

Scenario of Safety Issues Prevailing Accident in Rural Engineering Workshop in Bangladesh

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Abstract

Safety is the condition being protected against any hazardous situation and any other type of failure, error and accidents. As a developing country our technology is growing day by day. But the man who works to develop this technology and works in different industries, factories and rural engineering workshops is deprived of their required safety. The safety issues provided for the workers are not properly maintained in Bangladesh. Almost no safety is provided for the workers in rural engineering workshop in Bangladesh and for that they are suffering from various problems such as financial, physical, social, spiritual, occupational etc. Many accidents have already been taken place due to not providing enough safety to the workers. Therefore, safety must be provided minimizing accident hazards and risks. The workshops safety situation in Bangladesh is very severe by international standard. An overview of the prevailing accident problem characteristics and some working safety priorities that should be addressed with due urgency are briefly discussed in the paper. In this paper an attempt has been made to highlight the workers safety issues in rural engineering workshops in Bangladesh.

Keywords: Safety Issues, Socio-Economic Development, Rural Engineering Workshop, Occupational Safety, Safety Management.

1.0. Introduction

A workshop is a part and parcel of any engineering section. Small and Medium Size Enterprises (SMEs) having less than 50 employees comprise the majority of enterprises in many countries, and they employ 40~90% of the total work force [1]. Small enterprises are essential for job creation and economic growth [2] because of their clients centered and focus on local or regional needs and thus play a vital role in communities [3]. There is no doubt that rural engineering workshops play a vital role in our socio-economic development. But safety issue is a crucial question here. An alarming no of accidents and cases of illness are reported per annum in rural engineering workshops. Most of the accidents are originated by illiteracy, rowdiness or misuse of machinery and equipment [4]. The owners and workers both are responsible for these accidents. They take the safety issues very lightly and sometimes neglect it willingly. On the other hand, child labor is a threatening issue. Illegal

conditions of the environment of workplace are so murky and offensive. Otherwise the workplace is too small for an operation. In their man, machine and material stay almost in contact. The employer must take reasonable care to protect his employees from risk of foreseeable injury, disease or death at work by the provision and maintenance of a safe place of work, a safe system of work and reasonably competent fellow employees [5]. Efforts to prevent accidents and deaths are extremely relevant because of their relationship to the integrity of the human being and the survival rate of the companies [6]. From a political and financial point of view, the importance of small companies is becoming more and more noticeable [7]. Many engineering processes are dangerous and these consist of different activities like cutting, casting, soldering, welding, etc. Additionally, some activities consist of the use of venturesome materials and chemicals. What is more, even the foremost basic and easy activities will doubtless be dangerous if allotted victimization inappropriate tools, materials, and ways. Altogether cases, the right tools and protecting equipment ought to be used and proper coaching ought to be provided. Additionally, safety warnings and notices ought to be conspicuously placed within the geographical point, access to areas wherever venturesome processes turn up ought to be restricted and thoroughly controlled so only fittingly trained personnel is present. Additionally, the storage of venturesome materials (chemicals, hot substances etc.) needs special care and effective access management.

Productive health and safety management in tiny engineering workshops is concerning distinctive the foremost frequent and high risks and adopting the correct precautions, taking account of time, cash and resources [8]. Generally speaking, all employers and employees have the same occupational health and safety (OHS) rights and obligations [9]. The data was collected during this study associated with commercialism scenario, employment and labor issues and connected particularly to occupational safety, health and working surrounding, cautions at work, pointers in promoting the event of safety standards at work in rural engineering workshops in Bangladesh. Various activity ways like reportable work injuries, hospital treated work injuries, and survey based mostly estimates of labor injuries might provide totally different estimates of the quantity of labor injuries [10].

The cases of labor injuries enclosed during this study are so the less severe injuries, within the sense that they solely embrace injuries inflicting temporary absence from work. The effort and type of occupational health and safety (OHS) management system does significantly affect the injury rate. Studies on Occupational Health and Safety Management Systems (OHSMS) have proposed methods for increasing organizational efficiency together with the confrontation of this reality of many work accidents to improve the operations of companies and their interaction with the

society [11]. This study aimed to supply an outline of occupational health and safety management in rural engineering workshops.

