

IJERT

ISSN : 2278-0181

International Journal of Engineering Research & Technology

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Risk Factors in Construction Infrastructures Projects and Safety Engineering Practiced in Nepal

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Abstract— The occupational accidents are not standardized to rating the risk factors for timely execution of infrastructures. Particularly, developing countries do not have guided information on their accidents due to safety, health and environment which are lack of proper systems. The number of accidents occurring in each infrastructures construction projects are not projected and published in Nepal. Training, awarding for the workers is not done or not effective. Safety engineers along with the workers need to aware to every construction project is not yet started. Project owner, consultant and contractors must be responsible along with the construction safety act which must be promulgated as soon as possible to response the Health, Safety and Environment risks. Safety engineering and prosperous Nepal are two side of same coin. By ignoring safety engineering to achieve prospers Nepal and happy Nepali is baseless dream .There would be lot of chances to inviting the risk factors which can lose much more.

Keywords— Risks, Infrastructure, Construction, Projects, Safety Introduction

I INTRODUCTION

Risks in housing and infrastructure construction projects are the chances of occurrence of events which affect the objectives and hence it will be lost the productivity within the project construction period. Workplace health, safety and environment accidents cause direct and indirect or hidden costs for the whole society. Experts are use to compare it to iceberg model which is a popular way to demonstrate in every infrastructure Construction projects. In many construction projects many variations of the proportion of the costs but usually the proportion of indirect costs is much bigger than direct costs. Other side, the economic calculations are made in good projects that have established specific compensation and social security systems. But in the developing countries an accident use to occur in the work place does not cause direct costs. Therefore, risk is a potential event that, if it occurred would have a negative impact on the project time, cost or quality (Koirala, 2014)

II LITERATURE REVIEW

Workers' health and safety is an important asset, it enhances the productivity, efficiency, quality of every industry if well maintained. Construction material producer are vital industries from where supplying the demand of emerging construction materials to infrastructure and habitat projects as per projects' need. These industries employing lot of workers but they are not being worry about health and safety (Koirala, 2016). Risk use to generate from various factors like, unpredictable

variations, escalation of materials, delays, various losses degradation in qualities issues, accidents, natural disaster and more. Infrastructures like housing, road, rail, bridge, irrigation, water supply, hydro projects, transmission line, telecommunication and many more projects are constructing by construction industry. During construction many more accidents are occurring from which fatal, injury and due to poor health.

Most of the work places, especially the ones requiring more physical work and labor, do not possess proper safety and preventive measures, likewise, the workers do not have proper understanding of exposure to hazards and measures to minimize them (Joshi et al, 2011).

In India lot of resources and experts' knowledge is to deployed to enhance safe infrastructure development plan. The analysis and findings also present valuable data for the Indian government and local construction agencies to have an in-depth understanding of the risk environment in construction in Pune city of India. Such understanding is very important for implementing further effective measures to ensure the right direction of future development to construction professionals (Pawar et al, 2015).

In china carefully identifying the risk factors, analysis, rank them and proper response to manage systematically. To manage it they use to take an important effort. China is world's biggest market with massive opportunities but any Western business seeking entry into this market faces profound cultural, legal, political, financial and administrative complexities. Research by World Bank and other has shown that privet investment in infrastructures in developing economics is essential. In addition to providing more funding streams, it also promotes better risk allocation project management, monitoring and overall project accountability. However in order to facilitate this partnership, it is necessarily to firstly identify the obstacles associated with the privet finance initiatives within individual economics (Xiaoyan, Kassim & Noel, 2004)

In Nepalese construction industry, there is no proper act addressing construction worker's health, safety and environment except industries' workers what is called labour Act 1991 and National building code. Including housing and real estate all infrastructure projects are rapidly growing and hence construction industry is becoming more professional, competitive, and transparent and business oriented to adopt globally accepted one. It is more difficult to assess these risks and impact of relationships among them. Legal policy framework has not made by the government because of

frequently changing government and hence legal and political risk factors are playing great role for urbanization. Financial and economic is other risk factors. It is more difficult to assess these risks and impact of relationships among them. The trend in our projects is just ignoring and making the decision of unrealistic and irresponsible by authorized professionals and other fact is identifying analyzing new risks becoming complicated, expensive and time consuming due to omitting the risks management plan during planning phase. This need to success, when all management team and professionals carefully work out in the paper during planning phase and especially skilled and experienced risk manager need to plan by taking enough time with adequate amount of information(Koirala,2012).

