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Construction worker's safety measures: A comparative risk analysis of construction sites of City Corporation and municipal areas of Bangladesh

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Abstract

This study assesses the risk status of construction workers at different levels of municipal and local government. Construction workers perform a crucial function for the structural and financial improvement of the country. This area is much less mechanized, but it requires more effort. Security issues are the main topic of this business. Various information has shown that this discipline is incredibly dangerous. This research attempted to evaluate the threat reputation of manufacturing workers at different levels municipal and municipal level using a structured risk assessment questionnaire in which primary data plays the main role. This evaluation leads to represent the comparative vision of security practices at the two levels indicated above. In addition, an effective risk management framework for safety issues was formulated which will ensure a safe workplace and reduce loss of life and property and develop an effective framework for sustainable safety management. This study has assessed the risk status of construction workers at different level (city corporation level and municipality) that leads to represent a comparative overview between them. This research can apply to the construction workers all over Bangladesh so that people can have a safe environment while working and give their best to build up the country.

Keywords: Construction worker; Safety Measures; Risk Assessment; Risk Management.

1. Introduction

Working surroundings protection can be a crucial global issue, and in specific, the improvement enterprise is overrepresented in paintings surroundings harm and passing insights. In spite of modernization, the enterprise stays hard work critically and employees are exposed to energetic, high-danger conditions at the exclusive ventures and improvement locales [1]. International Labor Organization (ILO) reports that at slightest 108,000 deadly mischances happen each year at development locales around the world, comparable to one passing each ten minutes [2]. Besides, one out of each six lethal working environment mishaps take place at a development location, and typically expanded in creating nations, where development location fatalities account for 25-40% of all work environment fatalities [3].

In Bangladesh, there have been round a hundred ninety fatalities recorded in the preparatory facts for 2020, which changed into the instant maximum multiplied wide variety of fatalities of all businesses. This compares to a casualty charge of 7.35 fatalities in keeping with 1, 00,000 specialists, which debts for 16% of fatalities for all businesses. In expansion, for the very last six an extended time, the improvement enterprise accounted for round one hundred thirty-five passing in keeping with 12 months on an ordinary in the nation. This determine is one of the maximum noteworthy in comparison to different nations [4]. But, the safety management trouble on this phase is notably destitute in Bangladesh characterized through tall casualty rates [5]. In spite of the fact that there's broad investigate in this segment around the world, but in Bangladesh, thinks about are constrained and investigate cannot go distant due to need of information and need of information almost security. Subsequently, these subject requests encourage consider and inquire about, as its significance is being realized at national level to keep on track with the universal standard [6].

The risk status of the construction workers at different level is not concern of the authority of the government. This may lead to severe problem of the employers. As workers are the man power of any country in economic development specially in a developing country like Bangladesh, a study regarding their safety management can bring about a revolutionary change in different types of constructions. This kind of research is not built yet and this research will pave the further development significantly. This study will assess the risk status of construction workers at different level (city corporation level and municipality) that leads to represent a comparative overview between them. The principal focus of this research about different construction sites of Dhaka city corporation area and Ghorasal municipal area that will provide a clear impression about the variation of their safety measure practices. This assessment demonstrates the need to develop a workable framework to contribute to the improvement of general conditions.

1.1 A general overview of the construction site safety of Bangladesh

Bangladesh is a rising nation in terms of development parameters. But it is a major concern that workers safety is not a necessary issue here. Specially, safety in construction sites is always kept out of tension [7]. Dhaka, the capital of Bangladesh is also well known for the high density of population with high intensity of multistoried buildings. RAJUK (Rajdhani Unnayan Kartripakkha) official opinion is "Every year on an average more than thousands of new buildings rise in Dhaka city" [8].

