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Identification of risk factors involved in SCP of developing countries-establishing guidelines: an analysis of mixed method sequential approach

Syyed Adnan Raheel Shah[1], Ahsan Nawaz*[2], Muhammad Abid[1], Ahmed Salman Malik[1], Saleem Fakhar[1], Mudassir Elahi[1]

[1] Department of Civil Engineering, Pakistan Institute of Engineering and Technology, Multan (Pakistan)
[2] College of Civil Engineering and Architecture, Zhejiang University, Hangzhou (China)
*Correspondence: ahsanklasra@zju.edu.cn, ahsanklasra@gmail.com

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Abstract: Risk evaluation and its identification is one of the prominent fields in the construction industry concerning performance management and project success. Under the project mechanism and business development system, risk assessment and mitigation are compulsory components of a management network to achieve the project's success. In this study, the major focus of risk assessment and management revolves around the SCP (small construction projects) which are the backbone of the construction industry. Every stakeholder is involved in this process because the construction of the house is a basic need of humans for a living. Targeting the major stakeholders (contractors, consultants, and clients) as mixed-method (qualitative & quantitative) sequential approach has been adopted to evaluate the major risk factors and their occurrence with the assessment of risk management system at the country level in SCP (small construction projects). The data used in this research has been collected from sixty-two (62) small construction firms, thirty-two (32 projects), to attain the research objectives. The results indicate that the performances of most of the risk management system and organizations are responsive, shapeless, semi-stable, and unorganized with inexistent and confined compromised resources to respond with risks. The major issue was identified as the non-existence of a proper risk management system because no formal education is involved with the personals working in small construction projects. The five most important risks that should be preferable are quality and quantity dissimilarity, change in scope of work/design, deficiency of manpower, planning, and management, and technical errors. The prime hurdles which are analyzed for impressive risk management are the absence of connection between construction experts and contractors who have not been formally trained at any technical institute. This study will help in targeting the existing gap for implementation of the risk management system at small construction engineering projects. Furthermore, it will generate a pathway for the young enterprisers to come forward and take part in the development of the small construction industry by implementing effective risk management practices to achieve the project performance in terms of project success and fruitful outcomes for the upcoming projects.

Keywords: risk factors, project performance, risk assessment, SCP, construction development, project success.

1. Introduction

The rapid evolution of the construction industry has placed extra expectations on the construction process. Risk management is an important scheduling and control technique for the management team who want to reduce uncertainty and make better decisions. Risk cannot be eliminated; rather, it must be identified, analyzed, and addressed. The likelihood of risks is quite high due to the engagement of different parties associated with the project, as well as several environmental factors. Construction risk has a negative impact on the project timelines, budget, scope, and performance targets. In comparison to other industries, studies show that the construction sector has a bad experience in risk assessment (Nasir et al., 2003). The construction industry has a wide and comprehensive history with its phases of initiation, execution, monitoring & controlling, and finishing the project (Liu et al., 2018). Houses began to construct since humans left caves and construction as a professional division was introduced before the pyramid construction (Tavakolan and Mohammadi, 2018). As the introduction of risk management in Pakistan has just begun due to which it has been infrequently researched as a subject. The proficient management of the projects is responsible for a disciplined approach to describe, strategize, plan, communicating, and controlling a project. Construction management is an extensive and highly demanding process. It's a backbone for every construction project and the key to its accomplishment (Sharma et al., 2019). The main goal of construction management is to firmly control and observe the betterment of the project in terms of time, quality, and budget. The construction industry and its clients are broadly interconnected with the great importance of risks due to the structure of the microenvironment, and its culture particularly to construction (Zou et al., 2007). When it comes to the construction industry it is reputed to be weak in dealings with risks, as countless projects collapse to satisfy deadlines and financial plans (Fung et al., 2020). Contractors, clients, the community, and others are the ones who suffered as a result.

The risks in a construction project may be known from two sources. The first source known as external risks comprises the environmental influences (Iqbal et al., 2015). While the second source includes the uncertainties extant in the project itself and is known as internal risks (Hwang et al., 2014). Construction projects can be charged with uncertainty and might be extremely complicated (Tang et al., 2007). Risk and uncertainty have harmful results for construction projects (El-Sayegh, 2008). All parties engaged in a building project, including the owner, contractor, or subcontractor, need to save money and get things done on schedule. Construction risk has a negative impact on the project's time, cost, scope, and work quality. Delays and the inability to complete work within the agreed cost and time are the most common causes of building project conflicts. Cost and schedule overruns have an impact not only on the building industry but also on the economy overall. Even though building projects are becoming more expensive and time-consuming, researchers have paid close attention to them (Lyons and Skitmore, 2004). Consequently, nowadays, risk management and analysis continue to be a major feature of the project management of construction projects to deal efficiently with unexpected events and uncertainty to complete the project successfully. The practically common project capacity in the Pakistan construction area is less than 1.5-million PKR (Nawaz et al., 2021a). In the research reported in this study, projects in the range of 1.5 million PKR have been chosen. In smaller projects, the risks tend to be extra reasonable and the consequences are relatively less spectacular (Yingfei et al., 2021). These projects are more ticklish to changes of the kind that have an effect on time while there is a lesser chance of close in on time if the scheduled drop. On the other hand, the essence of the project environments and the construction work are often straightforward (Huo et al., 2021), and the technical provocation is limited (Maqsoom et al., 2021). For powerful management of risks, it is important how people in this industry identify and comprehend each risk (Nawaz et al., 2020).

2. Background

In Pakistan, small construction industry (SCI) is going through a hard phase and the risk phenomenon is also not understood well (Nawaz et al., 2019). If not handled in a proper way, risks may induce failure to abide by intended project goals resulting in issues relevant to the functionality of time delays, increased cost, facilities, and lack of quality (Qin et al., 2021). The construction industry has both i.e. opportunities and challenges. As per, Nawaz et al. (2019), Pakistan's population is over 204.76 million as at end of July 21, 2019, which is proposed to be the world's sixth-largest population with an annual growth rate of 2.65 percent and expected to become the fourth largest nation of the world in terms of population by 2050 (Nawaz et al., 2020). On the other hand, there is a shortage of an estimated 7.57 million housing units in 2019 alone. While housing denotes only a portion of the construction industry. In today's modern construction era, the small construction industry is still surviving besides the fact that there is a lack of management of risks throughout the project which usually leads the project towards failure in terms of time, quality, and money (Ali et al., 2021), different types of risks have a different impact and vary from project size (i.e. small, medium, large), two key risk parameters to develop models are the risk likelihood and risk impact and it should be quantified on both qualitative and quantitative basis (Nawaz et al., 2020), leading to the model followed as shown in Figure 1.