But it is important area where we can give employment opportunities to our people. We can use locally available construction materials which contribute to generate revenue to the nation. Despite mechanization, construction remains a major employer of labor, it often employs between 9 and 12 per cent of a country’s working population, and sometimes as much as 20 percent (ILO, 1995). Housing access is not enough to the citizen. Altogether 87.2 percent of households reside in their own house whereas 10.2 percent in rented. Average number of rooms is 4.5. Tap/piped water is the main source of drinking water for 49.5 percent households. Electricity is the main source of lighting for 76.1 percent households, and 82.1 percent households have access to mobile (cbs, 2012/13). Finally, the characteristics of workplace samples (e.g., single workplaces, large refusal rates) also prevent certainty about the applicability of the findings to other workplaces (

Table-1: Labour law in Nepal

Working Hours	48 hrs in a week
Overtime	pay - 150% per hour
	limit - 20 hrs in a week
Annual Holidays	public holidays 13 days
	House leave 18 days
Maternity Leave	52 days (in Govt. service, it is 60 days)
Paternity Leave	no provision in law, union movement has got in some place as a token holiday through CBA
Sick Leave	15 days
Others	OSH matters yes in Law
	Labour law is not so bad but there is a question of effective implementation

Source: Labour Act, 1991

i. Problems in infrastructures and safety practice
 Problems are being complex depends on nature and size of projects. Here it is trying to explore risks due to safety and health being complex in construction industries. All of infrastructure projects are suffering various adversities. It is trying to address the risk due to safety engineering. No act had been promulgated addressing to construction professions or workers.

ii. OBJECTIVE OF RESEARCH

The main objective of this research is to identify the risks due to safety and health, rank them and response as soon as possible so that it can mitigate.

a. Limitation

As it is known risks during construction projects are measured on various factors, like quantities overrun, quality variance, time overrun, budget overrun etc. Here it is limited the risk due to construction safety engineering because of time, financial, unavailability of data, present condition of Nepal (strike, Nepal band etc) and other factors like busy schedule of contractors and consultants, indifferent nature of clients etc, many problems have aroused during study. Not being the professionals, at times it was difficult to find the appropriate and desired professional engineers to insufficient contact. The outcome of the study has basically shown status of Safety measure in construction of the Commercial building and infrastructures projects in Nepal including the safety practices at the site. The study has Recommendation for best practices and policy for construction safety to enhance the construction industry by creating awareness among everyone related to this field. Therefore this study has tried to support and give best knowledge to the Engineering professionals and aware them about the safety in construction. The study has suggested both preventive and curative measures which time and again might be essential for anyone concerned about the construction industry.

b. Overview of Risk

Nepal is being the surrounded of India from east, west and north and other side joins with the republic of china. Booth the country china and India both countries are economically raised their per capita income by industrializing the resources. Nepal is influences from their economic growth. Nepal is planning its infrastructures like road network, railways, housing, irrigations, hydropower development by optimum uses of own construction materials and manpower. During development of construction infrastructures, in facts, laws, management system of occupational health safety risk management throughout project life cycle is important subject. Health and safety in workplace management is to industrial safety practices including approaches using historical data and industrial interventions. Many facility managers are now required to deal directly with small firms engaged in the maintenance, alteration and cleaning of physical infrastructure. Increasingly the performance of small firms reflects on the manager of the facility, and so an understanding of their operation is required. It is mandatory for all firms to provide a safe working environment for their workers and subcontractors (Lin & Mills, 2001). Health and safety risks are among the most significant risks in construction projects since the construction industry is characterized by a relatively high injury and death rate compared to other industries(Robson et all, 2007).

