Work Place Safety and Health Dynamics in Rural Infrastructures: A Study from Dhading District of Nepal

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Abstract

This research explores the occupational safety and health (OSH) conditions in rural infrastructure development projects in Dhading District, Nepal, focusing on construction projects managed by three different authorities; users' committees, contractors, and NGOs/INGOs. The study employs a mixed-methods approach combining primary data from field surveys and real-time observations, and secondary data from scholarly sources and relevant organizational publications. Data were collected from six construction projects with varying management structures, encompassing 36 purposively selected workers as sample. The analysis reveals significant disparities in safety practices across project types. NGO/INGO-led projects demonstrate superior OSH practices, including compliance with standard working hours, safety training, and health facilities, while contractors and users' committees show notable deficiencies, such as extended work hours, limited safety equipment, and poor health support. The study emphasizes the urgent need for improved safety measures, compliance with labor laws, and the provision of adequate health facilities to safeguard workers' well-being in all types of projects.

Keywords: *Occupational Safety and Health, Rural Infrastructure, Construction Projects, Safety Equipment, Dhading District*

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Introduction

Occupational Safety and Health (OSH) is a critical discipline aimed at safeguarding workers' physical, mental, and social well-being by minimizing workplace hazards and adapting work environments to human needs. In modern infrastructure development, where construction activities are labor-intensive and involve hazardous environments, ensuring OSH has become a central concern. The construction sector accounts for a significant proportion of global occupational injuries and fatalities due to its complex and dynamic nature. The International Labour Organization (ILO) emphasizes that OSH is essential for sustainable economic growth, as healthy workers are more productive and contribute positively to national development (ILO, 2022). With rapid urbanization and increased infrastructure projects worldwide, construction activities are more frequent, heightening the need for effective safety measures. Key challenges include unsafe work environments, lack of proper safety tools,

knowhow, training, and inadequate safety enforcement mechanisms.

Implementing OSH policies helps reduce workplace accidents, ensuring the safety of workers while enhancing productivity and project efficiency. Modern infrastructure development requires integrating OSH from project planning to completion. This includes conducting risk assessments, providing protective equipment, and ensuring compliance with local and international safety standards. As mentioned by Trivedi and Lai (2024), in 2019, work-related illnesses and injuries claimed 2.9 million lives, while 395 million people experienced non-fatal workplace accidents. Work-related fatalities accounted for 6.7% of global deaths, resulting in significant economic losses and immense human suffering. These challenges emphasize the critical importance of occupational health and safety (OHS) as a priority on both global and national levels.

Occupational safety and health (OSH) is defined as the science of anticipation, evaluation and control of hazards arising in or from the workplace that could impair the health and well-being of workers, and taking into account, the possible impact on the surrounding communities and the environment. Though the International Labor Organization (ILO) has maintained and developed a system of international labor standards since 1919, which aimed at promoting opportunities for decent and productive work, in conditions of freedom, equity, security, and dignity. It is relatively new and very few industries maintain occupational standards (OSHA, 2007; ILO, 2009). Simukonda et al., (2020) concluded that the status of OSH management practice is poor in developing countries which is significantly high in case of companies handled by the contractors. By its nature, construction work is hazardous, with thousands of fatalities reported annually in countries like the USA and India (U.S. Bureau of Labor Statistics, 2017; The Times of India, 2017). Being one of the basic prerequisites of development, construction of infrastructure are widely taking place ranging from small scale peace-meal to large scale multi-year projects. National as well as Local governments globally allocate significant budgets to rural infrastructure projects such as roads, canals, drinking water systems, and public buildings (GoN, 2016).

In developing countries like Nepal, where infrastructure development is expanding rapidly, enforcing OSH standards is crucial. Local governments must implement safety regulations, ensure compliance, and allocate resources for training and monitoring construction projects. As the construction sector continues to evolve, addressing OSH as a core element of infrastructure development will ensure long-term sustainability and worker welfare (Suwal, 2021). Occupational Safety and Health (OSH) focuses on ensuring workers' physical, mental, and social well-being by preventing work-related health risks and adapting work environments to human needs (ILO, 2009). In Nepal's federal system, the central, provincial, and local governments share responsibilities, with local governments tasked with infrastructure development to improve living standards (GoN, 2015).