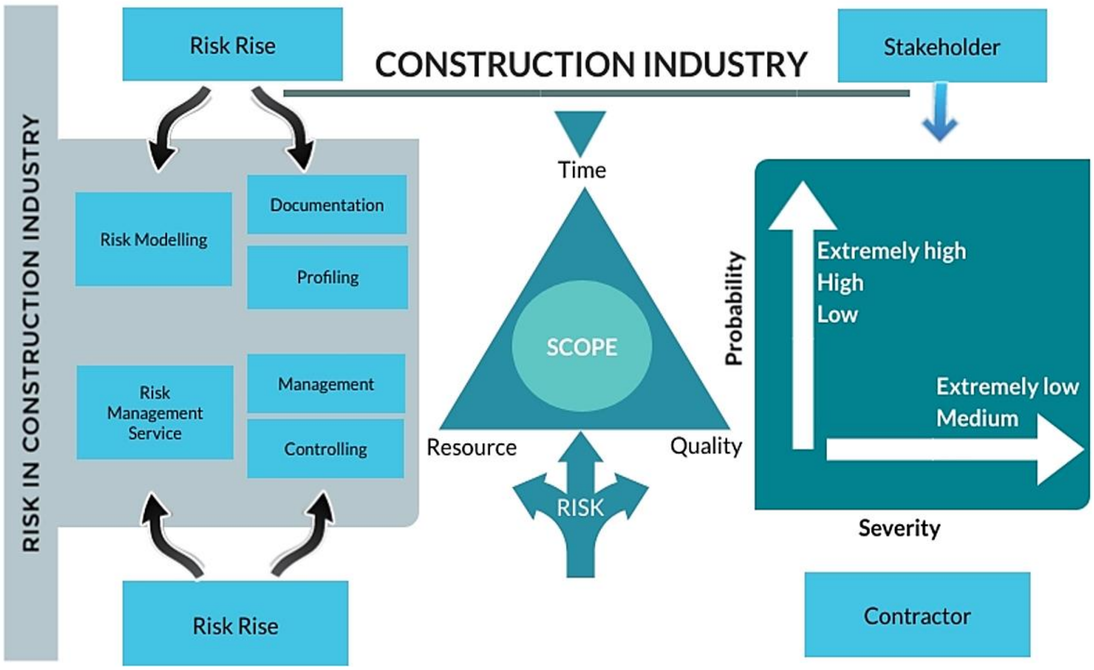

Figure 1. Model of risk in construction industry (Nawaz et al. 2019).

Various risk management approaches were used by different researchers during their investigation in different countries, for instance, the risk of differences between enterprise stakeholders in several projects in UAE construction industry (Sharma et al., 2019) and in Singapore construction industry (Zhang, 2021). Previous empirical research studies of risk management in developing an non-developing countries were mainly (1) US- based study of the top contractors and their perception towards risk management and allocation of risk towards owners (Shayan et al., 2019); (2) UK-based contractors perception study with risk management techniques and the allocation of risk to the different groups i.e clients, consultants, designers (Xiang et al., 2018); (3) Hong Kong-based contractors perception towards usage of risk management techniques and identification of critical risk factors cause trouble in construction projects (Sharma, 2020); (4) Australian-based study with perception of risk awareness and usage of effective risk management practices towards construction industry regarding project life cycle (Hamzaoui et al., 2019); (5) Korean based study, which results in identification of risk factors and their remedial measure based on a comprehensive model with perception of joint venture projects in construction industry (Smith et al., 2014); (6) A developing countries based study emphasizing in China based infrastructure projects with perception of build operate projects (BOP), including identification of critical risk and their remedial measures (Carpio-de Los Pinos and González-García, 2020); (7) Russian-based survey study with perception of role of foreign cooperation in term of joints venture, including the process of identification of critical risk factors and their analysis by using risk management techniques (Mishra and Mishra, 2016); (8) China-based with perception of real life projects in term of joint-venture, study including the method of risk significance index for prioritizing the critical risk factors (Soliño, 2014); (9) A study with the perception of client and owner in term of identifying the risk factors that effect on construction projects and their assessment by using Delphi analysis, in addition it also include the risk management process with maturity model (Wahyudi, 2021); (10) India-based study with the perception of stakeholder in build-operate-transfer (BOT) in roads projects by including high level consultant officer and got officers as respondents, different eight type of risk were identified and their acceptance and allocating were also extensively different according to geographical scenario (Zilke and Taylor, 2015); (11) A Gulf-based study in which, different seventeen 17- case studies has been analyzed on the base of two techniques i.e PERT (program evaluation review technique), Monte Carlo Simulation after identifying the risk which were based on brain storming and expert judgement (Kwofie et al., 2015); **(**12) Taiwan based study with perception of contractors in term of risk allocation, risk analysis strategies focusing on the high way projects, contractual agreement between client and contractors were also be discussed (Walker et al., 2015); (13) Queensland industry-based (Australia) study in term of usage of risk management techniques, including identification process and assessment of risk and comparing those risk to the earlier surveyed around the world, besides finally risk factors were graded as low level, moderate and higher level (Medda, 2007); (14) Korean-based study including the analysis of critical risk of different underground construction projects by using the risk management techniques i.e. risk identification, analyzing of risk, evaluating and monitoring of risk (Wang et al., 2016); (15) A study focused on international construction projects of developing countries in which twenty eight (28) risk were identified and categorized and mitigated by using risk model (Trajkovski and Loosemore, 2006); (16) UK-based study with perception of stakeholders i.e. public and private including allocation of risk to different sectors (Nasirzadeh et al., 2016); (17) China-based study with perception of different allocation of risk i.e. contractor, client, consultant, and compared to the Australian survey data of risk factors, containing the process of identification, and prioritizing by using significance index method.

The study reveals mostly risks were related to the contractors (Mishra and Mishra, 2016); (18) China based study with perception of risk management techniques to analyze the critical factors, status of risk management system, barriers to risk management, comprising study of three gorgeous dam (Bing et al., 2005); (19) Singapore-based study with perception of small projects, including risk management techniques used for small projects and impact of RM on project performance by showing correlation analysis (Jaafari, 2001). Various investigations of different risk management skills have been done, but all these skills and techniques don't need to be appropriate in local environments too with simulation real time management (PMI, 2017) about risk and public perceptions (Sharma et al., 2019), even covering the difference of perception due involvement of foreigners in management (Fung et al., 2020) to handle the different types of risk and to manage project activities (Tepeli et al., 2019).

