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ABSTRACT

Purpose: *Zero risk construction is only a dream not reality as there is nothing certainity in the real world and scientists are only capable of coverting the same into risk with high level data science. The practice of risk management is an attempt to highlight risk elements with a case of urban road construction in Sindhupalchowk district, Province 3, Nepal.*
Design/Methodology/Approach: *The 5-point Likert scale questionnaire survey was done to collect the primary data. Risk Management Practice is documented based on survey response in percentage through charts and graphs. Field visit were done for visual assessment of the construction procedure along with key informant interview and Secondary data of Detail Project Reports, Design and Drawings were effectively analyzed. Cronbach's alpha was used to measure the reliability and triangulations were done for validity.*
Findings/Result: *The results from this research indicates that contractor's organization are averagely aware with a mean score of 3.30 about Risk Management Practice and averagely practicing risk management formally with mean score of 2.83. They are averagely analyzing risk management techniques with mean score of 3.07. Mean score is slightly higher based on client's perspective with score for awareness being 3.93 and score for risk management being practiced formally is 3.13. Risk analysis score based on client's management is 3.40. Mostly adopted technique of risk identification is monitoring and evaluation report of similar past projects and direct judgment is widely used technique for risk assessment of road construction projects at Sindhupalchowk district based on both client's and contractor's perspective. Risk response strategy based on contractor's perspective is monitoring the risk and preparing contingency plan whereas that for client is transfer of risk.*
Originality/Value: *It is action research which is significant for professional to understand the practices of risk management being adopted by Nepalese Contractors in hilly region of Nepal.*
Paper Type: *Ex-Post Facto Research*
Keywords: Risk, Practice, Identification, Assessment, Response.

1. INTRODUCTION :

Risk is function of experience of project team and uniqueness of activities of project. So, highly professional team for risk management should be focused from earlier stage of project (Petrovic, 2017) [1]. This facilitates in clearer understanding of potential risk factors associated with project, detail assessment methods and appropriate response strategy. It also helps to establish well documented historical record that serves as a reference for evaluating future projects.

Risk can be categorized based on its nature, occurrence, severity and many other purposes. Different authors have classified risks based on different categories. PMI (2017) [2] has categorized risk into two broad categories as internal and external risks. As per Aleshin (2001) [3], risk is categorized into numerous categories like market risk, financial risk, political risk, social risk, intellectual property risk

and safety risk. Similarly, Ahmed & Dikbas (2013) [4] have categorized risk based on project being local level or international level. The internal risk depends within the constraints of project and is independent of project being local or international level where as external risk depends upon the environment where the project is being constructed and depends on political scenario, social environment, applicable regulations, legal authorities and procedural formalities.

Risk can come from various sources like possibility of project failures at any phase of project life cycle as in planning &design phase, construction &development, operation and sustainment of life cycle, legal boundaries, financial risk, accidents, force majeure conditions, uncertain events and unforeseen conditions. Standard risk management practice has been developed by various institutions like Project Management Institute (PMI), ISO Standard, National Institute of Standard and Technology (NIST) and Actuarial Societies.

2. OBJECTIVES :

The objective of this research is to assess the practice of risk management adopted in road construction project in Sindhupalchowk district, Province 3, Nepal.

3. LITERATURE REVIEW :

3.1 Risk and Uncertainty:

Risks are those uncertainties or conditions which when occurs, has both positive and negative impacts on deliverables of the project. Risk is generally expressed in terms of occurrence probability and its consequences, or impact on output of project. For any event to be taken as potential risk factor, it must have a probability of occurrence between 0 and 1, which explains to what extent, the risk event is likely to occur. Hence, the impact of risk factor can be stated when details related to possibility of occurrence and series of probable outcome with their likeliness to occur. (Smith et. al., 2014) [5].
Uncertainty are those events to which the probability of occurrence is unknown, i.e. uncertainty are those events about which little is known related to extent of its occurrence with only possibility that it might occur. Uncertainty is said to exist when an event results in multiple possible outcomes yet the probability of those outcome is unknown (Smith et al., 2014) [5].

3.2 Sources of Risk:

The risk can be categorized based on project specific risk and non-project specific risk. Risk related to both the categories needs to be considered during identification of risk factors within a project. Project team, during analysis of risk event needs to define the boundaries up to which the risk needs to be considered and break down the risk event into independent risk elements. This facilitates in easy understanding of the risk events and helps in better selection of risk response strategy. The general checklist for source breakdown of risk includes commercial, financial, legal, political, environmental, communication, geographical, constructional, technological, operational, and management risks (Chitkara, 2011) [6].

3.3 Typical Risk in a Construction Project:

Typical Risks in a Construction Project includes: -

- Accidents on site resulting in physical injury.
- Failure in completing the project as per design planned.
- Unable to accomplish project within estimated time duration.
- Failure to obtain the approval documents as per local authorities and legal requirements.
- Delay in project due to unforeseen site conditions.
- Price fluctuation and market uncertainty related to construction material and labor.
- Possibility of budget exceeding the upper boundary limit as per Client's expectation.
- Force majeure conditions.
- Failure to maintain project progress within the estimated cost.
- Loss to the contractor due to unaccounted events.
- Unable to take timely decision related to variation and uncertainties.
- Unable to achieve the required quality standards, Safety Health and Environment regulations, etc. (Flanagan & Norman, 1993) [7].

3.4 Risk Management Process:

The process of risk management is broadly categorized into two distinct phases as risk assessment and risk control. The first phase, risk assessment includes identification of risk, analysis of risk and its ranking where-as risk control comprises of risk management plan, risk resolution, risk monitoring and taking preventive actions (Raz & Michael, 2001) [8].