2.1. Questionnaire development

A form was developed comprising check-box queries and open-ended queries. The form was divided into four sections that coated:

- i. Information about the workshop
- ii. Enquiry the accidents and workers condition data
- iii. Condition of workshops and workers
- iv. Occupational health and safety regulations

The adjustment of the questionnaire was made following the comments

2.2. Types of workshop

The counted workshops were small sized rural engineering workshop in Bangladesh. Which were

- i. *Automobile service center*
- ii. Welding shop
- iii. Lathe shop
- iv. Air cooler & refrigerator service center
- v. Wood shop
- vi. Painting workshop
- vii. Fiber & glass workshop
- viii. Electronic device service center
- ix. Saw mill (cutting and processing wood)

2.3. Procedures

A cross-sectional non-experimental design was used for this study. From January 2017 to May 2017, here prepared the survey in the two districts (Jessore, Khulna) in Bangladesh. It also tried to contact to the owner of different rural engineering workshop and the victim of different types of accident. Based on the type of workshops and the questionnaire that we did the survey. Finally, 80 small size rural engineering workshops were investigated for obtaining the questionnaire. All most 85% of these workshops were road side workshops. The survey was designed to capture the common injury that occurred in rural engineering workshops as identified by safety science based on online database. Then, the survey was designed to identify the common nature of injuries, parts of body

affected by injuries, causes of injuries. The survey was furnished to gather information from five major sections consisting of 35 items: (a) causes of injury (table 1); (b) nature of injuries (table 2); (c) occupational injury socio-demographic category (table 5); (d) occupational injuries in work related category (table 6); and (e) working conditions. We asked to report any injuries or experience of accident while working for the current operation.

2.4. Data analysis

Data from the form were hinted and analysis. Percentages were used.

3.0. Results

3.1. Accident statistics

There are many accidents and cases of injuries reported every year in the small engineering workshops. Almost two-third of all such accidents arise from the movement of people, goods and vehicles around the workshops and out of it. Of these “movement” accidents are about half involve lifting and moving goods and other half involving slips, trips and falls and hitting stationary or moving plant and equipment. “Non-movement” accidents mostly arise from the use of machinery, this account for 10 to 15% of all accidents. Electrical accidents are common and they frequently have the potential for more serious injuries. The most common occupational diseases are dermatitis, deafness, asthma and vibration white finger, and back, hand, arm, shoulder and neck problems. In any particular workshop risks which are relevant should be assessed. Those likely to be of most concern includes movement of people, goods and vehicles around the workshop, particularly manual handling, machinery safeguarding, hazardous substances, particularly metalworking fluids, degreasing solvents and dust or fume from welding, brazing, soldering, coating and painting, noise and vibration.

Besides these reasons there are many other causes for accidents such as poor lighting, electrical hazards, fire hazards, poor exhaust ventilations, human carelessness etc. Unguarded and badly maintained plant and equipment are obvious causes to injuries. However most of the common causes of accidents are falls on slippery floors, poorly maintained stairways scaffoldings and obstructed passageways in overcrowded workplace. The costs of accidents and ill health to small engineering workshops may be high. Many employees are ‘key’ workers whose loss through injury or ill health severely disrupts production and lowers profitability. The overall condition and different cause for accidents in rural engineering workshops were investigated. The accident statistics of workshops were classified by number of injured workers by different causes is shown in **Table.1**. From this tabel it is seen that most of injuries in rural engineering workshop are caused by machinery and then by

handling and carrying equipments. The accident statistics of workshops were classified by nature of the injury is shown in **Table.2**

Table 1: Injuries to rural engineering workshop by accident.

Total number of injured person(investigated)	26
1.Handling and Carrying	7 (27%)
2.Falling objects	5 (19%)
3.Slipping and tripping	2(8%)
4.Machinery	10 (38%)
5.Falls from height	2 (8%)
6.Workplace transport	0 (0%)

Table.2: Nature of injury for 26 interviewed injured wrokers.