Amid development, appropriate security for the common open and specialists utilized there on should be given agreement to the different arrangements of the Bangladesh national building code. All existing and abutting open and private property might be ensured from any harm due to development operations [4]. All hardware and defend required for the development work such as transitory stair, step, slope, framework, raise, runway, blockade, chute, lift etc. might be considerably developed and raised so as not to form any hazardous circumstance for the specialists utilizing them or the common open passing beneath, on or close them. But this safety culture always remains negated that causes the loss of life, injured [9]. That's why every year construction industry is at the second highest position in terms of fatalities (Figure 1).

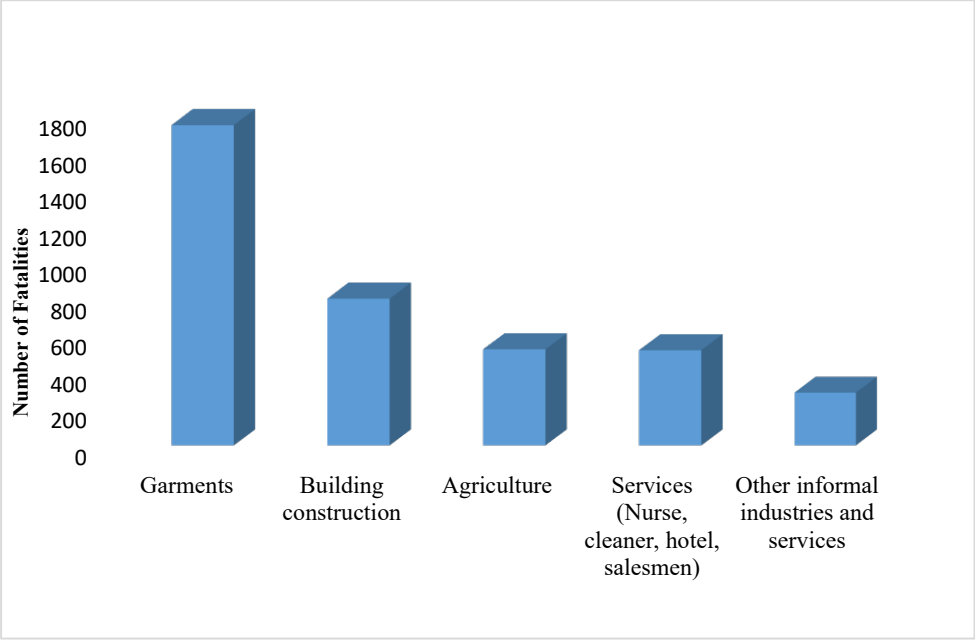

Figure 1: Sector wise distribution of fatalities. Source: [13]

2. Aim & Objectives

The main aim of this research was to make a comparative study between the risk statuses of the construction workers of Motijheel Thana and Ghorasal municipal area that helps to construct an effective framework for sustainable safety measure issue.

To fulfill this aim two objectives were considered-

i. To assess the risk status of the construction workers at different level (City Corporation and Municipal).

ii. To develop an effective framework for sustainable safety management.

3. Study Area

Motijheel thana is commercial center of Dhaka city (Figure 2). This area has strong economic

background because of the presence of head offices of Bangladesh Bank and most of other commercial banks, largest stock exchange and railway station of Bangladesh and so on [10].

Motijheel Thana is located between 23°43' to 23°44' N and 90°24' to 90°25'E (Table 1). It is surrounded by Ramna, Rampura and Khilgaon thanas on the north, Sutrapur thana on the south, Khilgaon and Sabujbag thanas on the east, Paltan and Ramna thanas on the west. Ghorasal Paurashava is well known industrial area of our county. It is located at the west bank of Sitalakha River.