According to research conducted by Nawaz et al. (2019), risks and opportunities do not favor disciplinary boundaries and emerge over the entire life cycle of the project. Any system that is designed and practiced must object to the life cycle approach, from construction to destruction and so on. If seen from this perspective, the risk management gets replaced over project management as the former infrequently aims at life cycle approach. In addition to it, in companies, the project management methodology accepted does not voluntarily assist the increasing requirements for risk management and projects are hence not set up to manage risk (Low et al., 2008). Risk management can be produced effectively in construction projects by comparing future benefits and likely risk. The threat is considered to be an event of project risk which has great impact on project performance with respect to its success which needs to be achieved (Uher and Toakley, 1999).

Uncertainties and risks do not specify any bad things in construction projects, they only have a positive or negative impacts (Mohamed et al., 2015), Negative risk produces threats and opportunity is produced by positive risk. Uncertainties and risks which have a negative impact deviate the total result of activity from the planned result, both have great effect on duration (time) and financial plan (budget) considering the direction of a positive and negative event. In any case in a system, the negligence in its preparation and execution will surely miss the target at first occurrence and balanced calibration will be required. This will need guidance, patience, leadership, time and resources on parts of management (Rasul et al., 2019). The components which affect the risk in the building at the time of construction are determined by the different constructions like's small, medium and large constructions (Hamzaoui et al., 2019). The main components identified are as follows: (1) project, (2) design, (3) owner, (4) contractors, (5) subcontractors, (6) labors, (7) site staff, (8) material suppliers, (9) equipment, (10) execution, (11) system, (12) budget, (13) environment.

The main aim of this research is to explore the opinion of construction procurators toward various types of risk and corresponding tasks with respect to risk allocation. Whereas the study presents the majorly powerful techniques in order to mitigate or prevent a different variety of risk. The main goal of this study is the recognition of risks in construction projects and examination of responsibilities related to risk and determination of risk order for clients and contractors in order to manage risks essentially. It further tests and measures the relationship between each risk stakeholder occupying risk allocation thorough correlation statistical approach to check the consensus on different risk factors. Furthermore, this research will help to determine and emphasize general risks and its management methods to address the present situation of the application of risk management systems in organizations and hindrances in the construction industry for powerful risk management. By describing relevant risk management techniques, this research makes a novel contribution by classifying essential risks and determines obstacles to effective risk management in the construction industry.

3. SCP (small construction projects)

The definition of "small projects" has been briefed by many authors, in which, Westney (1985) stated about the project as "an effort in which numerous tasks are performed to attain a particular objective". They listed small construction projects as cost range between $5,000 to $50 million. Actually, projects are classified as small when they do not have extensive investment and are started to meet certain business objectives (Liu et al., 2018), for instance, increase of production capacity and conformity with environmental requirements, maintenance, and achievement of research for new product development (Fung et al., 2020). A complimentary conclusion was drawn by the study of Griffith and Headley (1998), that although the term 'small project' is generally used across the construction industry, still it has diversification in the realizing of the expression. Manual for special project management (PMI, 2017) mentioned that "due to the broad modifications in complication, schedule period, relative size, and number of projects executed by an even less homogeneous cross-section of architects, proprietors, constructors, and engineers, it is impossible to define what is a small project properly". It listed $100,000- $25 million cost as small construction project only (Medda, 2007). It has been stated that small projects have certain characteristics that differentiate them from large projects and elaborated its installed cost between $100,000 and $5 million (Iqbal et al., 2015). These characteristics have been compared in different studies through which the broadness in which small projects can be defined as construction duration less than 6 month, $10 million with low level of skilled construction teams and budget (Sharma et al., 2019) as shown in Table 1.

Table 1. Small and large project in context of construction industry.

Factors	Small projects	Large projects
Construction duration	<6 months	>6months
Environment/Regularity	Minimal permitting required	Extensive permitting required
Total installed cost	< $10 Million	> $10 Million
Risk to reputation	Minimal	Significant
Engineering effort	< 5000 Hours	> 5000 Hours
Impact to operations	Minimal	Significant
Team expertise	Minimal special or new	Extensive special or new
Visibility to owner management	Local/Department	Organization/Corporate
Core team resources numbers	1-5 individuals/firms	> 5 individuals/firms
Team resources availability	Mix of full or part-time	Dedicated full-time
Funding decisions	Plant/local	Corporate
Stakeholders impacted	Internal	External
Experience with project characteristics	Repetitive or some new aspects - technology, processes	Extensive new aspects - technology, processes
Core team makeup (Engineering and craft)	1-2 disciplines/crafts	> 2 disciplines/crafts

4. Materials and methods

This was a sequential-mixed study and states the conclusions of the narrative perspective (qualitative approach) and questionnaire survey (quantitative approach). In addition to it, in Pakistan, the record of key participants of projects in the construction industry was also viewed. The questionnaire-based survey and the semi-structure interviews (narrative technique) has been adopted which is most popular is existing literature (Huo et al., 2021; Maqsoom et al., 2021; Nawaz et al., 2021b; Xiaolong et al., 2021). Overall, 15 interviews have been taken from the academia experts and the stakeholders by using the field links. The semi-structure interviews refer the qualitative approach which is most probably used for the extraction of the themes and nodes. A deemed literature analysis provides us a clear picture to identify the risk factors, several articles has been reviewed, investigated, and refined to collect the risk factors. Finally, 11 risk factors (nodes), including 71 sub-nodes has been chosen by the help of a literature review and narrative study approach to form a draft (questionnaire) to collect the reviews of the stakeholders i.e., contractors, clients, consultants. The complete research methodology used in this study is presented in Figure 2.

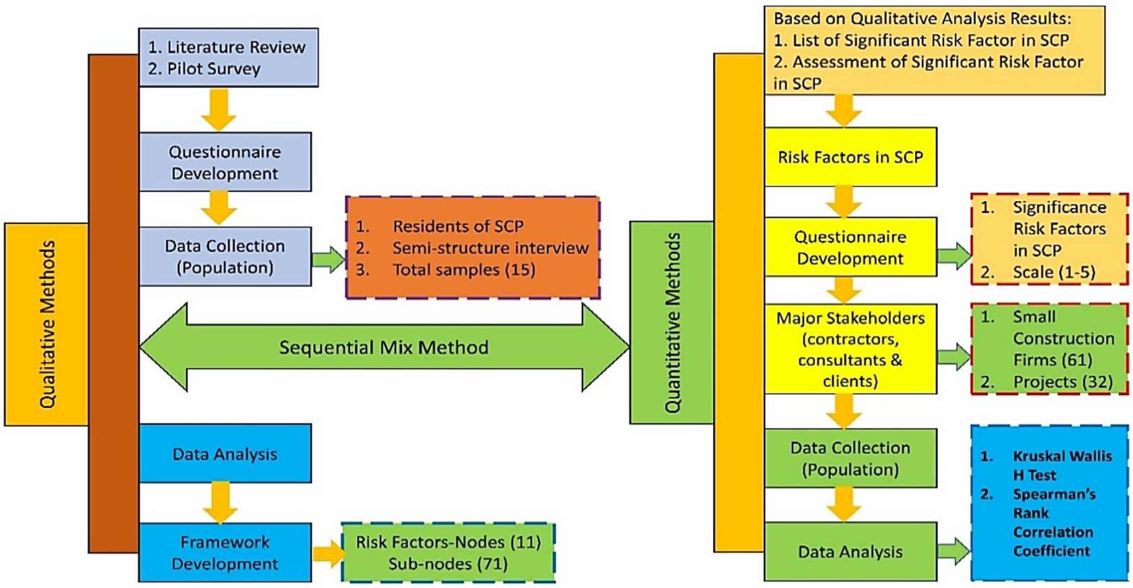

Figure 2. Research methodology (Nawaz et al. 2019).