Risk management is formal systematic process of identification, assessment and response to the risk events throughout the life cycle of a project with goal to attain optimum control over project deliverable. Mishra and Malik (2017) [9] suggests risk management process as an integrated approach with following activities: -

3.4.1. Risk Identification:

The identification of risk is the major step in process of risk management. The aim of this process is to identify the potential risk events that have high impact on project goals. Identifying all the potential risk is an impossible task and thus the goal of risk identification should be to identify and assess the high value risk factors that has potential to cause huge impact such that, the control of such risk events enables project team to achieve the overall objective of project (Smith et al., 2014) [5]. Risk management is an ongoing process that adopts various approaches on different phases of project life cycle. Risk identification is the initial step in process of risk management and reports of previous similar project serves as primary basis for identification of the risk events. Risk can also be identified through literature review, brainstorming, risk register, questionnaire survey, key informant interview and past experience.

3.4.2. Risk Assessment:

Assessment of risk provides detail description of the risk event, quantify the damage and prioritize them based on its severity. Assessment of risk event is based on cause and effect of the events that has potential to cause adverse impact on project which ultimately facilitates in decision making process (Estate Management Manual, 2001)[6]. The result of risk analysis is identification of all feasible options to manage risk and outcome associated with each decision adopted. Broadly risk can be analyzed through qualitative and quantitative approach where qualitative approach focuses on evaluation of impact and ranking of the risk and quantitative approach defines the severity of risk event in terms of high and low with its possibility of occurrence.

3.4.3. Risk Response Practice:

The final step in process of risk management is risk response that identifies the action to be taken to control the impact of risk event ensuring the success of the project (Mhetre et.al, 2016) [10]. PMBOK defines risk response planning as the set of activities that develop options and determine actions which reduce the impact of the threats and enhance the possibility of obtaining the desired output. Risk management responsibility is assigned to the party that can handle best the risk event and constant monitoring is done to measure the impact of risk on project success. PMI (2017) [2] suggests four risk response strategy in a project, they are as follows:

- **Avoidance:** This completely eliminates risk by adopting different approach for the construction works.
- **Transfer:** It is the method of assigning the risk to other parties eg. to sub-contractor, to supplier, to insurer etc.)
- **Mitigation**: This is method of developing a plan to minimize the consequence or reduce probability of occurrence of risk event.
- **Acceptance:** This is method of dealing with the consequences when the risk event occurs.

3.5 Global Practice of Risk Management:

Petrovic (2017) [1] in his paper "Risk Management in Construction Projects–A Knowledge Management Perspective from Swedish Contractors" found out that Swedish construction industry was fairly unknown about the process of risk management.

Sharaf & Abaelwahab (2015) as cited in Gain and Mishra, 2021[11] found that based on fuzzy logic model analysis, the overall risk in highway construction project in Egypt is considered at a medium level and needs to deploy the use of proper risk management.

3.6 Regional Practice of Risk Management:

Parera et.al (2009) [12] in their paper "Enhancing the effectiveness of risk management practices in Sri Lankan Road Construction Project" concluded that from the list of various identified risk factors during the project life cycle phases (conceptual, planning/design, construction and operational), one of the major risk was "design errors by consultant" that affected entire project life cycle (except conceptual phase).Based on its severity, it was second on list for the design and operation phase and fourth severe risk for the construction stage of project. "Delay in decision making by client" and "Error in estimation of duration and budget" were severe risk factor for conceptual phase as well as design phase. "Lack of funds for project" appeared prominent during design and construction phase of project and "Error committed during construction at site" was severe risk factor for the construction stage of project.

As per research findings, the construction stages in entire project life cycle were identified as most critical based on severity of risk factors. The risk factors identified during the construction stage ranked high based on its severity which was considered as the most important phase when exposed to externalities and human interaction. The research also stated that design phase was the second in the list in terms of vulnerability due to risk factors. So, additional care had to be taken during risk management strategy selection for both construction and design phases of project life cycle.

3.7 Risk Management Practice in Nepal:

Mishra & Malik (2017) [9] in their paper "Factor and impact of risk management practices on success of construction project of housing developers, Kathmandu Nepal" concluded that major risk factors in housing construction projects in Kathmandu valley were time overrun risk, project scope risk, financial risk, economic risk, organization risk, leadership risk and safety and health risk.

According to research finding top management were highly aware regarding risk management and was practicing it formally or informally with a mean score of 3.83. As per research finding, managements of Kathmandu valley were aware to some extent about risk management yet far behind in practical implementation of structured risk management approach. Major focus of managements was on risk related to time overrun and financial crisis.

Mishra and Adhikari (2019) [13] in their paper “Urban Road Construction Risk Management” concluded that contractor's top management awareness towards risk management was average with mean score of 3.44. They practiced risk management averagely either formally or informally by the urban road construction projects with mean score of 3.06. From the client's perspective their top management awareness about the process of risk management was high with mean score of 4.03. Similarly, practice of risk management either formal or informal was also found high with mean score of 4.0.

According to research, the risk response strategy, transfer of risk to other parties of project was the most applied technique to prevent risk events by the contractor and depend on subjective judgment by the client. The most remedial strategy recommended by respondent was close supervision to minimize extra unplanned work and lastly change in the adopted method of construction works.

Shakya and Mishra (2019) [14] in their research article “Risk Assessment in Construction of Gautam Buddha International Airport” concluded that no risk management approach was adopted in airport construction and thus all the issues impacting negatively were identified as the risk factors. Out of 96 risk factors categorized into 14 categories, risk factors significant from employer’s opinion was 33, consultant’s opinion was 41 and contractor’s opinion was 72 risk factors.