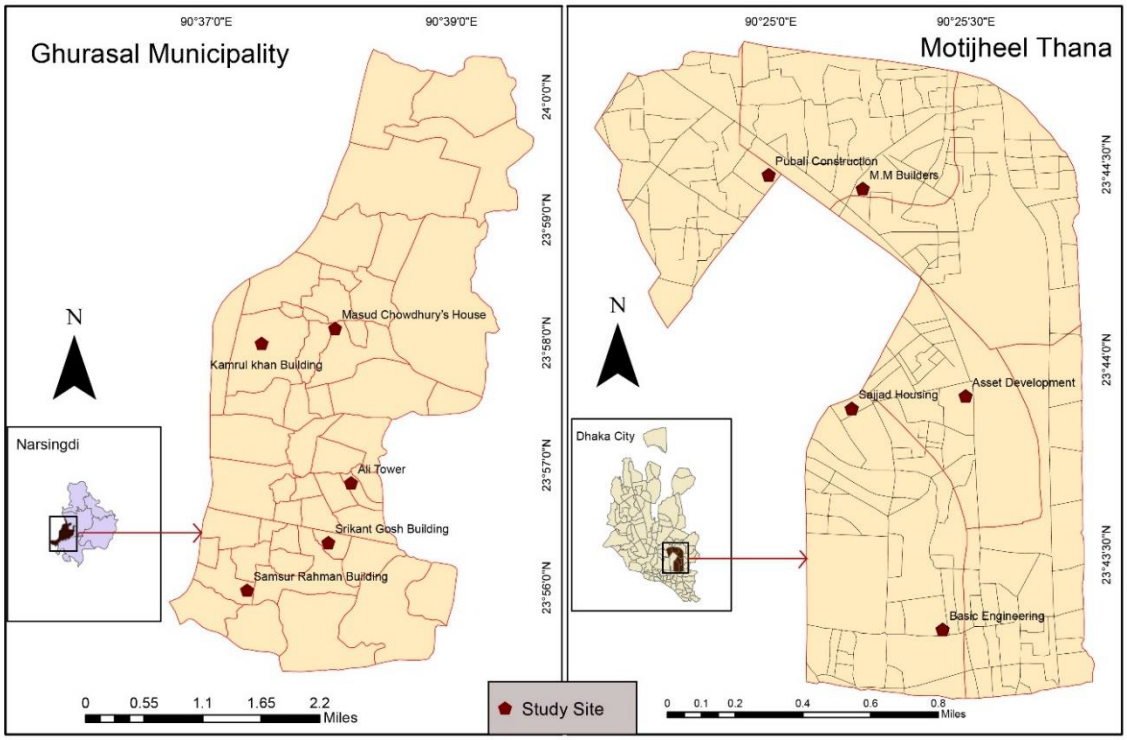

Figure 2: Map showing the study area

Table 1: Study area at a glance.

Study Site of City Corporation Area	Latitude	Longitude	Study Site of Municipal area	Latitude	Longitude
Asset Development	23°43'54.37"N	90°25'29.91"E	Kamrul Khan Building	23°57'59.66"N	90°37'26.95"E
Sajjad Housing	23°43'52.48"N	90°25'12.44"E	Masud Chowdhury's House	23°58'6.94"N	90°38'2.86"E
Pubali Construction	23°44'28.39"N	90°24'59.62"E	Samsur Rahman Building	23°55'59.01"N	90°37'19.75"E

M.M Builders	23°44'26.27"N	90°25'14.11"E	Srikant Gosh Building	23°56'22.08"N	90°37'59.65"E
Basic Engineering	23°43'18.49"N	90°25'26.37"E	Ali Tower	23°56'51.24"N	90°38'10.68"E

4. Materials & Method

To attain the point and goals of this research both essential and auxiliary information had utilized. The evaluation of hazard status of the development specialists was finished based on the information collected from essential sources, where construction workers and construction site supervisors are the unit of measurement. And with secondary data it is possible to define risk management standards that point to how to create a framework for the construction industry to reduce the amount of risk. In arrange to fulfill study destinations essential information are collected based on both quantitative and subjective approaches. Essential information is collected through Location visit, FGD (Focused Group Discussion), and Survey overview frame five diverse locales both city enterprise and region regions. A structured risk rating questionnaire leads this function. This questionnaire holds top five risk factors of construction workers which are selected through FGD (Focused Group Discussion). Each risk factors have some ideal risk control mechanisms that are mainly fixed by literature review (OSHE Standard, BUET, and RAJUK Standard).

