

# Quantitative Analysis and Correlation between Safety Perception and Working Performance of Construction Workers in Pampanga, Philippines

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**Abstract:** - Accidents are unfortunate incidents that happen unexpectedly and unintentionally, typically resulting in damage or injury. Construction hazards are heavily dependent on the type of construction work that is being carried out. Although these happen by chance, this probability is always high in the construction sector. The main idea is to perform a quantitative analysis in determining the correlation of the perception of workers on safety in relation to their work performance. Due to the presence of risks in construction sites, it is important to know how the performance of workers is affected by them being aware of the presence of risk. From this study, information on the construction workers' perception of risk would help in the improvement of the management of any construction site; helping the safety and health unit of any company in developing an outline of safety procedures, specific to their workers. A total of 50 respondents were subjected to the survey, coming from different companies within the province of Pampanga. The questionnaires were validated by the COSH and BOSH practitioners in the City of San Fernando, Pampanga. The awareness on the issue of safety on site was divided into three parameters: (1) the presence of hazard and risks; (2) the presence of safety protocols; and (3) the implementation or application of safety procedures on site. These variables were correlated with the workers' performance. Using the Statistical Package for Social Sciences (SPSS), the Spearman's Rank Correlation Coefficient ( $\rho$ ) was computed in pairing these three levels with the performance of workers. The three levels, in relation to the work performance, yielded the following coefficient values: -0.162, 0.057, and 0.140. The first of these values indicate that the more aware the workers of these risks, their level of performance on their assigned workload decreases. The second value indicates that being aware of workers on the presence of safety procedures on site will not greatly affect the performance of the workers. From here, it could be concluded that workers respond greatly when they are aware that the safety protocols and procedures are properly implemented on site. It is not enough that safety measures are there; they must be executed to ensure workers' safety.

**Key Words:** —*Safety, Construction, Engineering, Management, Risk and Hazards, Occupational Safety and Health.*

## I. INTRODUCTION

Accidents, as defined, are unfortunate incidents that happen unexpectedly and unintentionally, typically resulting in damage or injury. Construction hazards are heavily dependent on the type of construction work that is being carried out. Although these happen by chance, this probability is always high in the construction sector.

According to the Philippine Statistics Authority (PSA) report of 2016, a total of 2,115 reported cases of occupational injuries in the construction industry were reported in the year 2013. Around 75% of these cases of occupational injuries were cases without workdays lost. Mathematically and intuitively speaking, the construction workplace is neither a healthy nor a safe environment.

The construction industry in the Philippines has continuously increased through the years and it is projected to propagate in the years to come. Based on the same report of the Philippine Statistics Authority (PSA), a survey which is conducted every two years, the number of occupational accidents reached a total of 44,739 cases in 2015, a decline of 5.7 percent from the

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47,440 occupational accidents in 2013. However, this resulted to an increase in occupational injuries by 3.8%.

In the Philippine setting, construction processes in these recent years still require a lot of manpower despite the aid of machineries. With this being said, the demand for skilled construction workers is still very high, knowing that they perform the most difficult physical aspect of the actual construction work. Consequently, the risk, associated with the construction injuries, remain high at these types of workplaces. Matter-of-factly, construction workers are much prone to risk and hazards than most of the major industry groups in the Philippines.

Managing safety in construction is already a big challenge to most companies. Construction sites are among the riskiest places to work, with anyone within the vicinity of a site for construction being potentially at risk of injury. Thus, safety must be a key priority in this type of industry.

To foster a much better work environment than the current state of what a construction site is now, preventive measures against accidents are necessary. That is why we have a new path in the field of construction which focuses on safety—the Construction Occupational Safety and Health (COSH). Since many companies are still adapting to the rules and regulations proposed by the COSH, some businesses may not be fully aware of the workplace safety regulations, or they may not be fully equipped to handle unforeseen circumstances.

The main idea is to perform a quantitative analysis in determining the correlation of the perception of workers on safety in relation to their work performance. Due to the presence of risks in construction sites, it is important to know how the performance of workers is affected by them being aware of the presence of risk.

#### A. Research Objectives

The general objective of this study is to determine the correlation of worker's perception on safety and risk with their performance.

Specifically, this study aims to:

- to assess the level of awareness and measure the performance of construction site workers by conducting surveys validated by safety officers within the locale of Pampanga; and
- To use Spearman's Rank Correlation Coefficient as a tool through Statistical Package for the Social Sciences (SPSS) in determining the correlation of

safety risk perception with the performance of construction workers.

#### B. Significance of the Study

With the data collected through this study, information on the construction industry workers' perception of risk in municipalities within the province of Pampanga would help in the improvement of the management of the construction.