Since construction environments vary, each project requires a tailored safety plan. Construction of infrastructures involve skilled, semi-skilled, and unskilled manpower creating good employment opportunities. Despite its importance, infrastructure construction is considered risky with frequent and high accident rates and ill health problems to workers (Gautam and Prasain, 2011). Most of the involved workers are less experienced, less skilled, and untrained, increasing the rate of accidents in this sector. Also the responsible bodies do not invest in occupational safety and health in construction projects as they tend to save money by lowering safety standards rather than improvement in productivity (Pandit, 2018). Jilcha and Kitaw (2016) focused that even there are no uniformity in the research findings regarding OSH,for the betterment of OSH practices in most of the construction sectors, there found no proper budgetary provision whereas they used to say, "the accidents suddenly happens".

The enforcement status of safety and health-related acts and regulations from government and related authorities are limited and also occupational safety and health training which contribute to developing safety awareness among workers and supervisors are inadequate. Due to which safety issues are not taken as an obligatory factor in this sector that yields in higher accidents (Kanchana et al., 2015). So, it is significant to study the prevailing practices of safety measures, the gap between provisions in contract documents, and in real construction fieldsand perceptions of stakeholders toward OSH. Nui (2010), has connected the term ergonomics as a scientific discipline relating to the design of workplace and its associate factors to fit with the workers capability to improve comfort, safety and productivity at work place. Further it is viewed that ergonomics has become a fundamental focus of OSH initiatives of ILO. In recent days, because of the access to resources and administrative power they enjoy, rural municipalities are aggressively allocating their budgets in a lot of infrastructure construction projects which

are implementing through users committee, contractors, and INGOs/NGOs. The difference in implementing methods makes a different scenario in the implementation of occupational safety and health in construction projects. There is no satisfactory result in occupational safety and health in construction projects (Joshi & Dahal, 2008). So, it is significant to study the prevailing safety practices, health practices, clauses of OSH included in contract documents, and perception of stakeholders toward OSH.

Paplampu and Quartey (2012) have conducted the occupational safety and health issue based study and identified different kinds of OSH issues such as occupational risks, hazards, diseases and other challenges that are still prevalent in many developing countries because of the less attention given by the concerned sectors even if there are several preventive measure available. More specifically, occupational health issues are often given less consideration than occupational safety issues because health issues are more difficult to confront. However, when health is addressed, so is safety, because, a healthy workplace is by definition, also a safe workplace. What it is understood is a so-called safe workplace is not necessarily also a healthy workplace. The key point is that issues of both health and safety must be addressed in every workplace (Joshi, 2020). ILO account occupational diseases equated with the industrial poisoning means the severity of the health effect due to the unsafe or hazardous work station causes serious health impact on human life (Kim & Kang, 2013). It is viewed that improving construction occupational health and safety is a complex challenge that demands a comprehensive approach. Focusing on a single aspect seems insufficient; instead, progress requires integrating strategies, especially in the context of multiple complexities of working station in recent days (Lingard, 2013).

Literature Review

Occupational Safety and Health in Nepal

The standard of occupational safety and health is minimum or almost nonexistent in developing countries (Kanchana et al., 2015). The concept of OSH in Nepal is in its initial stage. It has been initiated in the industrial sector but its importance in other sectors is still needed to be justified. Despite various efforts, much remain to be done to establish sound OSH systems in the world of work (Rantanen, 2005). In this connection, ILO estimates that more than 250 million workers meet occupational accidents and 160 million are suffering from occupational diseases each year at the global level. Among them, about 1.2 million workers die annually caused by occupational diseases and accidents (ILO, 2009). OSH is one of the major issues directly related to the workers' rights. Almost all of the Nepali labor force involves in the informal sector and they are still unaware of the concept and importance of OSH. As a result of the continuous struggle of Nepali workers and trade unions as well as solidarity from international centers of trade unions and supportive organizations this issue is gradually coming in attention among Nepali working masses (Rimal et al., 2003).

