JBM
The Journal of Business and Management

ISSN 2350-8868
Volume VII | *Issue* 1 | *May 2023*

Safety Management in Public Building Construction: A Case Study of Pokhara Valley

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Received: 17 December 2022
Reviewed: 21 March 2023
Accepted: 25 March 2023
Published: 31 March 2023

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Citation:
Giri, O. P., Paudel, K., & Shrestha, S. K. (2023). Safety management in public building construction: A case study of Pokhara valley. *The Journal of Business and Management*, *7*(1), 90-101. https://doi.org/10.3126/jbm.v7i01.54548

Abstract

Background: Construction site safety is a major issue in the construction industry all around the world. In a developing country like Nepal, the number of construction industries is growing haphazardly at a high rate, but they are not being able to cope with factors associated with construction site safety.

Objective: The main objective of the study is to explore the status of safety management in public building construction projects and to suggest measures for improvement.

Methodology: To achieve the objective of the study, data were collected from the Engineers and site management personnel through a questionnaire survey. Data were analyzed descriptively by IBM SPSS and presented in tables and diagrams.

Conclusion: The identified major safety issues for public building construction sites are lack of regular safety inspection, lack of use of personal protective equipment (PPE), lack of conducting safety training, and a lack of proper safety policy and plan including a lack of an adequate budget for safety management. Increased worker safety awareness and introducing safe working practices through training and induction programs are vital to reducing construction site safety. The outcome of the study will be helpful while formulating a project-based construction site safety policy.

Keywords: Construction site safety, safety improvement, safety management

JEL Classification: L74, N70, R30

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Introduction

The construction sector is one of the most dangerous industries in the world (Bhagwat et al., 2022). Construction involves many types of resources like man, material, and machine, and work involves working in difficult working conditions and situations. Therefore, the accident occurs due to various reasons such as carelessness on the job, and improper handling of materials, tools, and machines. The result is loss of property, death, increase in project cost, and delay in construction activities. Due to the special nature of the activities involved and the repetition of many construction activities, construction is a hazardous occupation (Manzoor et al., 2022). The growth of the construction industry is crucial to the economy of the nation. Therefore, one has to be very careful about the situation, and effective safety management on construction sites.

Safety is concerned with no loss of life at the workplace and minimizing injuries to project stakeholders and other common people. It is also concerned with property damage, and loss of time. The number of accidents occurring in each infrastructure construction project is not recorded and given priority in Nepal. Safety engineers along with the workers need to be aware to every construction project is not yet started. Project owners, consultants, and contractors must be responsible for the effective management of construction site safety (Koirala, 2018). Due to the very specific nature of construction projects, frequent operation of heavy equipment such as tower cranes, hoists, concrete pumps, batching plants, engagement of large numbers of workers of various trades, various natures of works in the same construction sites, establishing the safe working environment at sites and avoiding the ill-health of workers has become more challenging (Nadhim et al., 2016). On the other hand, the lack of effective health and safety programs in construction companies, lack of worker awareness towards safety, and inadequate investment in safety programs and measures have created hurdles in establishing a safe working environment.

The high frequency of work-related accidents and fatalities makes the construction process a very risky endeavor. The gathering and analysis of construction site safety is a crucial component of developing measurement and improvement strategies (Awolusi et al., 2018). Construction industries in Nepal have not effectively implemented health and safety measures at construction sites due to a lack of proper organizational policy, adequate resources, and effective management (Acharya, 2015). Construction companies need to analyze risks and take necessary steps for effective management of construction site safety.

The study has been undertaken to seek the answers to the following research questions: (i) what is the status of safety management of the public building construction projects in Pokhara valley? (ii) what are the measures to be taken for improving the safety of public building construction projects? The objectives of this study are: (i) to study the status of safety management in public building construction projects in Pokhara valley and (ii) to suggest measures for the improvement of safety in public building construction projects.