5. Analysis and Discussion

The structured risk assessment questionnaire takes into account each factor and has 10 points divided by the ideal number of risk control mechanisms/functions. If, a risk factor has five ideal mechanisms to minimize the risk then each mechanism gets the value by dividing the point 10 with 5 or if a risk factor has four ideal mechanisms to minimize the risk, then each one gets 2.5 score. Here, risk was assessed based on a simple philosophy- “The more the risk control tools are available the less the risk and the less the risk control tools are available against the risk factor the more the risk.”

The risk status was assessed based on the value range that is classified into five categories, these are Extremely high risk, High risk, Moderate, Low and Very Low [10] (Table 2). Collecting this information, this reflection used a basic spot check strategy. Sample measure has calculated utilizing the taking after equation.

$$Sample\ Size = \frac{z^2.p\,(1-p)/\,e^2}{1 + (z^2.p\,\frac{(1-p)}{e^2N})}$$

Where,

Confidence Level = 80% and Margin of Error =10%

Table 2: The risk status table.

Risk Factors ($x_i = 10$)	Ideal risk control Tools (y_i)	Value of each risk control tools $(x_i/y_i)=m_i$	Number of Ideal risk control tools are available (n_i)	Total risk control value ($m_i \times n_i$)
Fall from height	☐ Safety net ☐ Safety boot ☐ Guardrails ☐ Full body harness ☐ Safety — $y_i = 5$	**2**		
Electrocutions	☐ Safety gloves ☐ Safety jackets ☐ Safety boots ☐ Routine checking ☐ Circuit breaker — $y_i = 5$	**2**		
Struck by objects	☐ Chemical splash googles ☐ Full face shields ☐ Safety jackets ☐ Routine checking — $y_i = 4$	**2. *5***		
Caught in or in between object	☐ Safety covers ☐ Positioning device system ☐ Guardrails ☐ Hard hat ☐ Safety jacket — $y_i = 5$	**2**		
Respiratory issues	☐ Dust mask ☐ Regular water spray ☐ Dust control ☐ Routine health check — $y_i = 4$	**2. *5***		

Value range	color	Risk status
0-10		Extremely high risk
11-20		High risk
21-30		Moderate
31-40		Low risk
41- *50*		Very low risk

The comparative study between the risk's statuses of city corporation and municipality areas had determined by line graph using MS Excel. Moreover, required secondary data was collected though literature review from different published articles, newspapers and others secondary sources.

5.1 Construction workers risk status in City Corporation & Municipal areas

Risk is considered as the situation when exposer is in danger. Basically, it indicates the probability of harm both physical and economic. Bangladesh is a developing country; its development is visible in both infrastructure development and economic uprising nature. The actual scenario is that in between 2009-2014 RAJUK was given the approval of almost 18000 buildings. This gigantic volume of development works grows the working segment beneath this industry. Concurring to Development specialists' union and REHAB (Real Estate and Housing Association of Bangladesh) (2017), "About 3.5 million individuals work in Bangladesh's development industry [11]." But it is matter of great upset that this huge volume of labor force is in great threat due to lack of standard workplace safety.

Motijheel thana is well known for its economic significance. The presence of the headquarters of economic institutions, trade & commerce, corporate offices make this area more significant one in Dhaka city. Most of the institution try to set their offices here that increases the demand of new buildings. In 2020,

about more than 700 new constructions have been applied for permission and 83 construction sites are under development. That means a huge number of construction workers work here. This study has assessed the risk status of construction works in five different construction sites. Around five hundred works are active here among them the workers of Basic Engineering show better risk management practices in compare with other sites because here about 83 percent workers are in low and very low risk. Whereas Khalil Mia's building & Pubali construction shows very worse condition in safety management (Table 3). Kismot mia (34) labor of Pubali construction has said- "The authority didn't supply all kinds of safety equipment's that you have mentioned, most of the works here use just a hard hat and boot. I have been working in this sector but it is disappointing we are always neglected. Most of the time supervisor provides us just boot & helmet. Sometimes they also supply mask, gloves. If they supply everything why not we use those, we need security for our life." Sumon Mir (44) supervisor of Khalil Mia's building has claimed that "Most of the time workers show less interest to use safety equipment's. We always try to ensure best safety management for our workers".