Occupational safety is considered significant in mechanized industries while its importance in other sectors isequally important. The scenario has been continuously changing for the last few years and is gradually accepted as a business tool. Despite that, there is a lot to improve. Presently, it is estimated that 11,779 thousand Nepali aged 15 years and more are engaged in one or the other occupation in Nepal. Among them, 74 percent are engaged in the agriculture and forestry sector where rest 26 percent are in the non-agriculture sector (CBS, 2009). It is estimated that each year approximately 20,000 workers suffer from accidents at a workplace which leads to about 200 lives lost in Nepal. From 1994 trade union confederations particularly the General Federation of Nepalese Trade Unions (GEFONT) has started an awareness campaign on OSH taking the issue seriously. Still, the issue is one of the major agenda of GEFONT and has conducted several OSH training at the workplace covering all 10 zones by the well-trained personnel from different national and international training institutions. As a result, despite various efforts, there remains a lot to be done to establish sound OSH systems in the world of work. The gravity of the issue is indicated that for more than three decades of multifarious needs assessment and prioritization still more than 80 percent of the global workforce live without adequate access to OSH (Gautam and Prasain, 2011).

Occupational Safety and Health in Rural Infrastructures Development in Nepal

The construction industry has a high risk of occupational accidents due to hazards stemming from materials, processes, technologies, and products. These risks pose threats to workers, nearby residents, and the environment. Creating a safe working environment enhances productivity, efficiency, and quality. Major risk factors in construction include operating machinery, working with electricity, handling chemicals, transportation, and exposure to dust (Baral & Koirala, 2022). Accident rates vary by industry, work type, and workplace conditions. Factors such as production methods, management efficiency, and worker awareness influence these rates. Poor coordination further exacerbates occupational hazards (Gautam & Prasain, 2011).

According to Part I, Clause 50 of the Constitution of Nepal 2072BS, the state follows specific principles, policies, and obligations concerning labor regulation (Pandit, 2018). The Constitution of Nepal 2072BS has focused on building a skilled and professional workforce while creating domestic employment opportunities and ensuring the social security and fundamental rights of all workers. Efforts aim to eliminate labor exploitation, promote worker participation in management, and foster harmonious employer-employee relations. Additionally, the regulation of foreign employment seeks to ensure safety, fairness, and rights protection while encouraging the reinvestment of resources and expertise gained abroad into the national economy for sustainable development. (GoN, 2015; 2016).

The Labor Act, 2074 BS, received parliamentary approval on Shrawan 27, 2074 BS, and was ratified by the President on Bhadra 19, 2074 BS. It took effect immediately following the President's approval, as per Section 3(f) of the Interpretation of Statute Act, 1953. This legislation replaced the earlier Labor Act, 2048BS. The updated Labor Act was enacted to safeguard workers' rights, interests, welfare, and workplace safety across various sectors. It was introduced under Section 296(1) of the Constitution of Nepal to address evolving labor needs and ensure improved labor management and protection standards.

Keeping in view to the literature and relevancy of the issue under study, this research paper aims to explore the occupational safety and health status in rural infrastructure development adopted by different construction projects in the Dhading District of Nepal. More specifically this paper intend to identify the current safety practices adopted by construction projects.

Materials and Methods

This research paper is prepared on the descriptive research design based on the quan-qual approach relying on primary as well as secondary data (Khatri, 2022). The primary data are collected from the field survey from the selected site employing survey questionnaire to the construction workers and real time observation at the work station. For this purpose, 6 different construction projects belonging two under the control of contractor, users committee and NGO/INGO collaboration based on its operation and management are conveniently taken form the Gajuri Rural Municipality of Dhading district where large numbers of projects are under construction. Since, it is hard to calculate the exact population of construction workers throughout the district, some 36 sample from the construction site are purposively selected consisting 12 workers from each three types of projects. The questionnaire are filled up by research assistant on behalf of researcher and processed by using simple statistical tool of Microsoft excel. Similarly, secondary data are collected from the varieties of scholarly sources obtained from different online databases such as; TUCL, Google scholar, ResearchGate, NepJOL, JSTOR and other relevant sources. Likewise, some necessary information are obtained from different governmental as well as non-governmental organization's publications and authentic digital sources prioritizing the up to date and relevancy of data that are valid and objectively suitable to the research issue. Some information are also taken from global multinational organizations such as; World Bank, ILO, FAO and UNDP to validate and contextualize the findings. The collected data and information are processed, tabulated, and analyzed by using simple statistical tools along with the field note analysis of field observation depending on the aim of the research work.