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Review of Literature

The safety of building works has a very important role in construction. Without the involvement of workers, no construction is possible. Therefore, construction job involves risk, and hazards while working in difficult working situations. Everyone who involves in construction activities should be aware of the required safety precautions, including wearing PPE.

An accident can be defined as an unplanned and unexpected occurrence that upsets the planned sequence of events and actions resulting in the loss of production, injury to the persons, and damages to the plants and equipment. It is an unexpected and unwanted event that cannot be anticipated in advance (Shrestha, 2019). Occupational accident covers an occurrence arising out of, or during, work those results in fatal or non-fatal injury (ILO, 2002).

Unsafe acts and unsafe conditions are often referred to as primary causes of accidents because they are the most obvious and are usually directly involved or present. Unsafe acts include: operating without authority, failing to secure equipment, or warning other employees of possible danger, failing to use PPE, throwing materials carelessly, operating or working at unsafe levels of speed, either too fast or too slow, making safety devices inoperative by removing, adjusting, disconnecting them, using unsafe equipment or using equipment unsafely, using unsafe procedures in loading, placing, mixing, taking unsafe positions, under suspended loads, lifting improperly, cleaning, adjusting, oiling, repairing, etc (Vaishali, 2019). Financial constraints, a lack of commitment, a lack of safety policies and programs, a lack of standards, a lack of knowledge and information, a lack of appropriate training, inadequate quality control systems, and other factors are secondary causes of accidents. The provision of safety pamphlets, the provision of safety equipment, the provision of a safe atmosphere, and the appointment of a competent safety representative on site were determined to be key elements related to construction site safety (Sawacha et al., 1999).

The actual expenses of a workplace injury exceed the raw cost. There are not only financial expenses connected with a workplace accident but also morale concerns and other indirect costs that might be difficult to measure. Indirect expenses may include negative effects on the company's reputation, damaged equipment, poorer morale, decreased efficiency, and lost production time (Harter, 2019). Maintaining the health and safety of the workforce is one of the challenges in the construction industry (Timilsina et al., 2021).

Most often accidents occur at construction sites due to a lack of safety awareness among workers and supervisors, improper work procedures, failure to use appropriate PPE, improper handling of machinery, and human error. Failure to use proper safety measures by predicting hazards in advance is another key contributing factor to construction site safety. Accidents result not only in loss of life but also in financial losses and delays in the project (Giri, 2020). Accidents at work result in a variety of losses for injured employees, their families, employers, and society (Feng et al., 2015). Issues with employees or the work team, workplace difficulties, equipment concerns including PPE, issues with appropriateness and condition of materials, and risk management issues all played a role in the incidents to varying levels (Haslam et al., 2005).

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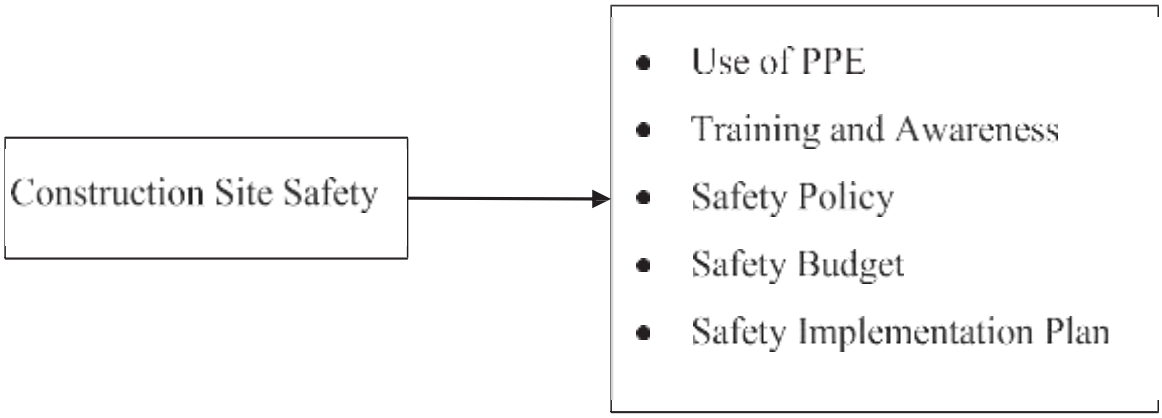
Falls may occur as a result of improper use of safety equipment and a lack of teamwork among the workers. Additionally, falls from higher levels are more likely to happen when construction workers perform risky tasks, and the complexity of the work may divert workers' attention at high altitudes, possibly resulting in an unintentional fall (Jo et al., 2015). The basic problem in maintaining safe working conditions in construction industries is negligence towards safety, lack of use of proper safety equipment and tools, and illiteracy of potential health hazards. Faulty machinery or improper use can cause accidents or even fatalities in the construction industry. Construction difficulty, which is a physical feature of the building, the urgency of the construction period, including accelerated work, and insufficient responses to unforeseen circumstances on site are direct factors affecting critical accidents in building construction (Ahn et al., 2022).