4.1. *Questionnaire design*

In distinction to the literature review and narrative analysis, a questionnaire was designed, and a pilot survey was organized to investigate the appropriateness of the questionnaire in the local surroundings of the country. For the pilot study, twenty questionnaires were distributed to industry and academia professional's clients (5), contractors (5), universities (5), pursue by consulting with the individual participant. Furthermore, by taking advantage of the social media apps (LinkedIn), the number of 5 (five) drafts has been sent to the international academia working in different parts of the globe (Australia, United Kingdom, Malaysia, Singapore, and China) to check the suitability of the scale. All the defendants had experienced greater than 10 years in their various areas. Interviews were performed personally for achieving a 100% interest rate (Abd El-Karim et al., 2017). To suit the local environments, the questionnaire was modified by merging the assessment of professionals of the construction field. After completion of this pilot study, the final questionnaire was designed with a presentation of the defendant covering their name, construction industry experience, qualifications, organization, appointment, and the association that they serve as (contractor and client). The questionnaire covers eleven core factors:

1) Tender awarding
2) Technical risks
3) Construction risks
4) Contractor risks
5) Labor risks
6) Client risks
7) Market risks
8) MMM (Material/Machine/Manpower)
9) Financial risks
10) Unforeseen risks
11) Environmental risks

This questionnaire is covering 71 total statements. Moreover, in the first section (tender awarding) the 12 major statements were raised, in the second section (technical risks) the 7 major statements were raised, in the third section (construction risks) the 12 major statements were raised, in the fourth section (contractor risks) the 7 major statements were raised, in the fifth section (labor risks) the 9 major statements were raised, in the sixth section (client risks) the 4 major statements were raised, in the seventh section (market risks) the 6 major statements were raised, in the eighth section (MMM risks) the 7 major statements were raised, in the ninth section (financial risks) the 3 major statements were raised, in the tenth section (unforeseen risks) the 2 major statements were raised, in the eleventh section (environmental risks) the 5 major statements were raised. In response, the questionnaire is divided into two kinds of responses (frequency of response and risk occurrence).

4.2. *Survey and data collection*

The developing cities of Pakistan (Multan, Lahore, Karachi, Peshawar, Islamabad) were selected to conduct the survey. Multan known as the city of saints and is located on the banks of the Chenab river in Province Punjab. Furthermore, with respect to area, Multan stands as the 7th largest city of Pakistan. Multan occupies an area of 133 square kilometers (51 sq. mi). While has an approximate population of about 1.43 million people (Nawaz et al., 2019). Lahore is the capital city of Province Punjab with a population of 7.2 Million, Karachi is the capital of Province Sindh with a population of 15 Million, Islamabad is a capital of Pakistan and it makes a population together with neighbor city Rawalpindi of 3 Million (Nawaz et al., 2021b).

Districts of Islamabad, Lahore, Rawalpindi, and Karachi has a significant role on the development of the construction industry of Pakistan. Keeping in view the quality of data, the under-construction projects (houses, small markets, local plazas) located in Lahore, Islamabad/Rawalpindi, Multan and few projects in Province KPK were visited personally for data collection to get the questionnaire completed face to face/by interviews whereas the data from other cities were collected through postal mails by adopting the Fieldwork approach. The two major groups of respondents were made (clients and contractors). Around two hundred and forty-two (242) questionnaires were distributed around the country. In the next stage, the samples were refined and screened out to get the data in raw form, which can be used for the statistical analysis (quantitative). Five number of questionnaire were found incomplete, and 11 drafts found the missing values, so in this way total number of two hundred twenty-six (226) samples has been finalized for the analysis. The fieldwork path was used to give out and fetch back the given questionnaires, where an interview was conducted before collecting each. Among which sixty-five percent (65%) of the total defendants had the experience of 10 or more years, and the rest had the experience of 4 to 10 years in the construction area. By the geological diffusion of the respondents, their industrial advancement contribution, and broad experience in a wide range of construction projects, comprehensive data was collected and proposed to be illustrative of the construction industry.

5. Analysis and discussion

The basic statistical techniques used in order to examine the data are given below: The study concluded level 0.05 as the figure that was statistically significant, and 0.01 as highly significant. Where the statistical techniques that were used to inspect the data are briefed below: In this research, a similar population risk value was the basis of ranking in this research.

- Kruskal Wallis H test

This method is basically non-parametric and it is utilized for the comparability between two or more variables for testing the attitude of every group (client and contractor) related to the effect of a certain risk, obstacles to the risk management and management approach to direct the risk (Low et al., 2008). The null hypothesis for the test shows that the means of variables are balanced and if the result is powerful, then it refused (Reader et al., 2015). The achieved results are then tested against the highly statistically significant (0.01) and start of the statistical significance (0.05).

- Spearman's rank correlation coefficient

This technique produces a non-parametric measure of the direction and strength of the relationship among the two variables which is calculated on somewhat an ordinal scale and symbolically denoted by the symbol r (rho)(Avotra et al., 2021; Hao et al., 2020). It analyses the agreement between the different groups (client and contractor) on the project's risks affect ranking, the management approaches employed, and obstacles to the execution of effective risk management (Mohamed et al., 2015). The null hypothesis for this test concluded that there were no interrelationships between the variables, and it refused if the result is statistically significant at 0.01 and significant at the level of 0.05.

5.1. *Significance of risk factors*

Defendants were convinced to give responses about the significance of 11 risk factors that affect the construction industry on Likert-scale of 1-5, where 1 expressed very low occurrence of the risk and 5 expressed very high occurrence (see Table 2). The overall ranking of risk factors according their risk values are shown as; market risks (risk value = 11.66), environmental risks (risk value = 11.24), labor risks (risk value = 11.03), unforeseen risks (risk value = 11), contractor risks (risk value = 10.97), construction risks (risk value = 10.91), owner risks (risk value = 10.60), financial risks (risk value = 10.54), technical risks (risk value = 10.22), tendering risks (risk value = 9.86), MMM (material / machine / manpower) risks (risk value = 9.78).