On the other hand, the site supervisor of Pubali construction M.H Hasan (Aged 52) have explained "We provide all the necessary personal protective equipment's but the workers are not always interested to use those products because of the weight, warm feeling, uneasiness and many other reasons." But he cannot provide satisfactory answer about their poor monitoring system. All the above opinions clear the conflict between constructions authority and workers on safety management. This is the common practice in every sector of Bangladesh.

Table 3: Risk status of city corporation area

Construction Sites	Total Population	Sample Size	*Risk Status in municipality (in %)*				
			Extreme Risk	High Risk	Moderate Risk	Low Risk	Very Low Risk
Asset Development	133	45	2.22	8.83	71.11	17.77	0.00
Sajjad Housing	85	38	7.89	13.16	63.10	13.16	2.63
Pubali Construction	117	43	6.98	20.93	55.81	9.30	6.28
M.M Builders	140	46	0.00	4.35	36.96	43.48	15.22
Basic Engineering	70	35	0.00	0.00	17.14	65.71	17.24

In Ghurasal Municipality almost 85% of the total construction workers are in extreme & high risk at their working sites. Every construction site shows almost nil about their workers safety. The condition is very severed at Samsur Rahman's construction site where more than 95% of the workers are in extreme and high risk. Moreover, the workers of Kamrul Khan's, Masud Chowdhury's and Ali Tower are also in worse condition in terms of safety practices (Table 4).

Ripon (Aged 22) worker of Samsur rahman site has said "We are working here more than three months; no one gets seriously injured. So, this is not our concerning issue, we know to work in this sector some risks need to consider but if owner supply necessary tools we are ready to use." This type of vocalization is common in Ghurasal municipality. In this study area construction workers are not concern about their safety management. The safety culture is not grown here on proper basis. According to local contractor Sadik (Aged 22)" Any kind of construction work under this municipality needs to take permission and have to prove the construction plan in accordance with the rules but there are no specific rules about construction worker's safety issues."

Table 4: Risk Status of Municipal Area

Construction Sites	Total Population	Sample Size	*Risk Status in municipality (in %)*				
			Extreme Risk	High Risk	Moderate Risk	Low Risk	Very Low Risk
Kamrul Khan Building	42	26	38.46	46.15	15.38	0.00	0.00
Masud Chowdhury's House	63	33	24.24	57.58	12.12	6.06	0.00
Samsur Rahman Building	35	24	58.33	37.50	4.17	0.00	0.00
Srikant Gosh Building	38	25	20.00	44.00	28.00	8.00	0.00
Ali Tower	78	45	31.11	48.89	8.89	11.11	0.00

Construction industry in Bangladesh is a raising economic sector. Construction workers are the running fuel of this industry. But it is matter of great concern that they are always neglected. In municipal areas construction works pays no attention about their safety issues where as the workers of City Corporation area are in slight safety net. But this is not enough for the reduction of loss of lives. According to the assessment, the maximum construction workers in the Ghurasal city area are at high risk, but in the Motijheel area, the risk situation is medium in nature (Figure 3).