There is a limitation of research and studies on the area of safety in building construction. There is very little research in the field of occupational safety and health (OSH) in Nepal. Especially in Pokhara valley, there is no research on safety in public building construction projects. Therefore, the researchers intended to research safety on a public building project in Pokhara valley. The conceptual framework of the research is shown in Figure 1 below.

Figure 1

Conceptual Framework



Personal Protective Equipment

Protective clothes, goggles, helmets, or other garments or equipment designed to safeguard the wearer's body from damage are examples of PPE. PPE is regarded as one of the most significant elements influencing construction site accidents. Lack of knowledge, worker reluctance to use PPE, and negligence in PPE maintenance are all factors influencing construction site safety (Elavarasan, 2022).

Safety Training

Safety training is essential for orienting workers to their safety as well as making them aware of the nature of their work, and the usage of PPE for enhancing safety performance.

Safety Policy

The safety policy guideline incorporates the firm's aims and objectives. A safety policy

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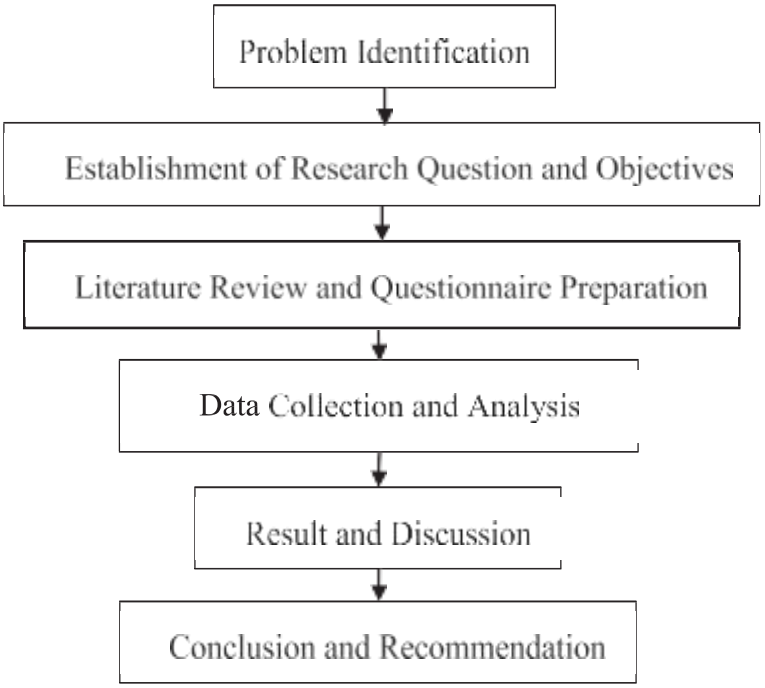
includes regulations and methods to safeguard workers' and the general public's health and safety.