In addition, the information about the workplace safety is a set of essential measures for the execution of any work, having as the main purpose to prevent or minimize the creation of unsecured conditions and correct existing ones in the work locations or means, as well as preparing people to practice the prevention of accidents.

Healthy and safety measures are primarily to protect employers and staff from any other form of harm in the workplace. Safety programs create an environment where safety improvements are considered, encouraged, and implemented. The manpower—the construction company's most valuable asset must be protected.

Knowing the preventions can create a safe and productive work environment. Having a safe and healthy workplace might help attract and retain quality employees; also, leading to an increase in workers' productivity to operate and work efficiently. Aside from the obvious benefit of keeping workers safe, a safe workplace will reduce overall construction costs.

And knowing the correlation of safety and risk perception with the performance of the construction workers will help the safety and health unit of any company in developing an outline of safety procedures, specific to their workers.

## II. REVIEW OF RELATED LITERATURE

Many related literatures are studying about the safety of the employees in construction site. The research is about the perception regarding safety and how it is correlated in a worker's performance, and to identify the concept and importance of construction safety based on surveys obtained and collected from different construction sites.

*Construction Workers' Perceptions of Safety Practices Organizational Characteristics and Worker Perceptions.* These are among the main factors affecting the safety climate in construction sites. Although some perceptions of the workers may seem absurd to others, these components are part of their reality. Worker behavior is an extremely important factor in workplace safety as many accidents are often caused by

insecure actions, in which combinations of human behavior are the consequence of such perceptions.

The aim of this study was to explore workers' perceptions of safety practices in their habitual work environment, and a building site. The conclusion was that the workers have received very little education and possess a limited culture of safety awareness, which has led them to perceive that their lack of precaution is the main cause of accidents.

*Survey on Occupational Health Risk Assessment in Construction.* Many building construction activities are risky to the health and safety of workers. It affects productivity and overall performance of the construction project and diminishing the workforce and labor force etc. The purpose of study is to identify the factors affecting occupational health risk during construction and different diseases associated with the construction occupations. Construction of any facility or a building involves a number of vast activities such as Excavation, Foundation, RCC work, Masonry work, Plastering, of are windows, Plumbing, Installation door Painting, Electrification. Many other miscellaneous work activities having different in nature. Workers can be exposed to different risks at the workplace, like chronic exposure to harmful substances, accidents, physical stress, and natural disasters or may be any malicious act.

*Global Occupational Safety and Health Practice; Accidents Severity* (2016). This literature review focuses on researches undertaken since 1980s onwards. The purpose of the study is to identify existing gaps on workplace safety and health management and propose future research areas. The review adds value to existing electronic database through integration of researches' results. To identify existing gaps, a systematic literature review approach has been used. The reviews were undertaken through keywords and safety related topics. In the literature, various characteristics of workplace safety and health problems were found emanating from the lack of operational activities of the employees, internal working environment and external environment those impose hazards on employee temporarily, permanently and on working environments. The integration of multi-disciplinary approaches and collaborative model of hub and peripheral industries to protect workplace safety hazards to develop multilevel model has been undermined in many researches.

*Risk Perception of construction workers in construction Safety* (January 2010 to April 2019). These are empirical studies on the risk perception of construction workers from the given time.

Results show that the risk perception of construction workers is an important construct in understanding their behavior at work.

Previous studies have attempted to assess the cognitive risk perception of construction workers but have overlooked the affective risk perception of construction workers.

These studies have also failed to report the content, convergent, discriminant, and criterion-related validity tests when they measured the construction workers' risk perception.

These validity tests are vital for developing a valid scale because relevant literature lacks a psychometrically sound instrument, which measures the risk perception of construction workers. Further efforts are necessary to develop a reliable and valid scale for quantifying both the cognitive and affective risk perception of construction workers.

### III. METHODOLOGY

All paragraphs must be indented. A quantitative research design is used in this study to investigate the safety and risk perception of workers in various construction sites in Pampanga. This design is employed to quantify the problem by way of generating numerical data that can be transformed into usable statistics.

#### A. Research Instrument

A variety of related studies were reviewed, which may serve as the reference for the analysis of this study. The data were gathered through a survey questionnaire. The researchers will provide a letter of request addressed to some of the construction companies around Pampanga for the approval of having a survey of workers at the site. To achieve the objectives of this research, questionnaires are deemed to be the most effective tool for collecting information.

#### *Questionnaire Design:*

The survey instrument—a questionnaire—will be designed based on references to COSH/BOSH. The test for the level of awareness, which is the independent variable, has three parts:

- First, the level of awareness/perception regarding the presence of hazard and risk of workers at site;
- Second, the level of awareness of workers regarding the presence of safety procedure; and
- Third, the level of awareness and knowledge in the implementation of safety procedures.