iii. Occupational accidents by country

Table: 2 HSE in resign

Country	Economically Active Population	Total Employment	Estimated number of Fatal Accidents	Fatality Rate	Non- Fatal Accidents, < 3days			Accident Rate
					Lower Limit 0.19%	Upper Limit 0.1%	Average	
India	458720000	419560000	48176	11.5	25355777	48175977	36765877	8763
Nepal	11000000		3293	29.9	1733079	3292850	2512964	22845
China	708218102	699771000	73615	10.5	38744649	73614834	56179742	8028

Source : (Hamalainen, 2006)

III. METHODOLOGY

A questionnaire was developed regarding the risks identification and analysis who were studying safety engineering were oriented, trained and inspire to administer the questionnaire (Annex--). The students were asked to meet personally any engineer with the questionnaire and to collect their opinions. Special precaution was taken for avoidance of duplication. A target was of approaching 21 engineers but only 15(71% of the target) were approached. This paper is the outcome of the opinion of 21 engineers randomly surveyed and the survey was conducted 2015. Weighted mean has been taken for managing the rank.

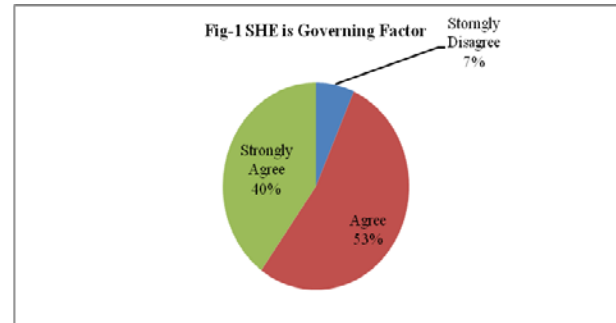
IV. RESULTS BASED ON DISCUSSION

The safety policy should deal with the following matters: Regarding the arrangements of required training at all levels. Particular attention needs to be given to key workers such as scaffolders and crane operators whose mistakes can be especially dangerous to other workers; safe methods or systems of work for hazardous operations: the workers carrying out these operations should be involved in their preparation;

- the duties and responsibilities of supervisors and key workers;
- arrangements by which information on safety and health is to be made known;
- arrangements for setting up safety committees;
- the selection and control of subcontractors (ILO,1995)

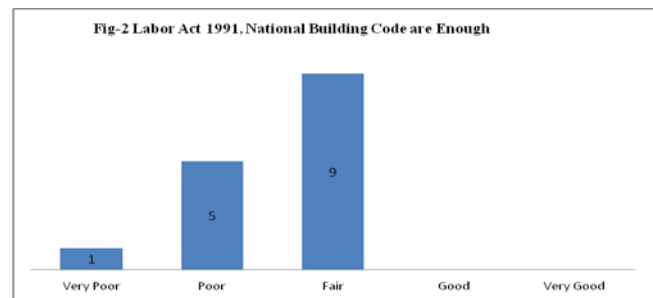
a. (SHE) Safety, Health and Environments are Main Factors

Among various factors, risk due to safety, health and environment (HSE) is important, for any infrastructure projects like housing, road, power projects. Asian Development bank or World Bank funded projects are incorporated the safety, health and environment but not other projects sponsored by domestic and government of Nepal. Respondents were strongly disagree by 7% followed by 40% strongly agree and 53% were Agree on the issue. The respondent were nil on the issue of disagree and neutral.



b. Labor Act 1991 and National Building Code are not enough for SHE regulation

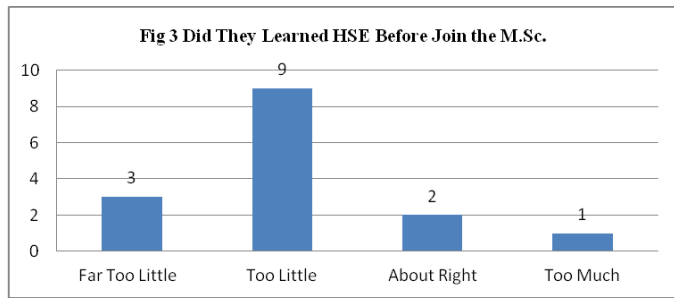
In developing country like Nepal Safety, Health and Environment is secondary thing in construction industry. Firstly owner, consultant and contractor want to make profit and professionals want attractive salary. In construction industry, Nepal had not yet promulgated the construction safety Act. We have industry workers 1991 act and National Building Code are not enough for construction safety, health and environment. In the same issue about 7 % respondent said it is very poor,33% said it is poor, 60% said it is fair means not guided rule, where as no one said it is good and very good.



c. HSE in school or college before joining M.Sc.?