Materials and Methods

The problem identification was done through a literature review and discussions with professionals in the construction industry. Nine public building construction projects under construction were identified and selected from different government agencies in the Kaski district of Nepal. From each construction project two engineers/sub-engineers, one contractor, one consultant engineer, and two persons from government authority were selected to collect the data. Then, the collected data were arranged, edited, and coded systematically. Data were analyzed quantitatively using Microsoft Excel, and SPSS. Finally, data were interpreted and presented using simple descriptive statistics, tables, and charts, and a conclusion was drawn. The research flow chart is shown in Figure 2 below.

Figure 2

Research Flow Chart



Result and Discussion

Demographic Profile of Respondents

All the respondents to the questionnaire were civil engineers working with clients, consultants, contractors, and government authorities who have direct involvement in public building construction projects. The demographic profile of the respondent is given in Table 1 below. Out of 54 respondents, 50% of the respondents were clients (government authority), 16.6% were consultant engineers, and 33.4% were contractors. Majority of respondents 90.3% were male and 9.7% were female. Regarding the age of respondents, the majority, 66.7% were 18 to 30 years old, 27.8% were 31 to 43 years old and 5.5% were 44 to 55 years old. Similarly, 3.7% of respondents have less than one year of experience, 42.6% have 1 to 3 years of experience, 33.3% have 4 to 6 years of experience and 20.4% have more than 6 years of experience in public building construction projects.

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Table 1

Demographic Profile of the Respondents

Variable	Category	Percent
Type of Company	Client (government authority)	50%
	Consultant	16.6 %
	Contractor	33.4%
Sex	Male	90.3
	Female	9.7
Age	18 to 30	66.7
	31 to 43	27.8
	43 to 55	5.5
Years of working experience	<1 year	3.7
	1 to 3 years	42.6
	4 to 6 years	33.3
	>6 years	20.4

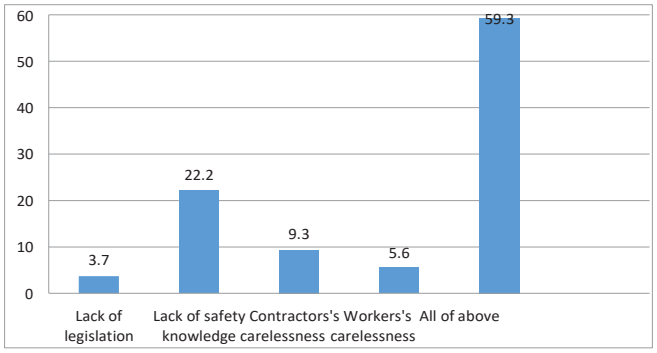
Descriptive Statistics

The result reveals that 96.3% of respondents do not have information about health and safety in construction sites, while 3.7 % have some information. Similarly, 49.1% responded are known, and 50.9% were unknown about the accidents happening in public building construction projects in the last six months. It can be interpreted from the result that accidents, either major or minor, happened in most of the construction sites. The workers who replied that they were unknown of the happening of any accidents were either uninformed of the accidents or joined the site after the accidents.

From the result, it is also concluded that the number of accidents leading to death is less frequent than disability cases. However, accidents causing minor injuries are most frequent in construction sites. Due to the lack of practice in recording any accidents at construction sites, the number of minor injuries might be more in the sites than that found during the study. The contractors/Engineers in the construction site are mostly satisfied with the availability of safety gloves with gradually decreasing satisfaction on boots, helmets, and so on. As per the scenario of Pokhara valley, the uses of PPE are mostly not available. The laborers are compelled to do the work without the use of PPE which results in accidents. Figure 3 shows that the reasons of causes of accidents are lack of legislation, lack of safety knowledge, contractor's carelessness, and workers' carelessness. The major reason is the lack of safety knowledge. Contractors, government authorities, consultants, and workers are all equally responsible for happening accidents on construction sites.