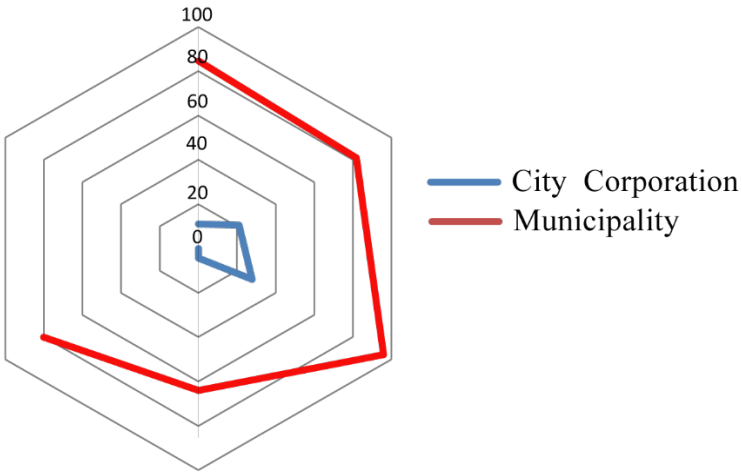

Figure 3: Comparative of Risk Status between City Corporation & Municipality

5.2 Way to improve the situation

Development industry is considered as one of the foremost ruling divisions of financial development and development of any nation within the world [12]. In our country a little percentage of workforce involves in this sector but it is now a most hazardous industry [13]. Most of the workforce of this sector are illiterate and they are not aware of their safety issues. Additionally, the development industrials and dependable national arrangement creators, backing organization pays less consideration on the security issues of development

work strengths. But a light of trust is the expansion of the Bangladesh Labor Act 2006 (BLA 2006) and the Bangladesh National Building Code 2006 (BNBC 2006). Bangladesh Labor Act 2006 (BLA 2006) guarantees security for all segments of work powers that are related to Net Residential Item of the district. And the Bangladesh National Building Code (BNBC 2006) bargains with the security purposes.

No prosperity and security law were associated to the improvement division as there was no existing law a few times as of late November 2006. In November 2006, the Bangladesh Work Act 2006 (BLA 2006) and the Bangladesh National Building Code 2006 (BNBC 2006) were to start with displayed. These rules and headings contain prosperity and security course of action noteworthy to the improvement fragment. The Bangladesh Work Act 2006 (BLA 2006) joins all sorts of labor that are included in any sort of work that are related to GDP of the country [14]. On the inverse Bangladesh National Building Code 2006 (BNBC 2006), especially deals with the labor security of the building advancement section. In addition, Rajdhani Unnayan Kartipakkha (RAJUK) is another stage for City Enterprise zone which primarily works on building arranging, domains and assets, plot allocation, and development endorsements from both open and private substances. And they provide a safety guideline for the construction workers and for the habitat of the surroundings area during construction of high-rise buildings [15]. But in municipal areas there is no specific authority like them. This study finds out what are the real onsite chance situation and what are the reasons behind the labor passing or harm in development destinations in Bangladesh against BNBC and BLA? The most common excuses are lack of sufficient man power for the inspection, lack of consciousness, corruption and so on" [16]. That's why compact framework needs to develop which can be able to minimize the safety problems at both of the study levels.

For the effective risk management, a systematic framework needs to formulate al all level of the urban areas (Both city corporation and municipality). This function should maintain a sequential order or steps. The volume of management practices must be selected by focusing on several factors like- existing capability of the responsible authority, amount of economic sanction and so on. That's why at the first phase of risk management we need to fix the specific issues and demark the scale of challenges which need to recover on emergency basis. These should be determined by in depth field investigation ad relevant case studies. At second phase, the magnitude of risk should be assessed. That will tell the policy maker about the urgency of risk management or helps to fix out the sectors which seeks emergency actions. According to the assessment the relevant causes should modify. All these should be under proper monitoring ad review of those functions. At last phase, policy maker should focus on the relevant barriers and ensure proper support against those so that the management can be successful (Figure 4).