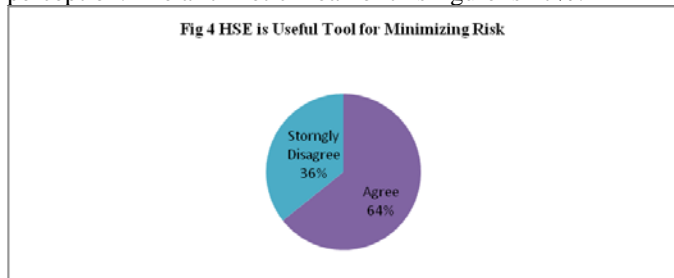
As per the nature of professional anyone who involved executing the construction industry need to know about HSE. After the establishment of the institution of engineering, most of people use to go to study engineering out of the country. When the institution of engineering started to train up lower level engineering professionals, they had taught about project management. In project management all of the topics were associated regarding overall project how to manage it. So in Certificate, bachelor level there was no separate subject but in master degree within the construction project management started one single subject. In the same connection, asked one question whether did you study construction safety, health and environment? About 7% of student replied studied too much, about 13% replied about right, 20% told it was far too little and 60% respondent said too little. The simple arithmetic

mean of this figure is 25%, so if student were not study too much before join Master in science.



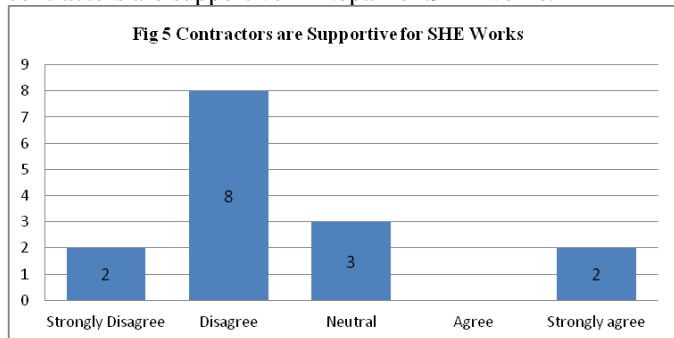
d. SHE is useful tool to minimizing risks for Nepal?

Safety, health and Environment in construction industry is very prominent factor do execute the work. If anyone skill or trained labour may suffer from safety, health and environment, whole project would loss the effort to fulfill his recovery and hence project felt the savior risks. The respondent about 64% said SHE is useful tool to minimize the risks in developing countries like Nepal, and about 36% does not agree this perception. The arithmetic mean of this figure is 47%.



e. Contractors are supportive to address the SHE in Nepal

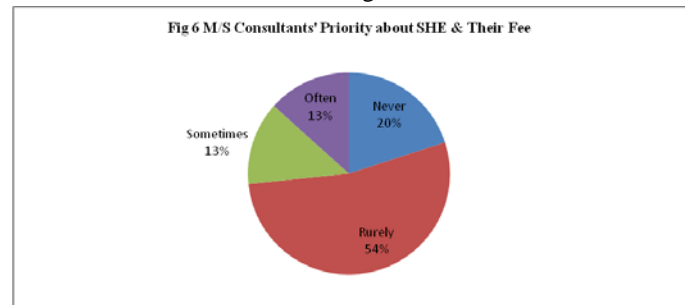
It is true if contractors are positive and they incorporate the safety, health and environment if, they ignore to support, first contractors will face the risks factor in connection with SHE and whole project will face the risks from safety, health and environments. 13 % respondent agree contractors are supportive in Nepal, 19% respondent did not comment in favor or against, 13% respondents are strongly disagree contractors in Nepal are supportive and 53% disagree the contractors are supportive in Nepal for SHE works.



f. Consultants give priority to get fee and then construction safety.