Figure 3

Reasons Behind Causes of Accident



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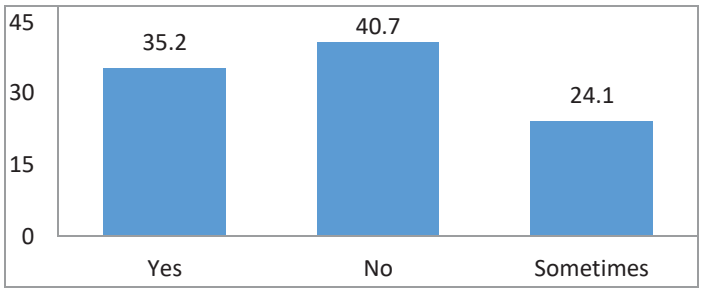
According to 40.7% of respondents, there is no regular inspection of sites to identify health and safety hazards while 35.2% of respondents, there is an inspection of sites by government agencies, and 24.1% of respondents responded that government agencies do inspections of the site sometimes. Safety inspections are the usual means used to enforce safety at the job site. From the research, it was found that there is a lack of regular site inspection from government agencies resulting in construction site safety violations.

Figure 4

Safety Inspection from Government Agency



As shown in Figure 5 the research reveals that contractors are more responsible for work-related accidents, injuries, illnesses, and fatalities on construction sites. However, clients and consultants are also equally responsible for the work that may cause accidents.

Figure 5

Responsible for Work-Related Accidents

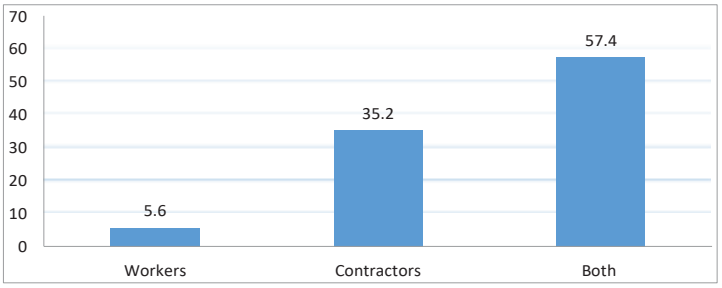
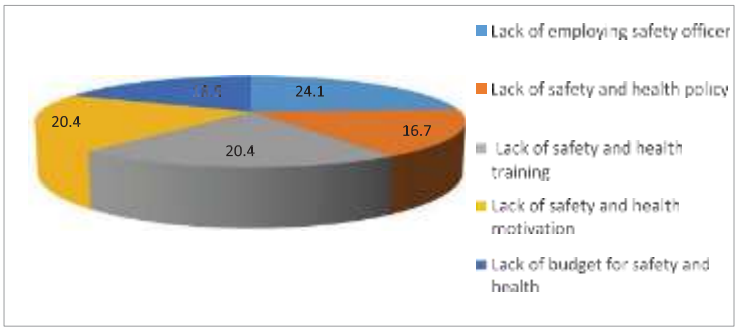


Figure 6 indicates that safety training and induction classes are not conducted in almost all construction sites. This shows that no importance has been given to increasing safety awareness among workers and introducing safe working procedures through training and induction classes.