Table 2. Ranking of tendering awards.

Statements	Overall		Contractor		Client	
	R.V*	Rank	R.V	Rank	R.V	Rank
Market risks	11.66	1	9.41	11	10.31	9
Environmental risks	11.24	2	10.64	8	9.79	10
Labor risks	11.03	3	11.04	3	10.79	6
Unforeseen risks	11.00	4	10.81	5	11.13	3
Contractor risks	10.97	5	11.14	2	10.91	4
Construction risks	10.91	6	10.86	4	10.35	8
Owner risks	10.60	7	12.52	1	10.80	5
Financial risks	10.54	8	10.39	10	9.17	11
Technical risks	10.22	9	10.60	9	10.48	7
Tendering risks	9.86	10	10.78	6	11.22	2
MMM (material/machine/man power)	9.78	11	10.75	7	11.73	1

Note: *R. V = Risk value

5.2. *Risk factors related to tendering awards*

A scale of 1–5 was used to identify the approaches where 5 represented always used and 1 represented never used, and defendants were asked to identify the rate of occurrence of use of these five risk identification approaches. An overall risk value ranking of tendering awards was calculated for each group (see Table 3). High risk of losses for contractor in target contract (risk value = 12.56), high risk of losses for contractor in lump sum contract (risk value = 11.28), selective tendering (risk value = 10.26), high risk of losses for contractor in cost-plus contract (risk value = 10.23), cost plus (risk value = 10.12), unit price contract (risk value = 9.89), lump sum contract (risk value = 9.86), target cost contract (risk value = 9.74), negotiated tendering (risk value = 9.61), open tendering (risk value = 8.98), high risk of losses for contractor in-unit contract (risk value = 6.07). Contractor and client have similar perceptions on lump sum contract (p=0.06) and unit price contract (p=0.05) which is revealed by Kruskal-Wallis Test. As according to Kruskal-Wallis test null hypothesis shall be rejected if the significant value is less than (0.05), whereas, if significant value of Kruskal-Wallis test is more than 0.05 then the null hypothesis shall be retained (Khan et al., 2019; Medda, 2007).

Table 3. Ranking of tendering awards.

Statements	Overall		Contractor		Client	
	R.V*	Rank	R.V	Rank	R.V	Rank
Open tendering is good for small construction.	8.98	10	8.75	10	9.18	10
Selective tendering is good for small construction.	10.26	3	9.40	6	10.99	4
Negotiated tendering is good for small construction.	9.61	9	9.1	8	10.10	6
Lump sum contract is good for the small construction.	9.86	7	9.64	5	10.08	7
Unit price contract is good for the small construction.	9.89	6	9.28	7	10.43	5
Cost plus contract is good for the small construction.	10.12	5	10.17	3	10.01	8
Target cost contract is good for the small construction.	9.74	8	10.05	4	9.424	9
There is high risk of losses for contractor in lump sum contract.	11.28	2	11.15	2	11.39	3
There is high risk of losses for contractor in unit contract.	6.07	11	5.09	11	7.11	11
There is high risk of losses for contractor in cost plus contract.	10.23	4	8.88	9	11.67	2
There is high risk of losses for contractor in target contract.	12.56**	1	12.03	1	13.10	1

*R.V= Risk value, **Kruskal-Wallis significant level (0.01 or 0.05)

The result of Spearman correlation (see Table 4) reveals that contractor and client do not agree with one another's ranking with the significant value of (r = 0.47) and value of significance value (p = 0.56). They differ between the results of clients and contractors is due to low expertise of client as compared to contractors. Many parties rely on information extracted on electronic and printed media and personal experience. Nonetheless, they do recognize that risk arises as a result of finding made in the backdrop of tender awarding risk (Fung et al., 2020). Furthermore, providing training and using creative people for the identification of risk is an uncommon event, and entirely idea input approaches are utilized for this purpose (Sharma et al., 2019).

Table 4. Spearman's correlation for tendering awards.

Group	Client		Contractor	
	r	p	r	p
Client	1	-	0.47	0.566
Contractor	0.47	0.566	1	-

Note: r = Spearman's correlation coefficient; P = significance value

5.3. *Risk factors related to technical risks*

On a scale of 1–5, defendants were convinced to identify the rate of occurrence of operation of five risk identification methods, where, 5 represents always used approach and 1 represents never used approach. An overall risks value ranking of technical risks was computed for each group (see Table 4). Changes in requirements (risk value = 11.41), complexity of interior and exterior designs (risk value = 11.12), improper estimation of budget (risk value = 10.62), lack of technical skill (risk value = 10.17), changes and errors in design (risk value = 9.53), incomplete drawing details (risk value = 9.51), time gap in revision of drawings (risk value = 9.09). The low-risk values refer that analysis is hardly applied for previously determined risks, and with their utility, these groups are not very common (Iqbal et al., 2015). The perception of various groups differs significantly in incomplete drawing details (p = 0.04) according to Kruskal-Wallis test.

Table 5. Ranking of technical risks.

Statements	Overall		Contractor		Client	
	R.V	Rank	R.V	Rank	R.V	Rank
Design errors/changings in design.	9.53	5	10.26	6	8.81	6
Incomplete drawing details.	9.51	6	9.97	7	9.06	5
Changes in requirements by owner.	11.41	1	10.74	3	12.10	1
Time gap of revision of drawings (incorrect).	9.09	7	10.56	4	7.722	7
Complexity of interior and exterior designs.	11.12	2	10.95	2	11.27	2
Improper estimation of budget.	10.62	3	11.62	1	9.67	4
Useful technical skills are not available.	10.17	4	10.36	5	9.95	3

The result of Spearman correlation (see Table 6) reveals that contractor and client do not agree with one another's ranking with the significant value of (r = 0.46) and value of significance (p = 0.26).

Table 6. Spearman's correlation for technical risks.