Unstructured risk management plan, poor assessment of site prior design, risk of hindrance in the airfield, dispute between consultant and contractor, communication difficulties among the working parties, inadequate control over cash flow, unsatisfactory status review, inability in taking corrective

action timely for design and construction error, mismatch within structural and architectural drawing, inaccurate time estimates and scheduled and unsafe working conditions were some of the major risk factors based on its severity.

4. METHODOLOGY :

4.1 Study Area:

The study is conducted at various areas of Sindhupalchowk district, Province 3, Nepal. It is an extension of earlier research of Gain and Mishra, 2021[11] which tends to select the same area of study also.

The selected road projects are: -

- "Construction of Black Top of Sukute- Chapagaun- Meldanda- Thokarpa-Bhanjyang Road, Sindhupalchowk (Contract No: -DROCHT/3371234/073/74-191)".
- "Construction of Black Top of Barabise- Thotanaari- Ratamate- Chulthidamar-Ghunde-Om Park Road, Sindhupalchowk (Contract No:- DROCHT/3371234/073/074-192)".
- "Construction of Black Top Work of Filmcity Access Road, Dolakha (Contract No: - DROCHT/3371234/073/074-123)".
- "Widening and Upgrading of Khagdal- Kukure- Kalleri- Sigarche Road, Sindhupalchowk (Contract No: - DROCHT/3371234/073/74-194)".

4.2 Sample Size:

The sample size of 30 for contractor and 15 for client is chosen for this research using senses method of technical person involved in risk management.

4.3 Data Collection:

4.3.1 Primary Data

The primary data for the study was obtained by:

a) The managerial aspects, planning aspects, construction safety plan adopted was deeply accessed through project in-charge and project manager interview as Key Informant Interview.
b) Hazard and risk associated with the construction project was surveyed through structured Questionnaire.
c) Visual assessment of the construction procedure was done through effective Field Observation.

4.3.2 Secondary Data

The detailed engineering project design report were accessed followed by reference of published journals, published articles, different websites and existing legal provisions from concerned regulatory departments.

4.4 Data Analysis:

4.4.1. To assess the practice of risk management adopted

Risk management practice adopted by Nepalese contractor is analyzed through set of statements related to risk management practice for which response are collected based on 1 to 5 Likert scale rating. Qualitative analysis of the response of questionnaire survey is done by MS-Excel. Following steps is conducted.

- Coding and defining the scale factors for linguistic meaning.
- Collecting and recording the data.
- Entering data on an Excel sheet
- Calculating the Mean score for each question based on rating provided by respondents between 1 and 5 where 1 means strong disagreement and 5 means strong agreement on Likert Scale.

$$\text{Mean Score} = \frac{\sum (f \times s)}{N}$$

Where, f is the frequency of responses to individual rating
S is the score given by respondent to the questions
N is the total number of response (Chan & Kumaraswamy, 1997)

4.4.2. Reliability Test:

Cronbach's alpha is using Formula as given

$$\alpha = \frac{K}{K-1}(1 - \frac{\sum Vi}{Vt})$$

Where, K = No. of Questions

V_i = Variance of score on each question

V_t = Total Variance of overall scores on entire set of question

5. RESULTS AND DISCUSSION :

Risk management practice of urban road construction project at Sindhupalchowk District, Province 3, Nepal has been obtained from the contractor's and client's perspective.

5.1 Risk Management Practice, Contractor's Perspective:

The practice of risk management adopted by contractor has been analyzed through a set of questionnaire survey. A total of 30 responses were collected from technical persons directly or indirectly related with the study area at Sindhupalchowk District. Risk management practice of urban road construction projects has been obtained from the statistics of management awareness regarding risk management, statistics of management formally/informally practicing risk management, statistics of management practicing the risk management formally and statistics of management analyzing various risk management techniques.

5.1.1. Management Awareness Regarding Risk Management Practice:

As per the 30 responses received during the research, it was observed that management awareness regarding the risk management as average with the mean score of 3.30 on Likert scale.

Table 1: Management Awareness Regarding Risk Management, Contractor's Perspective

Rate	Frequency	Percentage	Mean Score	S.D.
1(Least Aware)	0	0	3.30	0.53
2	1	3.33		
3	19	63.34		
4	10	33.33		
5(Most Aware)	0	0		
Total	30	100		

From the table 1, no response was obtained on scale 1 which means every management was little aware about risk management. Majority of respondents i.e., 63.34% of total rated 3 i.e., these managements were averagely aware regarding the risk management. 33.33% of total rated 4 i.e., these managements were often aware regarding the risk management. Lowest 3.33% out of total rated 2 which means these managements were rarely aware regarding the risk management.

During key informant interview, management awareness regarding risk related to COVID – 19 pandemics was found high. Management was completely aware about social distancing and quarantining measures. The use of face mask and hand sanitizer, frequent hand washing, covering cough and sneeze, adequate ventilation of indoor spaces was well known to the contractor's management.

From the Mishra & Malik (2017), management awareness regarding risk management from housing developers gives the means score of 4.03. From Mishra & Adhikari (2019), management awareness regarding risk management from urban road construction gives mean score of 3.44. However, management awareness at Sindhupalchowk district is slightly less comparatively with mean score of 3.30.

5.1.2. Management Practicing Risk Management Formally or Informally:

As per the 30 responses received during the research, it was observed that managements are averagely practicing the risk management with the mean score of 3.03 on Likert scale.

Table 2: Management Practicing Risk Management Formally or Informally, Contractor's Perspective

Rate	Frequency	Percentage	Mean Score	S.D.
1 (Least Practice)	0	0	3.03	0.48
2	3	10		
3	23	76.67		
4	4	13.33		
5 (Most Practice)	0	0		
Total	30	100		

From the table 4.2, no response was obtained on scale 1 meaning each of the management was practicing risk management to some extent. Most of the respondents i.e., 76.67% of total rated 3 i.e., these managements were averagely practicing risk management. 13.33% of total rated 4i.e. these managements were often practicing risk management. Lowest 10% out of total rated 2i.e. these managements were rarely practicing risk management formally or informally.