Figure 6

Major Problems in Health and Safety Management on Construction Sites



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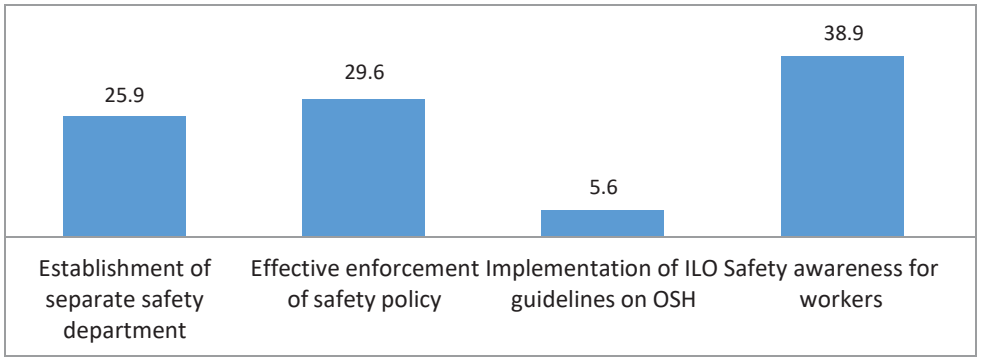
As shown in Figure 7, 38.9% of the respondents replied that safety awareness among workers is the best way to minimize construction site accidents and they think the existing provision is insufficient. 25.9% of respondent says that a separate safety department should be established for effective management of construction site safety while 29.6% of the respondent says existing safety policy should be effectively enforced. The result reflects the fact that existing laws and provisions do not cover all the safety issues of the construction industry. Safety provisions could be made more enforceable by including additional safety clauses.

Figure 7

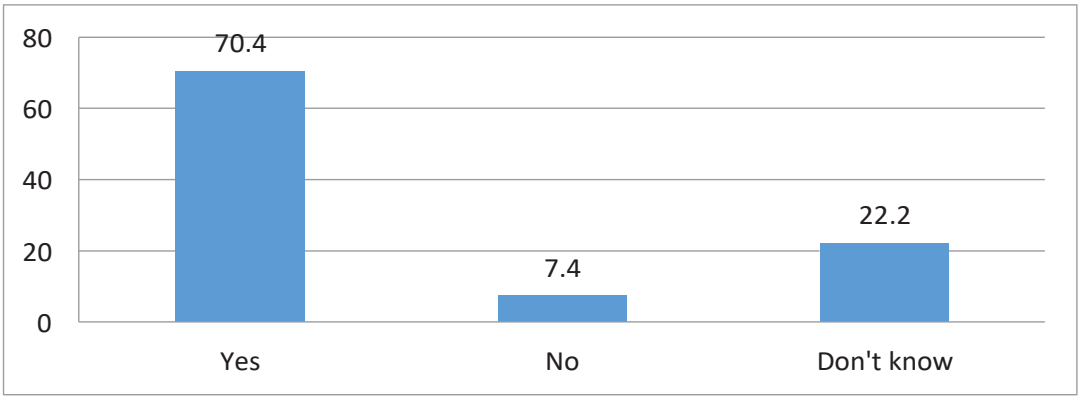
Factors to be Considered for Better Management of Construction Site Safety



According to Figure 8, 70.4% of respondents answered that the safety plan was included in the contract documents, while 7.4% replied was not included the safety plan in the contract documents and 22.2% replied did not know about the safety plan. The result reflects that most of the projects included the safety plan in the contract documents but in the practice, there is poor implementation of the safety plan in the public building construction projects.

Figure 8

Inclusion of Safety Plan on Contract Document



Most of the contractors have implemented the contractor-all risk (CAR) policy in the construction sites. Here we can conclude that the inclusion of workers on insurance policies is satisfactory, however, there is space for improvement. The status of insurance is shown in Figure 9 below.

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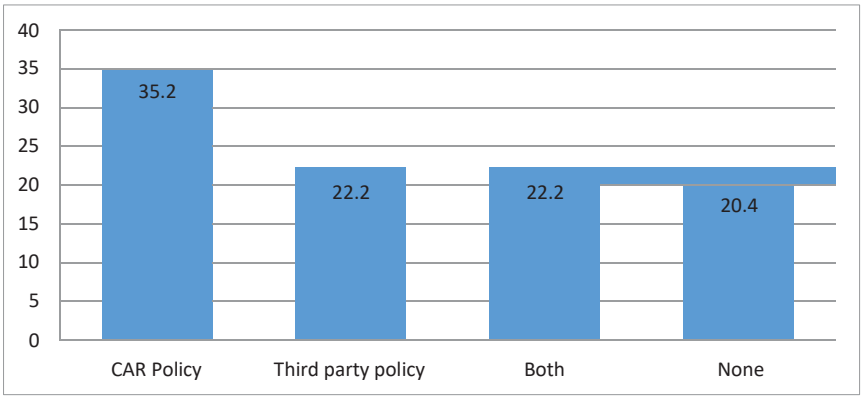
Figure 9