Group	Client		Contractor	
	r	P	R	p
Client	1	-	0.46	0.263
Contractor	0.46	0.263	1	-

Note: r = Spearman's correlation coefficient; P = value of significance

5.4. *Risk factors related to construction risks*

On a scale of 1–5, defendants were convinced to identify the rate of occurrence of operation of five risk identification methods, where, 5 represents always used approach and 1 represents never used approach. An overall risks value ranking of construction risks was calculated for each group (see Table 7). Quality of construction (risk value = 12.95), independent contractor (risk value = 12.76), fluctuation of material rate (risk value = 11.89), defective material supply (risk value = 11.57), shortage of material supply (risk value = 11.22), insufficient construction knowledge (risk value = 10.93), difference in site condition (risk value = 10.77), shortage of qualified labor (risk value = 10.61), contractor dependent on basic rules (risk value = 10.41), drawing issues resolving by his own (risk value = 10.32). Kruskal-Wallis test revealed that all the groups had almost same opinion about individual other than the fluctuation of material rate (p=0.03). According to this factor, the study concluded that faulty design and accidents on site are the most dangerous risks that affect maximum construction projects. Moreover, the contractor is in charge for management of maximum risks occurring at sites during the execution stage, for example, issues related to labor, problems with subcontractors, quality and presence of materials, while the client is responsible for the risks those are related to design documents, regulations financial issues, and alterations in codes, and the scope of work and its justifies the findings of (Fung et al., 2020; Khan et al., 2019; Medda, 2007; Tang et al., 2007).

Table 7. Ranking of construction risks.

Statements	Overall		Contractor		Client	
	R.V	Rank	R.V	Rank	R.V	Rank
Chances of injuries and accidents in peak hours.	8.76	12	8.64	11	8.88	12
Chances of injuries and accidents in overtime shifts.	8.76	11	8.40	12	9.12	11
Shortage of qualified labor.	10.61	8	10.92	8	10.30	8
Fluctuation of material rate.	11.89	3	12.25	4	11.54	4
Shortage of material will delay the project.	11.22	5	12.45	3	9.98	10
Quality of construction depends on the experience of contractor.	12.95	1	12.89	2	13.02	1
Insufficient construction knowledge (i.e.; designer/contractor/ labor)	10.93	6	11.82	5	10.04	9
Defective material supply.	11.57	4	11.05	6	12.10	3
Contractor will not dependent on the basic rules at local area.	12.76	2	13.08	1	12.45	2
Contractor will be dependent on the basic rules in colonies.	10.41	9	10.10	9	10.72	6
If there is a mistake in design, you will sort it out by yourself rather than asking designer.	10.32	10	9.89	10	10.75	5
The actual site condition is different from those explained in the contract documents	10.77	7	10.99	7	10.55	7

In construction risks factor it is cleared the according to spearman correlation (see Table 8) both contractor and client do not agree with one another's ranking with the significant value of (r = 0.6) and value of significance value (p = 0.35).

Table 8. Spearman's correlation for construction risks.

Group	Client		Contractor	
	r	p	r	p
Client	1	-	0.6	0.0353
Contractor	0.6	0.035	1	-

Note: r = Spearman's correlation coefficient; P = value of significance

5.5. *Risk factors related to contractor risks*

Defendants were convinced to identify the frequency of usage of five risk identification approaches on a scale of 1–5, where 5 denoted always used approach and 1 represented never used approach. A risks value ranking of contractor risks was computed overall for every group (see Table 8). Lack in supervision (risk value = 11.62), low experience of contractor (risk value = 11.42), contract vs daily wages system (risk value = 11.12), lack of rework potential (risk value = 11.05), shortage of manpower (risk value = 10.72), shortage of material (risk value = 10.62), poor communication of contractor (risk value = 10.26). The Kruskal-Wallis test declares that impressions were similar for both groups about individual barriers and has a value of ($p > 0.05$) then retain the null hypothesis. The planning for works projects that require contractors has to be carefully considered and will depend on the purpose and scope of the works, schedules and timing, penalties and pricing and the legal framework that occurs where the works will be undertaken. A crucial consideration at the planning stage is describing where risk can be proposed into an organization's actions, exclusively where those contractors are operating huge risk, non-routine or safety-critical activities (Kangari, 1995; Uher and Toakley, 1999).

Table 9. Ranking of contractor risk.

Statements	Overall		Contractor		Client	
	R.V	Rank	R.V	Rank	R.V	Rank
Shortage of manpower.	10.72	5	11.27	4	10.17	7
Shortage of material while needed urgent.	10.62	6	10.03	6	11.22	3
Poor communication of contractor with labor.	10.26	7	10.11	5	10.41	6
Lack in supervision.	11.62	1	11.35	3	11.90	2
Low experience of contractor causes delay & losses.	11.42	2	11.62	1	11.21	4
Lack of rework potential when errors occurred.	11.05	4	11.42	2	10.68	5
Contract is war better than weekly wages system.	11.12	3	9.90	7	12.34	1

In contractor risks factor it is cleared the according to Spearman correlation (see Table 10) both contractor and client do not agree with one another's ranking with the significant value of (r = 0.54) and value of significance value (p = 0.438).

Table 10. Spearman's correlation for contractor risks.

Group	Client		Contractor	
	r	p	r	p
Client	1	-	0.54	0.438
Contractor	0.54	0.438	1	-

Note: r = Spearman's correlation coefficient; P = value of significance

5.6. *Risk factors related to labor risks*

Defendants were convinced to identify the rate of occurrence of the utilization of five risk identification approaches set on a scale of 1–5, where 5 represented always utilized approach and 1 represented never used approach. An overall risks value ranking of labor risks was calculated for each group (see Table 11). Labor from far areas (risk value = 12.46), temporary labor (risk value = 12.42), labor mood (risk value = 11.65), local labor (risk value = 11.08), wastage of material by labor (risk value = 10.75), contractor should have team (risk value = 10.73), disputes among labor (risk value = 10.31), alteration is quality (risk value = 10.23), weekly wages system (risk value = 9.59). The Kruskal-Wallis test declares that both groups have similar impressions about the individual barriers except labor from far areas (p=0.04). Not having enough manpower available to complete a project or achieve productivity goals is a serious risk when taking on new projects (Barber, 2005). The project can suffer from potential delays without the workers to perform the work, in delivering the project on time to the owner longer construction schedules (Sharma, 2020).

Table 11. Ranking of labor risks.

Statements	Overall		Contractor		Client	
	R.V	Rank	R.V	Rank	R.V	Rank
Contractor should have his own team.	10.73	6	11.2	5	10.23	7
Temporary labor would cause delay in construction.	12.42	2	12.46	2	12.38	1
Local labor works with honesty.	11.08	4	11.28	4	10.88	5
Labor from far areas works with honesty.	12.46	1	13.44	1	11.48	3
Speed in work depends on the labor mood.	11.65	3	11.42	3	11.89	2
Weekly wages system is beneficial than daily wages.	9.59	9	8.642	9	10.55	6
Disputes among labor causes delay in construction.	10.31	7	10.90	6	9.73	9
Alteration in quality can cause due to unskillful labor.	10.23	8	10.62	7	9.84	8

Wastage of material by labor increase the loss rate.	10.75	5	10.29	8	11.21	4

In labor risks factor it is cleared the according to spearman correlation (see Table 12) both contractor and client do not agree with one another's ranking with the significant value of (r = 0.61) and value of significance value (p = 0.07).