During key informant interview, management practicing risk management in response to COVID – 19 pandemics was found satisfactory. The use of mask was found implemented satisfactorily at the construction sites however no hand sanitizer or proper hand washing facilities were available at sites.

From the Mishra & Malik (2017), management practicing risk management from housing developers gives the means score of 3.86. From Mishra & Adhikari (2019), management practicing risk management from urban road construction gives mean score of 3.06. However, management practicing risk management at Sindhupalchowk district is slightly less comparatively with mean score of 3.03.

5.1.3. Management Practicing Risk Management Formally, Contractor's Perspective:

As per the 30 responses received during the research, it was observed that managements are averagely practicing the risk management formally with the mean score of 2.83 on Likert scale.

Table 3: Management Practicing Risk Management Formally, Contractor's Perspective

Rate	Frequency	Percentage	Mean Score	S.D.
1 (Least Practice)	0	0	2.83	0.58
2	8	26.67		
3	19	63.33		
4	3	10		
5 (Most Practice)	0	0		
Total	30	100		

From the table 3, no response was obtained on scale 1 meaning each of management was practicing risk management formally to some extent. Most of the respondents i.e. 63.33% of total rated 3 i.e. these managements were averagely practicing risk management formally. 26.67% of total rated 2 i.e., these managements were rarely practicing risk management. Lowest 10% out of total rated4i.e. these managements were often practicing risk management formally.

During key informant interview, management practicing risk management formally in response to COVID – 19 pandemics was found below satisfactory level. Proper use of face mask was not seen among most of the site personnel. Adequate quarantine facility, hand sanitizer, well sanitized facilities were lacking at the site. Social distancing was major challenge as per response of the interviewee.

From the Mishra & Malik (2017), management practicing risk management from housing developers gives the means score of 3.36. From Mishra & Adhikari (2019), management practicing risk management from urban road construction gives mean score of 3.06. However, managements practicing risk management formally at Sindhupalchowk district is much less comparatively with mean score of 2.83.

5.1.4. Analyzing Various Risk Management Techniques, Contractor's Perspective:

As per the 30 responses received during the research, it was observed that managements are averagely analyzing risk management technique with the mean score of 3.07 on Likert scale.

Table 4: Management Analyzing Various Risk Management Techniques, Contractor's Perspective

Rate	Frequency	Percentage	Mean Score	S.D.
1 (Least Analyzed)	0	0	3.07	0.68
2	6	20		
3	16	53.33		
4	8	26.67		
5 (Most Analyzed)	0	0		
Total	30	100		

From the table 4, no response was obtained on scale 1 meaning each of management was analyzing risk management technique to some extent. Most of the respondents i.e., 53.33% of total rated 3 i.e., these managements were averagely analyzing risk management technique. 26.67% of total rated4i.e. these managements were often analyzing risk management technique. Lowest 20% out of total rated2i.e. these managements were rarely analyzing risk management technique.

In response to COVID – 19 pandemics, as per key informant interview, management were not found to have taken necessary precautionary measures to control the risk of corona virus disease. COVID pandemic was taken very lightly, regular disinfection of the site facilities was not adopted, provision of quarantining the facility upon infection was not performed at most of the sites.

From Mishra & Adhikari (2019), management analyzing risk management technique from urban road construction gives mean score of 1.96. However, managements analyzing risk management technique at Sindhupalchowk district is much more comparatively with mean score of 3.07.

5.1.5. Risk Identification Techniques Used, Contractor's Perspective:

Out of 30 responses received from survey, following chart shows frequency of various risk identification techniques used by management for road construction in Sindhupalchowk District.

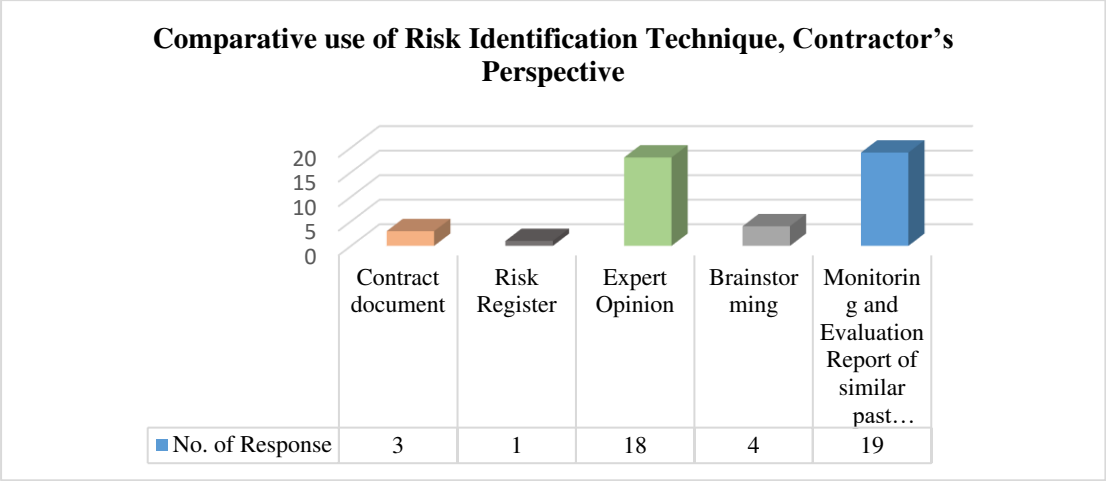

Fig. 1: Comparative use of Risk Identification Techniques, Contractor's Perspective

From figure 1, mostly adopted risk identification technique in Sindhupalchowk district are Expert Opinion and Monitoring and Evaluation report of similar past projects. 63.33% of the respondent used Monitoring and Evaluation report of similar past projects whereas 60% of the respondents used Expert Opinion as well to identify various risk factors. 10% and 13.33% respondent adopt contract document and brainstorming respectively as source of risk identification technique. The least used technique for risk identification was observed to be risk register where only one respondent claimed to use risk

register to identify various risk factors. The comparative analysis can be seen through bar chart shown above.