Insurance Policy Used in the Public Building Construction Sites



The study explored the existing acts and safety provisions for their weaknesses to achieve better safety performance at the site through a proper implementation based on the survey results. Labor Act 1992 and National Building Code (NBC) are silent in the conduction of safety training and communications to workers at the site. Contract documents have also not included provisions for safety training, induction classes, and hazard communication among workers. There is a lack of provisions for regular safety monitoring, evaluation, and submission of safety performance reports to the concerned regulatory bodies. There is a lack of provisions for fines and other punitive measures for violation of safety regulations and poor safety performance (Acharya, 2015). Construction accidents are primarily caused by worker negligence, failure to follow safety protocols, working at heights, operating machinery without safety devices, poor site management, harsh work conditions, workers' lack of knowledge and skill, failure to use PPE, and poor worker attitudes toward safety (Hamid et al., 2008). To improve safety performance at construction project sites and subsequently create a safer working environment for employees with fewer risks and accidents, the contribution of various stakeholders in the construction industry is essential (Mostly, 2022).

Safety management is one of the vital parts of construction project management, however, it is practiced poorly. Even though the practice is mentioned and included in the project specification, most of the topic is only limited in policy but is not implemented on construction sites. It is the responsibility that belongs both to the consultant and contractor but due to poor supervision from either side safety management is vastly neglected. Policymakers need to specify the better provision of safety in public building construction while making policies. On top of that, proper inspection should also be done from the executive level. From the side of the contractor, proper equipment should be of top priority including toolbox talk, induction training, and guidance on the use of equipment properly.

Conclusion and Recommendation

The study depicted that accidents, injuries, and illnesses are serious problems during construction activities. The authorities such as the government, clients, and consultants, are all responsible for the inadequate safety performance of the building construction project by

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selecting a competitive tendering system without incorporating safety and health concerns in the tender documents. The purpose of this study was to identify the safety management status and provide suggestions for the betterment of safety on public building construction sites. The major identified causes of construction site accidents are falling from heights due to being struck by objects. Except for general PPE like gloves and boots, no other PPE is available at construction sites appropriately and adequately. The study depicted that accidents, injuries, and illnesses were serious problems in building construction project sites in Pokhara valley. The lack of safety culture of workers, low safety and health motivation of contractors, and lack of strong commitment of the government to safety and health issues were the key contributors that aggravated the problem. Most of the respondents recommended including additional safety clauses in the contract document and including a site-specific safety plan. The implementation of safety provisions and regulations ensured by state laws and acts was poor at the site due to a lack of proper safety policy and plan, a separate safety department with a safety manager, and an adequate budget. The poor implementation was also contributed by the lack of regular safety inspections by government authorities. The study found that some key provisions need to be included in existing acts and regulations. Mandatory provision of conducting safety training to enhance safety awareness and safe working procedures among workers.

For better safety management on the construction site, it is suggested that the workers are not allowed to work in difficult health conditions and unfavorable weather conditions. The implementation of safety provisions and regulation ensured by state laws and acts were poor at the site due to a lack of proper safety policy, and safety plan. Thus, it can be concluded that for minimizing the contributing factors of injuries and fatalities, proper use of safety measures, PPE, and strict enforcement of safety policies and provisions are essential.

A safety manager should be appointed to inspect the safety conditions of the site and inform workers about hazards before starting work. Safety training and induction classes should be conducted to enhance the safety awareness and skills of the workers. Appropriate PPE should be used appropriately. Existing safety laws and regulations should be strictly enforced. Further study may be carried out considering other infrastructure projects and other project-specific construction site safety measures.

Conflicts of Interest:

The author declares no conflict of interest.

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