Table 12. Spearman's correlation for labor risks.

Group	Client		Contractor	
	r	p	r	p
Client	1	-	0.61	0.0714
Contractor	0.61	0.0714	1	-

Note: r = Spearman's correlation coefficient; P = value of significance

5.7. *Risk factors related to owner risks*

Defendants were convinced to identify the frequency of usage of five risk identification approaches on a scale of 1–5, in which 5 represented always used approach and 1 represented never used approach. An overall risks value ranking of owner risks was computed for each group (see Table 13). Delay in providing budgets (risk value = 11.12), unrealistic contract duration (risk value = 10.70), change in specifications (risk value = 10.30), conflicts with contractor (risk value = 10.3). The Kruskal-Wallis test declares that all the groups have similar impressions about the individual barriers and has value of (p > 0.05) then retain the null hypothesis. The owner plays very important role in construction process in terms of providing budgets, relationships with contractor and providing realistic duration for the completion of works (Carpio-de Los Pinos and González-García, 2020).

Table 13. Ranking of owner risk.

Statements	Overall		Contractor		Client	
	R.V	Rank	R.V	Rank	R.V	Rank
Delay in providing budgets.	11.12	1	11.55	1	10.68	1
Change in specifications during construction.	10.30	3	10.17	4	10.43	2
Conflicts with contractor.	10.3	4	10.49	3	10.10	4
Unrealistic contract duration imposed by the owner.	10.70	2	11.232	2	10.17	3

In owner risks factor it is cleared the according to spearman correlation (see Table 14) both contractor and client do not agree with one another's ranking with the significant value of (r = 0.04) and value of significance value (p = 0.809).

Table 14. Spearman's correlation for owner risks.

Group	Client		Contractor	
	r	p	r	p
Client	1	-	0.4	0.809
Contractor	0.4	0.809	1	-

Note: r = Spearman's correlation coefficient; P = value of significance

5.8. *Risk factors related to market risks*

A scale of 1–5 was used to identify the approaches where 5 represented always used and 1 represented never used. A total risks value ranking of market risks was calculated for each group (see Table 15). Low-rate contractor (risk value = 12.38), increase of labor price (risk value = 11.32), construction cost overrun (risk value = 11.25), increase of materials price (risk value = 11.24). According to market risks, if we discuss the selection of contractor then it should not be much cheaper because in that case there are huge chances of corruption and lower quality of working by contractor as he will try his best to save more of the money.

Table 15. Ranking of market risk.

Statements	Overall		Contractor		Client	
	R.V	Rank	R.V	Rank	R.V	Rank
Low rate contractor will lower down the quality of construction.	12.83	1	13.76	1	11.9	1
Increase of labor price.	11.32	2	11.42	4	11.22	2
Increase of materials price.	11.24	4	12.14	3	10.35	3
Construction cost overrun.	11.25	3	12.78	2	9.734	4

In market risks factor it is cleared the according to spearman correlation (see Table 16) both contractor and client do not agree with one another's ranking with the significant value of (r = 0.2) and value of significance value (p = 0.33).

Table 16. Spearman's correlation for market risks

Group	Client		Contractor	
	r	p	r	p
Client	1	-	0.2	0.333
Contractor	0.2	0.333	1	-

Note: r = Spearman's correlation coefficient; P = value of significance

5.9. *Risk factors related to MMM (material/machine/manpower) risks*

A scale of 1–5 was used to identify the approaches where 5 represented always used and 1 represented never used. An overall risks value ranking of MMM Risks was calculated for each group (see Table 17). Change is specifications (risk value = 10.43), shortage of material (risk value = 10.17), shortage of manpower (risk value = 9.89), delay in material's delivery (risk value = 9.85), lack of machinery (risk value = 9.72), failure of machinery (risk value = 9.68), unqualified manpower (risk value = 8.72). In MMM risk factor the most important risk is change in specifications which is very common on small level construction (Barber, 2005; Bing et al., 2005), many owners used to change the specification during the construction period which slows down or break the flow of construction and causes delays (Mohamed et al., 2015).

Table 17. Ranking of MMM risk.

Statements	Overall		Contractor		Client	
	R.V	Rank	R.V	Rank	R.V	Rank
Delay in material's delivery.	9.85	4	10.94	2	8.77	5
Shortage of material while needed.	10.17	2	9.73	7	10.62	1
Lack of machinery.	9.72	5	10.10	4	9.35	4
Shortage of manpower.	9.89	3	11.48	1	8.29	6
Unqualified manpower.	8.72	7	9.78	6	7.67	7
Failure of machinery.	9.68	6	9.85	5	9.52	3
Changing in material type/specification during construction.	10.43	1	10.88	3	9.98	2

In MMM risks factor it is cleared the according to spearman correlation (see Table 18) both contractor and client do not agree with one another's ranking with the significant value of (r = 0.35) and value of significance value (p = 0.649).

Table 18. Spearman's correlation for MMM risks.

Group	Client		Contractor	
	r	p	r	p
Client	1	-	0.35	0.649
Contractor	0.35	0.649	1	-

Note: r = Spearman's correlation coefficient; P = value of significance

5.10. *Risk factors related to financial risks*

A scale of 1–5 was used to identify the approaches where 1 represented never used and 5 represented always used. An overall risks value ranking of financial risks was calculated for every group (see Table 19). Delay in wages of labor (risk value = 11.12), delay in payments (risk value = 10.62), corruption and bribery (risk value = 9.89). At small level construction projects, timely wages of labor plays an important role to speed up the construction process, as well as corruption is also an issue on small level construction which can be resolved by good imposed budget for contractor (Jaafari, 2001). In addition to it, check and balance in quality and specifications of works also plays a vital role in project success (Kerkhove and Vanhoucke, 2017).

Table 19. Ranking of financial risk.

Statements	Overall		Contractor		Client	
	R.V	Rank	R.V	Rank	R.V	Rank
Delay in payments to (contractor by owner).	10.62	2	10.36	3	10.88	2
Delay in wages of labor.	11.12	1	10.55	2	11.69	1
Loss occurred due to corruption and bribery.	9.89	3	10.90	1	8.88	3

The result of spearman correlation (see Table 20) reveals that contractor and client do not agree with one another's ranking with the significant value of (r = 0.5) and value of significance value (p = 0.384).

Table 20. Spearman's correlation for financial risks.