5.1.6. Risk Analysis Techniques Used, Contractor's Perspective:

Out of 30 responses received from survey, following chart shows frequency of various risk analysis techniques used by management for road construction in Sindhupalchowk District.

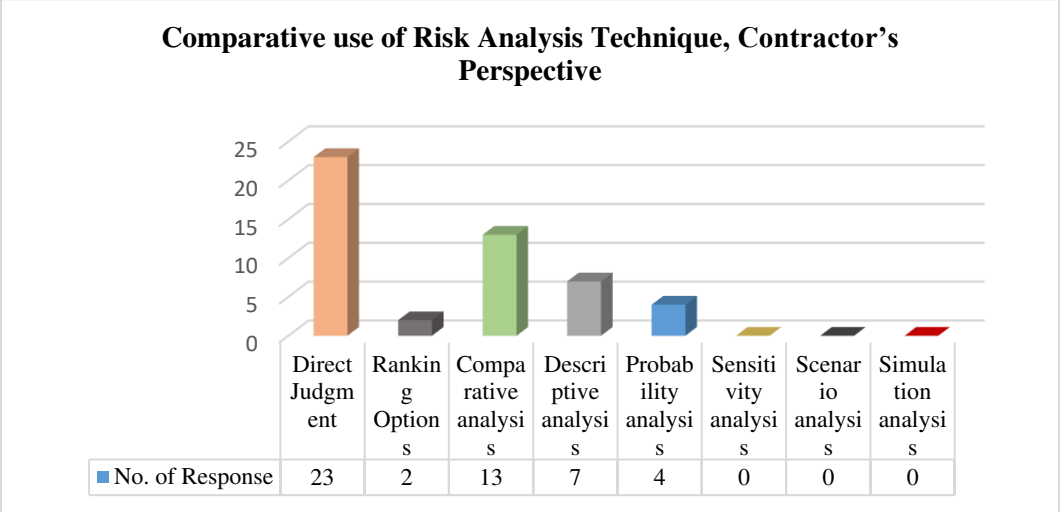

Fig. 2: Comparative use of Risk Analysis Techniques, Contractor's Perspective

From figure 2, mostly adopted risk analysis technique in Sindhupalchowk district is Direct Judgment. 76.67% of the respondent used Direct Judgment to analyze various risk parameters. Secondly used analysis technique were comparative and descriptive analysis used by 43.33% and 23.33% respondents respectively. The least used techniques for risk analysis were observed to be probability analysis and ranking options by two and four respondents only. No respondent claimed to have used sensitivity, scenario and simulation analysis for risk analysis which shows complexity in the use of above technique. Thus, training program is recommended for these techniques of risk analysis at Sindhupalchowk district. The comparative analysis can be seen through bar chart shown above.

5.1.7. Risk Response Strategy Used, Contractor's Perspective:

Out of 30 response received from survey, following chart shows frequency of various risk response strategy used by management for road construction in Sindhupalchowk District.

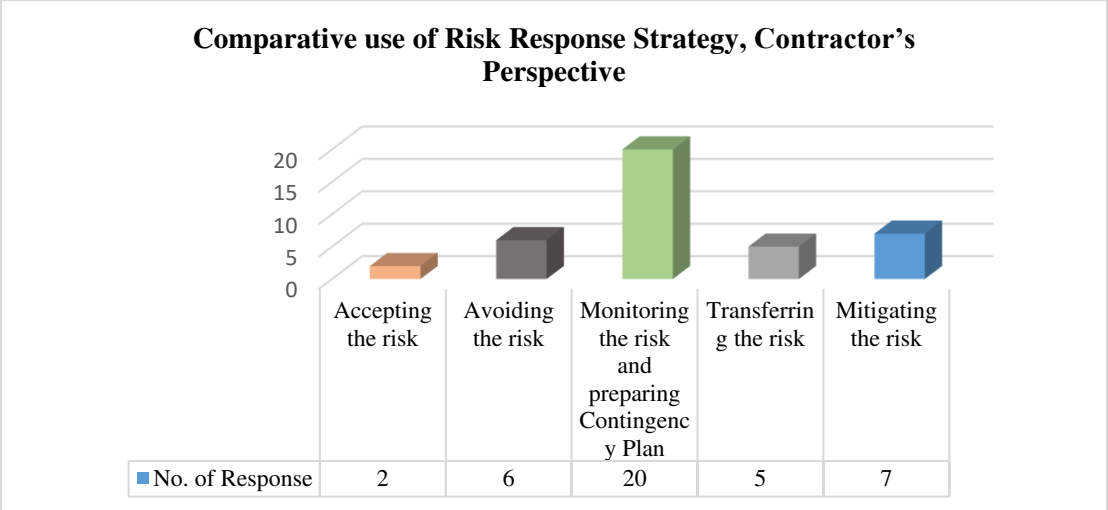

Fig. 3: Comparative use of Risk Response Strategy, Contractor's Perspective

From figure 3, mostly adopted risk response strategy in Sindhupalchowk district was monitoring the risk and preparing contingency plan. 66.67% of the respondent adopted this technique as risk response strategy. Similarly, with more or less equal response, mitigating, avoiding and transferring risks were

widely used by 23.33%, 20% and 16.67% respectively. The least used strategy for risk response was observed to be accepting the risk where only 6.67% respondent claimed to accept the risk depending upon the severity of risk factor. The comparative analysis can be seen through bar chart shown above.