Results

Overview of Study Area

Gajuri Rural Municipality lies at the North-Western part of Dhading District to the south of Trishuli River and

covers an area of 138.66 km2. The average altitude of the Gajuri Rural Municipality is 547 meters (1796 ft) above sea level.The municipality focuses mainly on the development of the varieties of infrastructure within its coverage. The municipal record shows, above 50% of the annual budget is allocated in infrastructure development. Roads, drinking water, canal, community/social/institution buildingare the major infrastructures focused by Gajuri Rural Municipality. In infrastructure development, there are mainly three types of the tendering process for implementing projects that is user community, contracting a contractor and partnership with INGOs/NGOs. And it's the prime responsibility of the Gajuri Rural Municipality for the proper quality maintain, monitoring, and evaluation of projects. This study covers Rural Municipality priory construction projects and projects havinga budget of more than 50 lakhs. It is a case study involving the study of occupational health and safety and safety measures related to the rural infrastructure construction within the Gajuri Rural Municipality. Although there are more than 100 rural infrastructure construction projects, sample construction projects were selected based on convenience of the researcher representaing the three catogaries based on their management. The selection of the construction projects was based on accessibility, co-operation, and co-ordination with the concerned authorities for the research purpose.

The status of occupational safety and health depends on the varieties of factors such as safety equipment employed, working conditions, working hours, health issues faced and its response mechanism, safety measures applied are taken as some principal factors. The existing status and the responses of the participants are elaborated in the following sub-heading leading to generate a conclusion of the study.

Provision of Safety Equipment

Safety equipment are considered as the best preventive measure to control or reduce the severity of the occupational hazards. To measure the OSH status of any development project are ranges differently from project to project. The existing status of safety equipment in the selected study area are shown in the table 1 below:

Table 1

Status of Safety Equipment at Workplace

SN	Name of Protective Equipment	Projects by Users Committee	Project by Contractors	Project Collaborate with NGO/INGO
1	Safety helmets	4(28.2%)	3(21%)	8(66.6%)
2	Safety eye glasses	2(16.6%)	2(11)	5(40%)
3	Safety footwear	1(8.3%)	3(25%)	8(66.6%)
4	First aid facility	0	12(100%)	12(100%)
5	Fire protection system	0	0	0

Source: Field survey, 2024

The table 1 highlights the distribution of safety equipment across three types of projects: those managed by Users Committees, Contractors, and those in collaboration with NGOs/INGOs. Projects managed through NGO/INGO collaboration consistently outperform others in providing protective equipment. Contractors excel in providing first aid but lag in other areas. Users Committees show the weakest safety standards, with almost no emphasis on essential safety gear. The total lack of fire protection systems across all projects is a critical concern that needs immediate resolution.

Working Hours of Different Projects

Working hour is considered as one of the fundamental measures of decent work by which workers can maintain work-life balance. Since 8 hours considered minimum working time, lesser time for work might be prone to underemployment whereas more than minimum working hours violets the motive of OSH needs for workers.