Group	Client		Contractor	
	r	p	r	p
Client	1	-	0.5	0.384
Contractor	0.5	0.384	1	-

Note: r = Spearman's correlation coefficient; P = value of significance

5.11. *Risk factors related to unforeseen risks*

A scale of 1–5 was used to identify the approaches where 1 represented never used and 5 represented always used. An overall risks value ranking of financial risks was computed for each group (see Table 21). Laws of community (risk value = 11.35), effect of change of change of government (risk value = 10.65). The Kruskal-Wallis test showed that all groups have almost same impressions about the individual barriers and has value of ($p > 0.05$) then retain the null hypothesis. At small level construction if project is in colony or at commercial area then contractor has to follow the rules and law of that specific area such as no distraction to surroundings also whenever government changes it disturbs the economy of country which causes the fluctuation in material prices so it can disturb the budget of project according to owners during survey.

Table 21. Ranking of unforeseen risk.

Statements	Overall		Contractor		Client	
	R.V	Rank	R.V	Rank	R.V	Rank
Change of government will effect cost of project.	10.65	2	10.62	2	10.68	2
Laws of community (i.e. colony) can delay the construction.	11.35	1	10.94	1	11.76	1

The result of spearman correlation (see Table 22) reveals that contractor and client are nearly agree with one another's ranking with the significant value of (r = 1) and value of significance value (p = 0.714).

Table 22. Spearman's correlation for unforeseen risks.

Group	Client		Contractor	
	r	p	r	p
Client	1	-	1	0.714
Contractor	1	0.7142	1	-

Note: r = Spearman's correlation coefficient; P = value of significance

5.12. *Risk factors related to environmental risks*

A scale of 1–5 was used to identify the approaches where 1 represented never used and 5 represented always used. An overall risks value ranking of environmental risks was calculated for every group (see Table 23). Construction rate is fast in winter season (risk value = 12.03), construction rate is fast in summer season (risk value = 11.77), construction quality is good summer season (risk value = 11.66), construction quality is good winter season (risk value = 11.21), rainy season distracts the flow of construction (risk value = 9.52). The Kruskal-Wallis test shows that all the groups have almost same impressions about the individual barriers and has value of (p > 0.05) then retain the null hypothesis. During survey the contractors and clients provide different statements according to their expertise that either summer season is good for construction or winter season regarding speed, strength and effort etc.

Table 23. Ranking of environmental risk

Statements	Overall		Contractor		Client	
	R.V	Rank	R.V	Rank	R.V	Rank
Construction rate is fast in summer season.	11.77	2	11.68	1	11.86	3
Construction rate is fast in winter season.	12.04	1	11.55	3	12.53	1
Construction quality is good summer season.	11.66	3	11.55	2	11.76	4
Construction quality is good winter season.	11.21	4	10.04	4	12.38	2
Rainy season distracts the flow of construction.	9.52	5	8.93	5	10.11	5

The result of spearman correlation (see Table 24) reveals that contractor and client do not agree with one another's ranking with the significant value of (r = 0.2) and value of significance value (p = 0.612).

Table 24. Spearman's correlation for environmental risks.

Group	Client		Contractor	
	r	P	r	p
Client	1	-	0.2	0.612
Contractor	0.2	0.612	1	-

Note: r = Spearman's correlation coefficient; P = value of significance

6. Conclusion

The research reflects the identification of major risk factors that involve in the process of the small construction projects from the initiation phase to the closing ones. Risk Management is one of the prominent approaches to attain the project success as a milestone, while executing the construction projects. To achieve the research findings, a mixed-method sequential approach has been adopted by applying the narrative (qualitative) and quantitative analysis. Semi-structured interviews triggered an opportunity towards the selection of the major nodes (risk factors), and the analysis of thirty research papers was also used as a narrative tool to verify and select and risk factors concerning the success of small construction projects. A qualitative analysis based on the survey declared numerous points of risk evaluation and performance management methods except contributing instructions to the stakeholders about the concern of risks in the construction industry. Outcomes create the chances for the consultants, contractors, and clients, including major and minor stakeholders, to consider the risk management approaches for their current and under planning SCP (small construction projects). Some of the described outcomes are expressed. The most important findings from this research acknowledged us some important points that.

1. Project should not be awarded to low-rate contractor; In small construction, unit price contract is very beneficial in achieving the objectives of the project; lack of experience of the contractor makes it very difficult to achieve the objectives of projects; contractor should have his own team; client should be satisfied with design before the construction.
2. The overall ranking of risk factors according their risk values are shown as; market risks (risk value = 11.66), environmental risks (risk value = 11.24), labor risks (risk value = 11.03), unforeseen risks (risk value = 11), contractor risks (risk value = 10.97), construction risks (risk value = 10.91), owner risks (risk value = 10.60), financial risks (risk value = 10.54), technical risks (risk value = 10.22), tendering risks (risk value = 9.86), MMM (material/machine /manpower) risks (risk value = 9.78).
3. The five most important risks that should be preferable are quality and quantity dissimilarity, change in scope of work/design, deficiency of manpower, planning, and management, and technical errors.
4. The applicability and usage of risk management approaches require to have opted in the small local level construction projects. In small level construction, contractors are unaware of risk management approaches and techniques for the better performance of they should follow the proper planning and risk management techniques. The pre and post planning approaches for better management are also beneficial.
5. Systematic development in the risk maturation level of the construction firms at the local level should take place. It can be done by injecting the series of knowledge-based short courses.

The prime hurdles which are analyzed for impressive risk management are the absence of connection between technical experts and contractors who have not been formally trained at any technical institute. Technical experts can easily implement this research on real field analysis by providing proper technical and materials support, safe environment as well as following safety laws and rules. Therefore, enhancement of risk management system is needed by the parties (i.e., contractors, consultants, and clients), specifically at local level small projects, its contractual features should be embedded with risk management framework. So, it could be concluded that the country risk management calibers for small level local construction are needed to be advanced and developed. Moreover, new policy must be needed there by higher authorities and it is the responsibility of the scientist to device such solution which is practically applicable.

This study will provide an access to the project practitioners for better platform to apply effective risk management practices by achieving the project performance/success while executing the construction projects. This research is an effort to highlight the risk factors, the effectiveness of risk allocation, their mitigation plan and establishing the guidelines with the perception of the different construction firms while achieving the project performance. It offers construction stakeholders with essential information about the risk variables that should be prioritized during the risk management framework. The study also discovered that stakeholders in the building industry had a low level of understanding regarding risk variables that influence construction costs. This study will help to build a simple and appropriate risk evaluation model for SCP that considers the nature and scale of projects in order to mitigate risks throughout the project's life cycle.

7. Limitation of study

This study is limited to the major stakeholders i.e., contractors and clients involved in the SCP (small constriction projects), besides for the future perspective, the study could be conducted in developing and non-developing countries for the mega infrastructure projects to enlarge the domain of the research area. There is an esteemed need to adopt the risk management practices effectively in developing countries i.e., Pakistan. The risk management guidelines and international standards codes for risk allocation need to be implemented.

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