Cronbach's alpha was calculated to test the reliability of response obtained regarding risk management practice of Sindhupalchowk district based on contractor's perspective. The value of Cronbach's alpha is shown below.

Table 5: Reliability Statistics for Risk Management Practice, Contractor's Perspective

No. of Questions (K)	No. of Respondents (N)	Value of Cronbach's Alpha
4	30	0.842

Here, value of Cronbach's alpha for response related to risk management practice based on contractor's perspective lies above 0.8. Hence, the internal consistency of data is good.

5.2 Risk Management Practice, Client's Perspective:

The practice of risk management adopted by client has been analyzed through questionnaire survey. A total of 15 responses were collected from technical persons directly or indirectly related with the study area at Sindhupalchowk District. Risk management practice of urban road construction projects has been obtained from the statistics of management awareness regarding risk management, statistics of management practicing risk management formally/informally, statistics of management practicing the risk management formally and statistics of management analyzing various risk management techniques.

5.2.1. Management Awareness Regarding Risk Management Practice, Client's Perspective:

As per the 15 responses received during the research, it was observed that managements are often aware regarding the risk management with the mean score of 3.93 on Likert scale.

Table 6: Management Awareness Regarding Risk Management, Client's Perspective

Rate	Frequency	Percentage	Mean Score	S.D.
1 (Least Aware)	0	0	3.93	0.68
2	0	0		
3	4	26.67		
4	8	53.33		
5 (Most Aware)	3	20		
Total	15	100		

From the table 6, no response was obtained on scale 1 and 2 meaning each management was little aware regarding risk management. Most of the respondents i.e., 53.33% of total rated 4i.e. these managements were often aware regarding the risk management. 26.67% of total rated 3i.e. these managements are averagely aware regarding the risk management. Lowest 20% out of total rated 5i.e. these managements were highly aware regarding the risk management.

During key informant interview, management awareness regarding risk related to COVID – 19 pandemics was found high. Management was completely aware about social distancing and quarantining measures. The use of face mask and hand sanitizer, frequent hand washing, covering cough and sneeze, adequate ventilation of indoor spaces was well known to the client's management.

From the Mishra & Malik (2017), management awareness regarding risk management from housing developers gives the means score of 4.03. From Mishra &Adhikari (2019), management awareness regarding risk management from urban road construction gives mean score of 4.08. However, management awareness at Sindhupalchowk district based on client's perspective is slightly less comparatively with mean score of 3.93.

5.2.2. Management Practicing Risk Management Formally or Informally, Client's Perspective:

As per the 15 responses received during the research, it was observed that managements are averagely practicing the risk management with the mean score of 3.33 on Likert scale.

Table 7: Management Practicing Risk Management Formally or Informally, Client's Perspective

Rate	Frequency	Percentage	Mean Score	S.D.
1 (Least Practice)	0	0	3.33	0.47
2	0	0		
3	10	66.67		
4	5	33.33		
5 (Most Practice)	0	0		
Total	15	100		

From the table 7, no response was obtained on scale 1 and 2 meaning each management was practicing risk management to some extent. Most of the respondents i.e., 66.67% of total rated 3 i.e., these managements were averagely practicing risk management. 33.33% of total rated 4i.e. these managements were often practicing risk management.

During key informant interview, management practicing risk management in response to COVID – 19 pandemics was found satisfactory. The use of mask was found implemented well at their office as well as construction sites. Adequate use of hand sanitizer or proper hand washing facilities were available as per client's management. Sufficient care was done to control the risk of spread of corona virus disease, however social distancing was still a challenge to satisfactorily achieve the required standard.

From the Mishra & Malik (2017), management practicing risk management from housing developers gives the means score of 3.83. From Mishra & Adhikari (2019), management practicing risk management from urban road construction gives mean score of 4.00. However, management practicing risk management at Sindhupalchowk district based on client's perspective is slightly less comparatively with mean score of 3.33.

5.2.3. Management Practicing Risk Management Formally, Client's Perspective:

As per the 15 responses received during the research, it was observed that managements are averagely practicing the risk management formally with the mean score of 3.13 on Likert scale.

Table 8: Management Practicing Risk Management Formally, Client's Perspective

Rate	Frequency	Percentage	Mean Score	S.D.
1 (Least Practice)	0	0	3.13	0.34
2	0	0		
3	13	86.67		
4	2	13.33		
5 (Most Practice)	0	0		
Total	15	100		

From the table 8, no response was obtained on scale 1 and 2 meaning each management was practicing risk management formally to some extent. Most of the respondents i.e., 86.67% of total rated 3 i.e., these managements were averagely practicing risk management formally. Remaining13.33% out of total rated4i.e. these managements were often practicing risk management formally.

During key informant interview, management practicing risk management formally in response to COVID – 19 pandemics was found good. Proper use of face mask covering complete mouth and nose was observed. Hand sanitizer, well sanitized facilities were available at their working environment. Social distancing, though implemented to a certain level, was still a challenge as per response of the interviewee.

From the Mishra & Malik (2017), management practicing risk management from housing developers gives the means score of 3.36. From Mishra &Adhikari (2019), management practicing risk management from urban road construction gives mean score of 3.66. However, managements practicing

risk management formally at Sindhupalchowk district based on client's perspective is slightly less comparatively with mean score of 3.13.

5.2.4. Management Analyzing Various Risk Management Techniques, Client's Perspective:

As per the 15 responses received during the research, it was observed that managements are averagely analyzing risk management technique with the mean score of 3.40 on Likert scale.