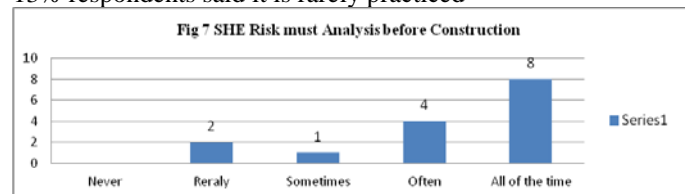
M/S Consultants are professionals' organization in the world but in developing countries like Nepal, healthy professional practices are not yet established so the concept is not matured.

First they look up their fee and they proceed about safety, health and environment related advices. 54% respondents said the consultants rarely study and works regarding the safety, health and environment instead of their fee. The simple arithmetic mean is 25% of this figure.



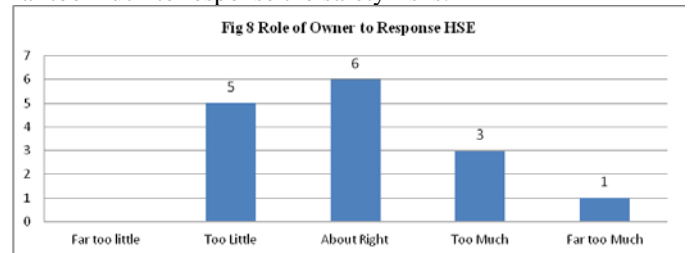
g. Risks due to SHE must be analysis before construction phase?

Of course it is not sense, to analysis the risk after assumption of the construction project. In developing countries due to unemployment construction projects take up in ad hock bases and then latter on contactor are concentrating the way how to complete it. This way risk will not minimize but get seivior. Every one professional practice need to analysis the risks before taking the construction project due to safety, health and environment. In this regard question was asked that the risks related safety, health and environment must be analysis before construction,53% respondents said yes it must be practiced all the time, about 27% respondents said often need to do so, about 7% respondents said yes we should do some times and 13% respondents said it is rarely practiced



h. The role of owner is positive to response the safety risks?

The role of the project owner will or will not in favor of construction Safety, Health and Environment. To know this important issue about 33% respondents said it too little, 40% respondents replied weather in favor or in against, 20% respondents said it is too much and 7% respondents said it is far too much to response the safety risks.



i. Provision of safety awards in Nepal?

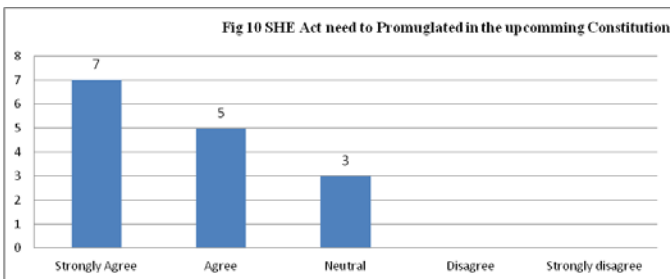
It is the practice in developed countries, the penalties and award regarding the maintaining of construction safety health and environment. Question was asked to weather

this provision is practicing in Nepal? 20% respondents said that they read it, about 7% said that it was listen, 60% said that they do not know and about 13% respondents said it is never practiced in Nepal.



i. *Construction Safety Act is needed to promulgate in the upcoming constitution for construction industry security?*

It is well known that construction industry also one of the emerging industry and contributing to the country in terms of revenue and employment to unemployed. So construction Safety Act is not yet promulgated to addressing Construction Safety. 47% respondents said strongly agree, about 33% respondents agreed and 20% respondents were in neutral.



V. CONCLUSION

Construction infrastructure, accidents health and Safety are big risk factors among others factors, construction industries have losing number of skilled workers during executing the work due to unsafe, unhealthy and improper environment of the construction site. Unavailability of the proper safety acts for the construction industry is losing skilled workers, is losing good citizens. Without fulfilling same type of skilled person projects are being delay and hence suffer big risks. Regulating body, the government of Nepal had not given a safety act. The Labor Act, 1991 industries workers safety and National Building Code are not enough to address the construction safety. Therefore risks due to safety works in housing, infrastructures projects need to be analyzed before caring out the project in developing countries like Nepal.

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