Nture of injury	Number (%)
1. Amputation, laceration	3 (11.53%)
2.Contusion	2 (7.69%)
3.Dislocation, facture	5 (19.23%)
4. Hernia, rapture	2 (7.69%)
5.Sprain/strain,joint inflamination	9 (34.61%)
6.Scratch, abrasion	1 (3.84%)
7.Brun,multiple, miscellaneous	4 (15.38%)

The accident statistics of workshops were classified by number of injured workers in different workshop is shown in **Table.3**. It is seen that most of accidents are taken palce in welding shop,automobile service centre,lathe shop,electronic devices service centre and wood shop. The accident statistics of survey classified by absences of workers is shown in **Table.4**. It is seen that due to accidents the function of the workshops are hampered severely and workers are absent for several days due to this. This affects the functionality of the workshop significantly.

Table.3: Numbers of injured workers in different types of rural engineering workshop by accident.

Types of workshop	Numbers of workshop	Injured workers (%)
1. Automobile service center	12	3 (11.53%)
2. Welding shop	14	5 (19.23%)
3. Lathe shop	12	6 (23.07%)
4. Air-conditioner & refrigeration service center	4	1 (3.84%)
5. Wood shop	10	2 (7.69%)
6. Painting shop	6	0 (0%)
7. Fiber & glass workshop	5	2 (7.69%)
8. Electronic devices service center	10	4 (15.38%)
9. Saw Mill	7	3 (11.53%)

Table.4: Accident statistics classified by absence of workers in the workshop.

Accident case	Number (%)
1. ≤ 1 day lost case	6 (23.07%)
2. > 1 day lost case	5 (19.23%)
3. Disability case	4 (15.38%)
4. Fatal case	4 (15.38%)
5. Scikness case	7 (26.92%)

3.2. Conditions of workers & workshops

In Bangladesh the occupational safety of rural engineering workers is not well organized. The owners are employing male workers with below 30 years of ages at the rate of 65% and the upper being 35% while the percentage of female workers is negligible. The most remarkable fact is that the percentage of child (age below than 15 years) workers in rural engineering workshop are minimum 30%. The owner of that workshop prefers them to take the opportunity of their poverty and also their wages are cheap. They are also deprived of their basic education. Their average working hour was 8.0 h/day (31%) and 48 h/week. Regarding a number of holiday/weeks, maximum workers had one day, two days holiday was rear. Most of the day workers had little time to lunch or breakfast. They were working from morning to till night most of the days. Most engineering workshop arranged several welfare facilities for workers namely. There was not arranged clean

drinking water, suitable eating places separated from operation area, clean and good sanitation of toilet facilities, washing basins and proper resting areas inside the workshop. It is very important that the workshops provide necessary welfare facilities for workers. Out of 80 rural engineering workshops studied, the workers were exposed to work by hazardous chemicals, excessive noise, working at dangerous elevation, in hot place, in confined space, low fresh air circulation, inadequate lighting quality, with excess vibration etc. The workers are not trained enough to the proper use of tools and machines in the engineering workshops which may cause injury to the operators. Percentage of unskilled workers and illiterate worker is high. Different types of rural engineering workshops were observed and different cases of accidents were investigated. Injured and non-injured people are divided into two categories firstly socio-demographic and secondly work-related category. And these categories are divided into some sub-categories. So that table 4 and table 5 is related to factors of occupational injuries in different types of workshop in socio-demographic category and work-related category.

Table.5: Data for factors of occupational injuries in socio-demographic category.

Factors		Injured workers (total 26)	Non-injured workers (total 248)
age	< 30 years	17 (65%)	108 (44%)
	≥ 30 years	9 (35%)	140 (56%)
Material status	Unmarried	15 (58%)	156 (62%)
	Married	11 (42%)	92 (38%)
Educational level	Illiterate/basic education	20 (77%)	176 (71%)
	College/technical	6 (23%)	72 (29%)

Table.6: Data for factors of occupational injuries in work related category.