Table 9: Management Analyzing Various Risk Management Techniques, Client's Perspective

Rate	Frequency	Percentage	Mean Score	S.D.
1 (Least Analyzed)	0	0	3.40	0.49
2	0	0		
3	9	60		
4	6	40		
5 (Most Analyzed)	0	0		
Total	30	100		

From the table 9, no response was obtained on scale 1 and 2 meaning each management was analyzing risk management technique to some extent. Most of the respondents i.e., 60% of total rated 3 i.e., these managements were averagely analyzing risk management technique. 40% of total rated4 i.e., these managements were often analyzing risk management technique.

In response to COVID – 19 pandemics, as per key informant interview, management were found to have taken necessary precautionary measures to control the risk of corona virus disease. COVID pandemic was taken seriously. Regular disinfection of the site facilities, sufficient quarantine period for infected employee, provision of quarantining the facility upon infection was performed by client's management. From Mishra & Adhikari (2019), management analyzing risk management technique from urban road construction gives mean score of 2.88. However, managements analyzing risk management technique at Sindhupalchowk district based on client's perspective is much more comparatively with mean score of 3.40.

5.2.5. Risk Identification Techniques Used, Client's Perspective:

Out of 15responsereceived from survey, following chart shows frequency of various risk identification techniques used by management for road construction in Sindhupalchowk District. From figure 4.4 below, mostly adopted risk identification technique by client's management in Sindhupalchowk district is Monitoring and Evaluation report of similar past projects. 93.33% of the respondent used Monitoring and Evaluation report of similar past projects. 26.67%, 33.33% and 40% respondent adopt brainstorming, contract document and expert opinion respectively as source of risk identification technique. The least used technique for risk identification was observed to be risk register where none respondent claimed to use risk register to identify various risk factors. The comparative analysis can be seen through bar chart shown below.

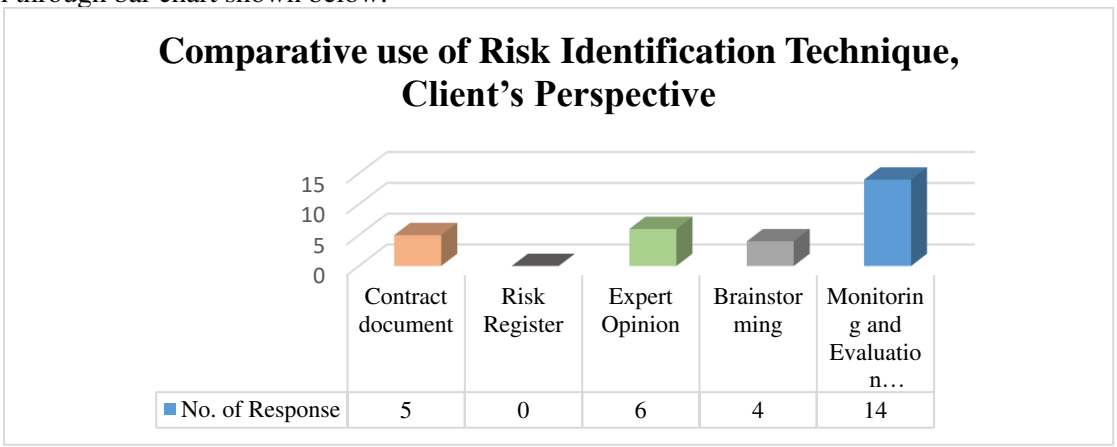

Fig. 4: Comparative use of Risk Identification Techniques, Client's Perspective

5.2.6. Risk Analysis Techniques Used, Client's Perspective:

Out of 15responsereceived from survey, following chart shows frequency of various risk analysis techniques used by management for road construction in Sindhupalchowk District.

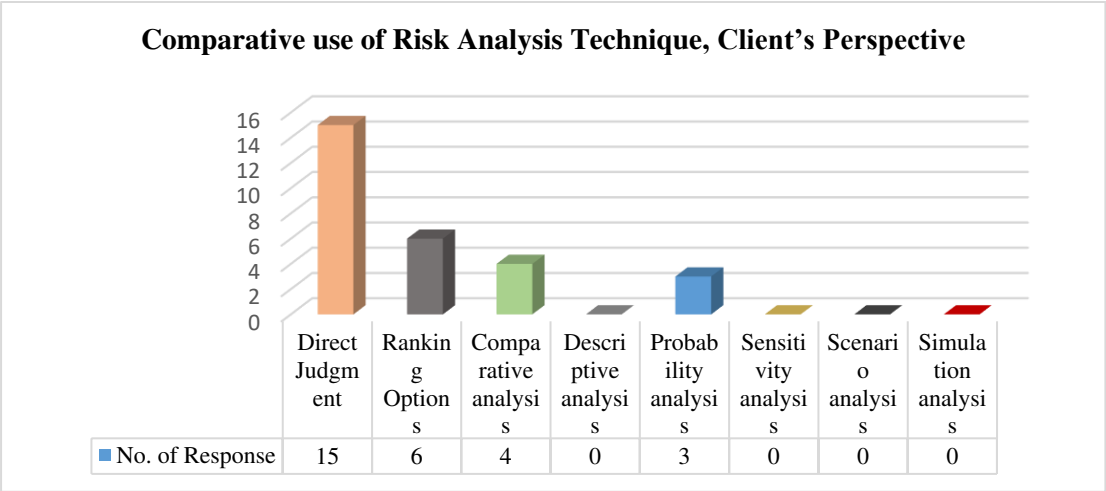

Fig. 5: Comparative use of Risk Analysis Techniques, Client's Perspective

From figure 5, mostly adopted risk analysis technique in Sindhupalchowk district is Direct Judgment. 100% of the respondent used Direct Judgment to analyze various risk parameters. Secondly used analysis technique were ranking options and comparative analysis used by 40% and 26.67% respondents respectively. The least used techniques for risk analysis were observed to be probability analysis by 20% respondents only. No respondent claimed to have used descriptive analysis, sensitivity, scenario and simulation analysis for risk analysis which shows complexity in use of above technique and thus training program is recommended for these techniques of risk analysis.