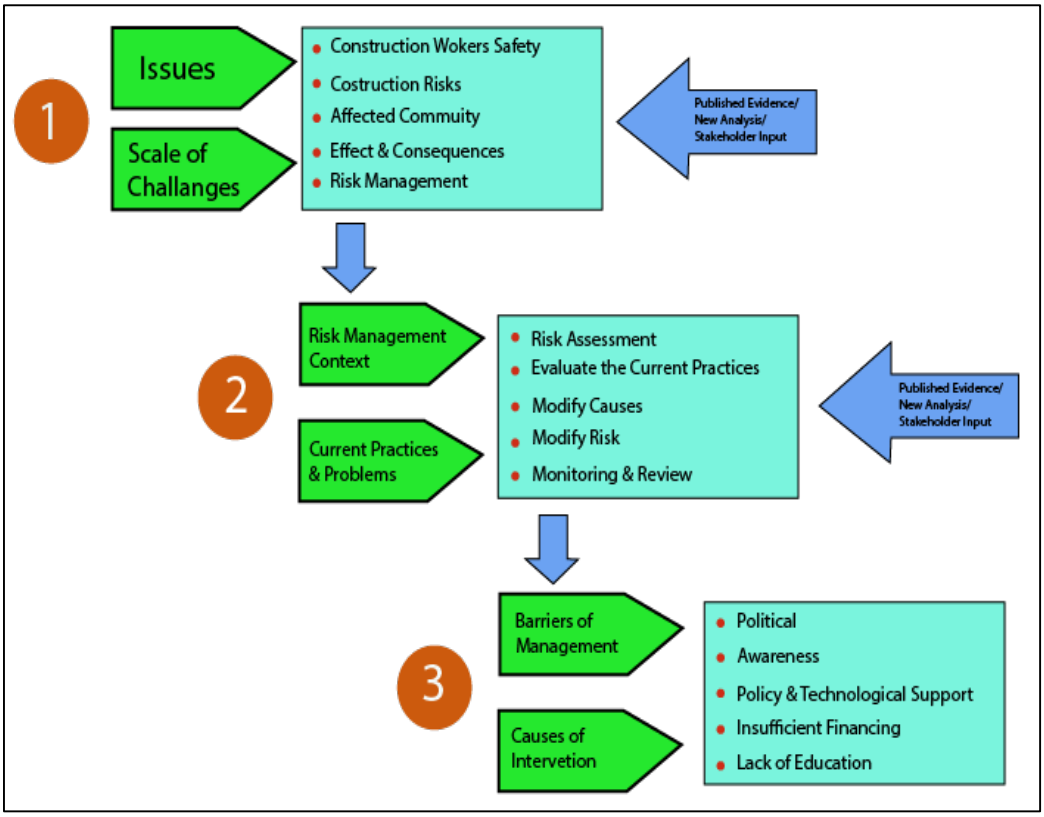

Figure 4: Sustainable Risk Management Framework

6. Conclusion

Construction industry is one of the most dominant and fastest growing sector now-a-days especially, when Bangladesh focusses on its structural development to achieve sustainable economic growth. as it helps create the infrastructure of cities, towns and countries. Unfortunately, the manpower has to work in adverse environment and use risky tools and gears. There is lack of awareness and availability of required tools.

This sector has turned out the most vulnerable one in terms of labor safety. This research happened to assess the risk status of the construction workers at different level by developing an effective framework for sustainable safety management. In Bangladesh, around 2.6 million individuals are included in development industry concurring to the Bangladesh Bureau of Measurements which constitutes approximately 4.4% of the overall workforce but the fatalities in this sector accounts for almost 16.6% of the full work environment fatalities. So, this is often the correct time to raise voice almost their security since financially Bangladesh is presently in a solid position and each working hand is our important resource to attain supportability. Now. It is a matter great hope that the government of Bangladesh focuses on these issues. The ILO is working in participation with the Service of Labor and Work , Bangladesh Employers Federation (BEF), National Coordination Committee for Workers Education (NCCWE), International Broadcasting Convention (IBC) and social accomplices such as the Bangladesh Occupational Safety Health and Environment (OSHE) and The Bangladesh Institute of Labor Studies (BILS), work to cultivate a preventative security and wellbeing culture by fortifying national word related Occupational safety and health (OSH) frameworks at distinctive level of the work places.

The assessment of this study will be helpful to secure the construction workers. The employment of the construction workers contributes to economic growth It requires a lot of strength and has a danger of injury but they give their best for economic growth and development in spite of having a high risk. Government should prioritize their well-being and this change will reflect changes in the economy of Bangladesh.

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