Factors		Injured workers (total 26)	Non-injured workers (total 248)
Job category	Unskilled	18(69%)	104(41%)
	Skilled	8(31%)	144(59%)
Duration of work(years)	<10	16(62%)	139(57%)
	≥10	10(38%)	109(43%)
Working hours/week	>48	8(31%)	177(72%)
	≤48	18(69%)	71(28%)
Workplace supervision	No	17(65%)	150(60%)
	Yes	9(35%)	98(40%)
Machinery & maintenance	Poor	15(58%)	172(69%)
	Good	11(42%)	76(31%)
Health and safety	No	21(81%)	188(76%)
	Yes	5(19%)	60(24%)

Reviewing these two tables that the perception about the rural engineering workshop is found and which is very woeful. Some pictures are given below which shows the hazardous situation of workshops.



Fig.1: Worker is doing gas welding without safety



Fig.2: Child is working in workshop

In Fig.1 shown that a worker is doing gas welding without safety. His dress is lungi (one kind of Bengali dress) which is long loose. That kind of dress is too much dangerous for any kind of machining

operations. In **Fig.2** it is viewed that a child is working in workshop. He was working there during two years.



Fig.3: Victim of workshop accident

In **Fig.3** it is noticed that a victim of workshop accident. He lost his one finger because of blasting the air trunk of truck. These types of accidents are very common in rural engineering workshop in Bangladesh. Every year many people suffer from this type of accidents largely. One of the reasons of that type of accidents is not to use proper safety measures and the workers are not trained enough to the correct use of equipment's and machines in the engineering workshops which may cause injury to the operators. Special safety measures and cares should be taken to minimize this type of fatal accidents.

4.0. Results and discussion

In engineering workshops accidents are unfortunately too common. They vary in degree from trivial to, in exceptional circumstances and facilities. The health and safety of people at work is covered by a variety of acts of parliament, each act containing a book of laws and regulations which govern the way in which work may be done in the workplace and the processes, operations and equipment employed to do the work. This case-control study of risk factors for injuries in rural engineering workshops recognized a number of work environment features that were connected with injury occurrence. The risk factors confirmed in multivariable regression models were high physical workload, machine-paced work or inability to take a break when tired, lack of training, absence of a lockout program, being new on the job, and being male. Overtime is considered important for workers in rural engineering workshops because they wanted to have more income. If the owners do

not provide overtime work, they might move to other places causing a high turn-over rate due to low take home pay. It can be seen that workers in workshops have to work very hard, for approximately 11 h/day on average, if they do overtime jobs. The results showed that most of the enterprises did not have a suitable eating place for workers; thus, workers had to bring some food for lunch or had to find a place to eat outside. The number of workshops which had a fire extinguishing training, fire drills and fire evacuation training were too low. We carried out environmental monitoring for dust, heat, noise and lighting for those workshops and found most of them complied with the law only in some parameters. Those workshops therefore still need to improve their working conditions.

Improvement of safety condition of rural engineering workshop is a multi-disciplinary task and does not occur by itself. One fundamental step should be taken by Bangladesh government and which is created an organization dedicated to initiating and coordinating safety activities for rural engineering workshop. These organizations will investigate the safety condition and give them the licenses. To ensure occupational safety and to develop the safety issues some policy should be taken which are given below.

National Policy:

- i. Safety management should be encouraged.
- ii. National occupational safety and health policy.

Government Organizations:

- i. Establish autonomous occupational safety institute.
- ii. Establish national occupational safety and health council.

Employers Organizations:

- i. Training, awareness and motivation of employer regarding workplace safety and health.

Labour Union:

- i. Encourage more bipartite approach.
- ii. Expand union activities to all occupational sectors.

Legislation:

- i. Update the laws and reduce inconsistencies.
- ii. Increase effectiveness of the law focusing on rural engineering workshop.
- iii. Encourage employment of occupational health service specialists, safety inspectors in every local zone.
- iv. Introduce safety audit.

Training organization:

- i. Develop and strengthen institutional capacity to provide education and training related to occupational safety and health.

National Statistics:

- i. Develop active data collection system.
- ii. Establish occupational diseases surveillance.
- iii. Establish national and regional accident and occupational diseases database.

In Bangladesh most of the workers are illiterate. So, it is very much important to give them at least primary knowledge about their work and safety measurements to be performed in their workshop. Suitable clothing is a very important factor in an engineering workshop. Overall and protective clothing should be sufficiently loose in order to allow easy body movement but not so loose that they interfere with engineering task and activities. Maintenance and equipment must be regularly serviced and maintained by appropriately trained and experienced personnel.