For the measure of the worker's actual performance, the dependent variable, a rating scale will also be used.

The questions are meant to identify the level of awareness of safety and risk and to measure their performance. A survey questionnaire enables the workers to respond to the corresponding questions by answering the level of awareness and to measure performance in a Likert scale. Thus, a validated questionnaire with some modifications will be adapted for this study to collect and analyze data.

#### *Validation of Survey Instrument:*

The questionnaire was validated by the COSH / BOSH practitioners. After the verification and improvement by practitioners, the prepared survey questionnaires are ready to be disseminated to the respondents.

#### *B. Data Collection and Analysis*

The method of collection of data as well as the treatment of these gathered data is detailed in this section.

#### *Sampling Size and Sampling Technique:*

A non-probability sample is drawn from the respondents. In non-probability sampling, there is an assumption that there is an even distribution of characteristics within the population; thus, any sample will be representative and because of that, results will be accurate. The sample size of the study is 50 (construction site workers) through convenience sampling.

#### *Statistical Treatment of Data:*

The researchers applied Spearman's Rank Correlation Coefficient as a tool to determine the correlation through Statistical Package for Social Sciences (SPSS) as an instrument to compute the correlation. In the analysis: First, the researchers will use a survey questionnaire as an instrument to identify the level of awareness of safety and risk and to measure the performance of the respondents. Second, the researchers will collect the data from the survey questionnaire. Third, Spearman's Rank Correlation Coefficient ( $\rho$ ) will be determined and computed by Statistical Package for Social Sciences (SPSS).

## **IV. RESULTS AND DISCUSSION**

There were a total of 50 respondents that were subjected to the questionnaire of the survey. These respondents came from different companies with safety implementations. The questionnaires are validated by the COSH and BOSH practitioners in the City of San Fernando, Pampanga.

### *A. Survey Results*

All the construction sites surveyed by the researchers are registered to Philippine Contractors Accreditation Board (PCAB) and are implementing safety hazards at the construction site. The company employers of the surveyed participants vary within their class, as registered.

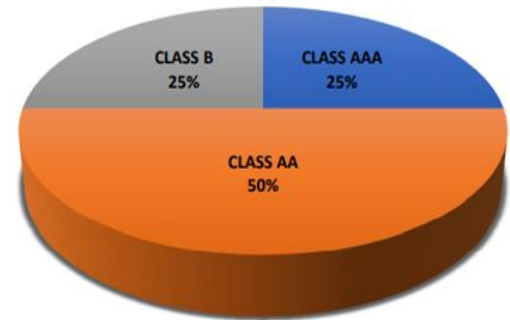


Fig.1. Company Profiling according to Classes

#### *Awareness or Perception Level 1:*

The Level of Awareness or Perception regarding the Presence of Hazard and Risk of Workers on Site. This first part is made up of 13 questions. The responses on the questionnaire may be: (1) MA – Very Much Aware; (2) A – Aware; (3) SA – Slightly Aware; and (4) NA – Not Aware.

Table.1. Summary of Responses of Workers on Awareness on the Presence of Risks and Hazards in the Construction Site

| Questions                                                                                             | Tally of Responses |    |    |    |
|-------------------------------------------------------------------------------------------------------|--------------------|----|----|----|
|                                                                                                       | MA                 | A  | SA | NA |
| 1. Workers recognized all the hazards in the construction site.                                       | 25                 | 21 | 3  | 1  |
| 2. Working in a construction site can impair your health in the long run.                             | 22                 | 23 | 5  | 0  |
| 3. Considering the nature of the workplace, workers' safety is important.                             | 41                 | 7  | 2  | 0  |
| 4. Some workers experienced an accident before going to a construction site.                          | 16                 | 28 | 6  | 0  |
| 5. The employees know who will be responsible for the health and safety in the construction site.     | 5                  | 38 | 7  | 0  |
| 6. Safety incentive program can cause a worker to work safely.                                        | 26                 | 20 | 4  | 0  |
| 7. Hazard present in the workplace are sometimes ignored by the workers in order to get the job done. | 28                 | 16 | 5  | 1  |

|                                                                                             |    |    |    |   |
|---------------------------------------------------------------------------------------------|----|----|----|---|
| 8. Workers perceive that the cause of incidents or accidents is unsafe acts and conditions. | 29 | 17 | 3  | 1 |
| 9. Workers' safety is the priority of the company.                                          | 21 | 22 | 7  | 0 |
| 10. There is safety material displayed on the construction site.                            | 12 | 27 | 11 | 0 |
| 11. There's a clinic at site to provide first aid in case of an accident.                   | 12 | 28 | 10 | 0 |
| 12. Workers are aware of the emergency procedure during fire or earthquake.                 | 16 | 23 | 11 | 0 |
| 13. Fall PPE are provided while working at heights.                                         | 17 | 22 | 9  | 2 |

*Awareness or Perception Level 2:*

The Level of Awareness or Perception regarding the Presence of Safety Procedure on Site. This part is made of 6 questions. The responses on these may be: (1) E – Excellent; (2) G – Good; (3) A – Average; (4) P – Poor; and (5) V – Very Poor.