5.2.7. Risk Response Strategy Used, Client's Perspective:

Out of 15responsereceived from survey, following chart shows frequency of various risk response strategy used by management for road construction in Sindhupalchowk District.

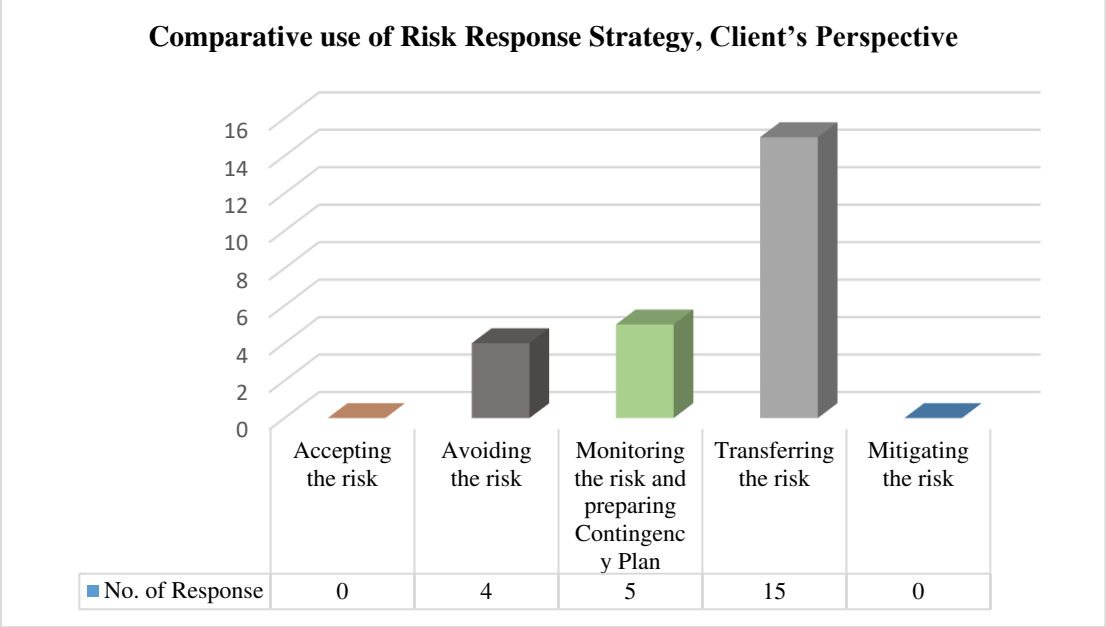

Fig. 6: Comparative use of Risk Response Strategy, Client's Perspective

From figure 6, mostly adopted risk response strategy by client's management in Sindhupalchowk district was transferring the risk to contractor. 100% of the client respondents adopted risk transfer as risk response strategy. Similarly, with more or less equal response, avoiding and monitoring risk and

preparing contingency plan were used by 26.67%and 33.33% respectively. None of the client respondent adopted accepting and mitigating the risk as a risk response strategy.

Cronbach's alpha was calculated to test the reliability of response obtained regarding risk management practice of Sindhupalchowk district based on client's perspective. The value of Cronbach's alpha is shown below.

Table 10: Reliability Statistics for Risk Management Practice, Client's Perspective

No. of Questions (K)	No. of Respondents (N)	Value of Cronbach's Alpha
4	15	0.875

Here, value of Cronbach's alpha for response related to risk management practice based on client's perspective lies above 0.8. Hence, the internal consistency of data is good.

6. CONCLUSION :

Risk management practice based on contractor's perspective shows average awareness of management with mean score of 3.30. Further, managements are found averagely practicing risk management formally or informally with mean score of 3.03. The study shows slight decrease in score for risk management being practiced formally with mean score of 2.83. It is also found that managements are averagely analyzing risk management techniques with mean score of 3.07. Based on contractor's perspective, mostly adopted techniques for risk identification are expert opinion and monitoring and evaluation report of similar past projects. Direct judgment is widely used technique for risk assessment of road construction projects at Sindhupalchowk district. Similarly, monitoring the risk and preparing contingency plan is the mostly adopted risk response strategy by contractors of Sindhupalchowk district. The study of management awareness regarding risk management practice based on client's perspective shows slightly higher score with mean score of 3.93. Further, managements are found averagely practicing risk management formally or informally with mean score of 3.33. The study shows slight decrease in score for risk management being practiced formally with mean score of 3.13. It is also found that managements are averagely analyzing risk management techniques with mean score of 3.40. Based on client's perspective, mostly adopted techniques for Risk Identification is monitoring and evaluation report of similar past projects. Direct judgment is also widely used technique by client for risk assessment of road construction projects at Sindhupalchowk district. Similarly, transfer of risk is the mostly used risk response strategy by clients of Sindhupalchowk district.

7. RECOMMENDATION :

- Training should be conducted for contractor's management related to formal techniques of risk management practice.
- Risk register should be maintained at site and updated on regular basis. Meetings among stakeholders should be conducted to identify the significant risk factors.
- Training should be conducted for client's and contractor's management for Risk Assessment through Sensitivity, Scenario and Simulation Analysis.

7.1 Proposed future studies

It is recommended for the researchers who are interested to conduct thesis work in Risk Management field can study on:

- Risk Management Practice in Nation Highway construction project in Nepal.
- Risk Management Practice in building construction project in Nepal.
- Challenges for road contractors to follow formal risk management methods in Nepalese context.
- Improvement required for road contractors in Risk Management practice.

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