Table 2

Daily Working Hours of Workers

Daily Working Hours	Projects by Users Committee	Project by Contractors	Project Collaborate with NGO/INGO
8 hours	1(8.3%)	-	12(100%)
More than 8 hours	11(96%)	12(100%)	-
Total	12	12	12

Source: Field survey, 2024

Table 2 presents daily working hours across three types of projects: users committees, contractors, and NGO/INGO collaborations. No projects operated for less than 8 hours per day, indicating that a standard or extended workday is common across all types of projects. ll projects under NGO/INGO collaborations strictly follow an 8-hour workday, suggesting compliance with labor standards. Users Committees reported only one project with an 8-hour schedule, while contractors have none. Nearly all projects managed by Users Committees and Contractors involve workdays exceeding 8 hours, indicating potential overwork or a lack of standard labor practices. No NGO/INGO project extends beyond 8 hours, reflecting strict adherence to regulated work hours. On the basis of these data of can be conclude that the projects handled by contractors and users committees heavily rely on workdays longer than 8 hours, possibly indicating labor law violations or productivity-driven targets seading prone to health and safety hazards whereas NGO/INGO projects maintain better labor management practices, while other projects may need improvements in regulating daily work durations.

Safety Measure Applied at Workplace

Maintaining safety measure at the working station truly represents the actual status of OSH in infrastructural development projects. Despite realizing this fact, there is no uniformity applying by different projects applying varieties of safety measure. The actual status of study area are represented by the help of table 3 below:

Table 3

Status of Safety Measure Applied at Workplace

Safety Measures Applied	Projects by Users Committee	Project by Contractors	Project Collaborate with NGO/INGO
Involvement of child labour	-	2 (16.6%)	-
Safety measures idea	-	2(16.6%)	3(25%)
Implementation of safety rules	2(16.6%)	1(8.3%	2(16.6%
Safety meetings attended by workers	1 (8.3%)	-	11(91.99%)
Safety training provided	2(16..3	-	11(91.66%)
PPE provided	2(16.6%)	3(25%)	2(16.6%)

Source: Field survey, 2024

The table highlights various safety measures across three project types: users committees, contractors, and NGO/INGO collaborations. Child labor is present only in contractor-managed projects, raising significant ethical and legal concerns. Users Committees and NGO/INGO projects maintain compliance by not employing child labor. Only a small fraction of projects have ideas about safety measures, with NGO/INGO collaborations performing slightly better. Users Committees show no safety awareness in this area. NGO/INGO collaborations excel in conducting safety meetings, while Contractors hold none, indicating a lack of safety communication in contractor-led projects. Safety training is almost entirely provided in NGO/INGO projects, with minimal efforts from Users Committees and none from Contractors. Contractors lead in providing PPE, though the overall numbers remain low. Users Committees and NGO/INGO collaborations lag, indicating an inconsistent provision of essential

protective gear.

Common Health Issues at Work Place

As a result of insufficient provision to OSH issue in the current study area, the workers face different kinds of health issues by which, they are losing the income, opportunity and compelled to bear unnecessary financial loses that eventually cause socio-economic backwardness of the workers. The basic health issues identified based on the project's types are shown in table 4 below.

Table 4

Major Health Issues Faced by the Workers

Major Health Issues	Projects by Users Committee	Project by Contractors	Project Collaborate with NGO/INGO
Eye strain	1(8.3%)	3(25%)	1(8.3)
Skin Diseases	9(74.7%)	7 (58.1%)	7(58.3%)
Nose irritation	1(8.3%)	2(16.6%)	4(32%)
Throat Irritation	1(8.3%)	0	1(8.3%)
Others	1(8.3%)	1(8.3%)	-

Source: Field survey, 2024

Table 4 reveals that skin diseases are the most common health issue across all project types, affecting 74.7% of workers in Users Committees and 58.3% in both Contractors' and NGO/INGO collaborative projects, indicating significant exposure to harmful substances. Nose irritation is notably higher in NGO/INGO projects (32%), suggesting possible environmental factors at these sites. Eye strain is more prevalent in contractor-led projects (25%), possibly due to inadequate eye protection. Throat irritation is minimal, appearing only in Users Committees and NGO/INGO projects (8.3% each). No lung or hearing problems are reported, though this could reflect underreporting or lack of assessments. Overall, the high incidence of skin and respiratory issues highlights critical gaps in workplace health and safety practices

Weaker OSH provision not only causing lasting health issues, it also bosting the immediate issues like back pain, wrist pain and many others. The perceived impression of different projects to their workers are shown in table 5 below:

