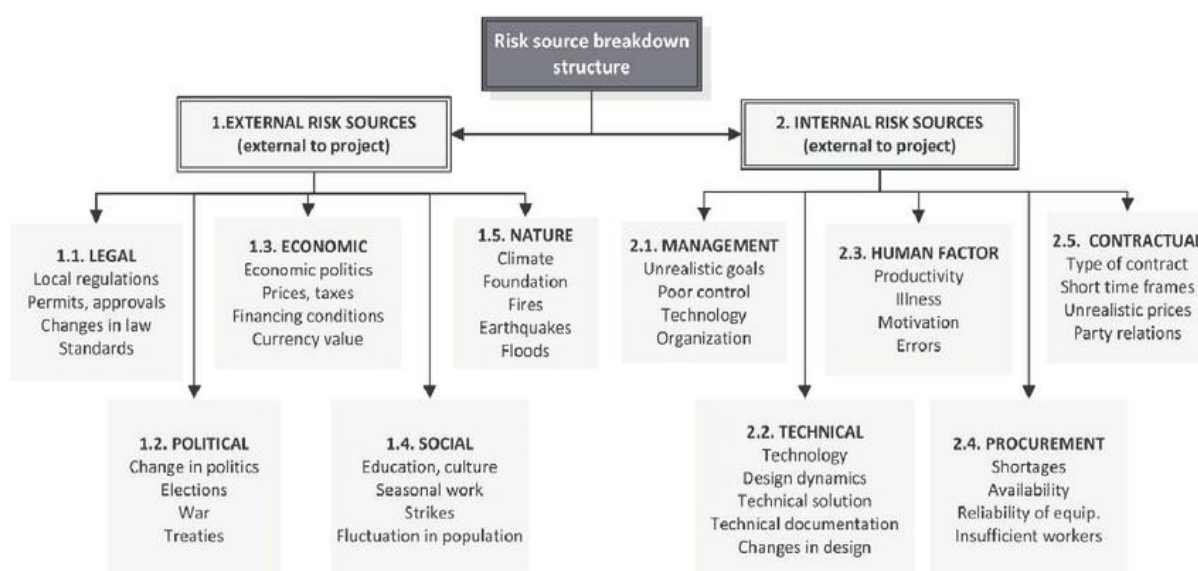


Fig 2. Risk in road project classification frame work

3.0 CONCLUSION

Risk management in road construction can be challenging and must be overcome to achieve a profitable project. The earlier these risks are identified and avoided before the start of the construction work or project, the more profitable and a successful will the outcome be. This research work aimed at understanding the major causes of these risks, project cost, use of questionnaire for data and factors to be considered for a profitable project work. Finally, it is important for the companies or parties involved to evaluate the past events and risks on projects to enable better comparisons and provision of better solutions.

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