These not only reduce the chances of a major breakdown leading to loss of production, it lessens to chance of a major accident caused by a plant failure. Equally important is attention to such details as regularly checking the stocking and locating of First Aid Cabinets and regularly checking both the condition and location of fire extinguishers. All those checks must be logged. But before all of these recommendations the first work is to grow up the vigilance of the owners, the workers and the government. If we can ascertain the occupational safety of the workers and the safety condition of the workshop then it will help to progress our country, to improve our social value and to achieve a good international reputation.

5.0. Conclusion

This paper consists of safety condition of rural engineering workshop in Bangladesh and occupational safety of workers. It was found that many rural engineering workshops are prone to accidents and casualties. Here occupational safety refers mainly to needs the workers. But the owners have no concern about their safety and their workshop environment. On the other hand, they want to enjoy benefits with increased production. The field of rural engineering has the ability to make the noticeable contributions to achieve an improved occupational safety system by maintaining safety issues and the law. As large number of people are working in rural engineering workshop and they serve us to meet our daily needs so they should provide with sufficient safety measures. Laws should be implemented and followed strictly. If we want to improve our economy the condition of the workers

must be improved and they should be facilitated by their basic needs otherwise we will lose our potentiality and our economy will be hammered. So, it is very important as a developing country to pay heed to the concerns about rural engineering workshops. Thus, we can improve life style of people, social values, and economical condition.

References

- [1] Liu Pingqing, Liu Fang, Gao Chunjing, "Occupational Health and Safety (OHS) in Small and Medium Size Enterprises (SMEs)", *Canadian Social Science* Vol.2 No.1 March 2006.
- [2] Cunningham, T. R., & Sinclair, R. (2015), "Application of a model for delivering occupational safety and health to smaller businesses: Case studies from the US", *Safety Science*, 71(100), 213-225.
- [3] Valdez RS, Ramly E, Brennan PH., *Industrial and Systems Engineering and Health Care: Critical Area of Research—Final Report* (Prepared by Professional and Scientific Associates Under Contract No. 290-09-00027U.) AHRQ publication No. 10-0079. Rockville, MD: Agency for Health care Research and Quality. MAY 2010.
- [4] Lortie, M., Nadeau, S., & Vezeau, S. (2016), "Holistic sustainable development: Floor-layers and micro-enterprises", *Applied Economics*, 57, 8-16.
- [5] Harns-Ringdahl, L., Jansson, T., Malmen, Y. Safety, "Health and environment in small process plants-results from a European survey", *Journal of Safety Science* 31 (2), 71–80, 2000.
- [6] Garnica, G. B., & Barriga, G. D. C. (2018), "Barriers to occupational health and safety management in small Brazilian enterprises", *Production*, 28, e20170046. <http://dx.doi.org/10.1590/0103-6513.20170046>.
- [7] Finn Tüchsen, Karl Bang Christensen, Helene Feveile, Johnny Dyreborg, "Work injuries and disability", *Journal of Safety Research* 40 (2009) 21–24.
- [8] Champoux D., Brun J.-P., "Occupational health and safety management in small size enterprises: an overview of the situation and avenues for intervention and research", *Safety Science* 41(4),(2003)), 301–318.
- [9] Pornpimol Kongtip, Witaya Yoosook, Suttinun Chantanakul, "Occupational health and safety management in small and medium-sized enterprises: An overview of the situation in Thailand", *Safety Science* 46 (2008) 1356–1368
- [10] Whysall, Z., Haslam, C., & Haslam, R. (2006), "Implementing health and safety interventions in the workplace: An exploratory study", *International Journal of Industrial Ergonomics*, 36(9), 809-818. <http://dx.doi.org/10.1016/j.ergon.2006.06.007>.
- [11] Pablo Arocena, Imanol Nunez, "An empirical analysis of the effectiveness of occupational health and safety management in SEMs", *International Small Business Journal*, Volume: 28 issue: 4, page(s): 398-419, 2010.