Table 5

Immediate Health Issues on Workers

Nature of Project	Nature of Health Issues		
	No Issue	Back Pain	Wrist Pain
Projects by Users Committee	8(66.6%)	2(16.6%)	2(16.6%)
Projects by Users Committee	9(74.7%)	2(16.6%)	1(8.3%)
Projects by Users Committee	11(91.3%)	1(8.3%)	-

Source: Field survey, 2024

The table 5 shows that most workers in all project types reported no health issues, with 66.6% to 91.3% experiencing no complaints. Back pain is the most common issue, affecting 16.6% in Users Committee and contractor projects, though less frequent (8.3%) in NGO/INGO collaborations. Wrist pain appears in 16.6% of Users Committee projects and 8.3% of contractor projects but is absent in NGO/INGO projects. No cases of deafness, fainting, or other health problems were reported. Overall, the prevalence of musculoskeletal issues like back and wrist pain suggests ergonomic challenges in Users Committee and contractor projects, while NGO/INGO projects show relatively better health conditions.

Provision of Health Facility

Basic health facility are taken as mandatory provision for any developmental or manufacturing projects worldwide in recent days. However, the provision is remarkably low or no in case of developing countries like Nepal. Following table 6 shows how the different kinds of projects delivering basic facilities to the workers. Projects by Users Committees offer minimal health support, with only 8.3% having first aid and 91.66% lacking any health facility. Contractor-led projects provide no health services at all, reflecting a critical gap in worker welfare. In contrast, NGO/INGO collaborative projects ensure 100% first aid availability but lack ambulances and health workers. This highlights the need for comprehensive health infrastructure, particularly in contractor and Users Committee-managed projects, to ensure workers' well-being.

Discussion

The findings reveal significant disparities in safety and health standards across different project management types, highlighting the superior practices of NGO/INGO collaborations compared to Users Committees and contractor-led projects. NGO/INGO projects consistently provide better access to safety equipment, such as helmets, goggles, and footwear, compared to Users Committees and contractors. Contractors excel in offering first aid facilities, but no fire protection systems are present across any projects, indicating a critical safety gap requiring immediate attention.

NGO/INGO projects adhere strictly to the standard 8-hour workday, demonstrating compliance with labor regulations. In contrast, projects by Users Committees and contractors often extend beyond 8 hours, raising concerns about overwork and potential labor law violations. NGO/INGO collaborations lead in implementing safety protocols, including safety meetings and training, which are almost entirely absent in contractor-led projects and minimally present in Users Committee projects. The presence of child labor in contractor-managed projects further highlights ethical and legal issues in safety practices. This finding supports the conclusion made by Sukamani and Wang (2020) that accident causing factors are more prevalent in private and public construction enterprises whereas NGO/INGO operating enterprises having improved safety performance in construction.

Skin diseases are the most prevalent health issue across all project types, reflecting exposure to hazardous materials. Other issues, like nose irritation and eye strain, are notably higher in contractor projects, indicating a need for better protective measures. NGO/INGO projects show lower incidences of these issues, suggesting better workplace conditions. Health facilities are notably lacking in contractor and Users Committee projects, with NGO/INGO projects ensuring basic first aid but no provision for ambulances or health workers. This underscores the need for comprehensive health support across all project types. Musculoskeletal problems, such as back and wrist pain, are common in Users Committee and contractor projects, likely due to poor ergonomic strength (Niu, 2010). NGO/INGO projects show fewer such complaints, reflecting better working environments.

Conclusion

This study underscores the remarkable differences in OSH standards across rural infrastructure projects in the Dhading District of Nepal. The findings emphasize the higher safety and health standards of NGO/INGO collaborative projects, which ensure compliance with safety protocols, standard working hours, and the provision of basic health facilities. In contrast, Users Committees and Contractor-led projects reveal significant deficiencies, including extended work hours, minimal safety measures, and inadequate health support. The presence of child labor in contractor projects and the absence of fire protection systems across all projects are alarming issues requiring immediate corrective actions. To enhance worker safety and welfare, all project types must adopt stricter safety practices, provide adequate health facilities, and ensure compliance with labor laws.

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