Table.2. Summary of Responses of Workers on Awareness on the Presence of Safety Procedure in the Construction Site

| Questions                                                   | Tally of Responses |    |    |   |   |
|-------------------------------------------------------------|--------------------|----|----|---|---|
|                                                             | E                  | G  | A  | P | V |
| 1. Having knowledge about safety issues.                    | 6                  | 12 | 29 | 1 | 2 |
| 2. Safety equipment helps to avoid or prevent accidents.    | 14                 | 22 | 8  | 4 | 2 |
| 3. Workers undergo safety seminar and training.             | 0                  | 15 | 28 | 7 | 0 |
| 4. The company have enough safety equipment for workers.    | 2                  | 20 | 20 | 7 | 1 |
| 5. The company actively encourage employees to work safely. | 2                  | 17 | 25 | 3 | 3 |
| 6. Company have established goals for safety performance.   | 1                  | 16 | 20 | 2 | 1 |

*Awareness or Perception Level 3:*

The Level of Awareness or Perception regarding the Implementation of Safety Procedures on Site. This last part is made up of 16 questions. The responses on the questionnaire may be: (1) A – Always; (2) S – Sometimes; and (3) N – Never.

Table.3. Summary of Responses of Workers on Awareness on the Presence of Safety Procedure in the Construction Site

| Questions                                                                                                  | Tally of Responses |    |    |
|------------------------------------------------------------------------------------------------------------|--------------------|----|----|
|                                                                                                            | A                  | S  | N  |
| 1. Wearing of PPE in the construction site.                                                                | 33                 | 16 | 1  |
| 2. Construction workers know how to use the protective equipment.                                          | 23                 | 26 | 1  |
| 3. Workers agree that all accidents can be prevented.                                                      | 18                 | 27 | 5  |
| 4. Safety work policies and procedures are effectively communicated to workers.                            | 9                  | 38 | 3  |
| 5. Company have procedures for reporting and investigating accidents, dangerous occurrences, and diseases. | 10                 | 32 | 8  |
| 6. All construction workers are using the safety equipment that they have been provided.                   | 12                 | 38 | 0  |
| 7. Construction workers report to their supervisor lately about safety issues on this job site.            | 8                  | 31 | 11 |
| 8. The company and workers collaborate on how to manage health and safety                                  | 9                  | 40 | 1  |
| 9. Workers have undergone the mandatory 8-hour (occupational safety and health) OSH in construction site   | 5                  | 32 | 13 |
| 10. Personal protective equipment is regularly inspected for workers safety                                | 3                  | 30 | 17 |
| 11. Everyone is wearing PPE while on site                                                                  | 8                  | 25 | 17 |
| 12. Workers are trained in handling materials                                                              | 2                  | 35 | 13 |
| 13. Damaged tools are removed from site                                                                    | 3                  | 22 | 25 |
| 14. The workers caution other workers about unsafe practices                                               | 3                  | 22 | 25 |
| 15. Compliance with safety policies and procedures slowdown the operation                                  | 5                  | 33 | 12 |
| 16. Construction machineries and equipment are inspected regularly                                         | 2                  | 23 | 25 |

*Performance:*

The Level of Performance of Workers on Site: This first part is made up of 10 questions. The responses on the questionnaire may be: (1) SA – Strongly Agree; (2) A – Agree; (3) D – Disagree; and (4) SD – Strongly Disagree.

Table.4. Summary of Responses of Workers with Regards to their Performance in the Construction Site

| Questions                                                     | Tally of Responses |    |    |    |
|---------------------------------------------------------------|--------------------|----|----|----|
|                                                               | SA                 | A  | D  | SD |
| 1. Works faster and effective when not wearing safety gears.  | 5                  | 22 | 21 | 2  |
| 2. Works faster when not having a safety procedure to follow. | 6                  | 20 | 20 | 4  |

|                                                                                     |    |    |    |    |
|-------------------------------------------------------------------------------------|----|----|----|----|
| 3. Not wearing of PPE in construction site makes the job easier but riskier.        | 4  | 25 | 16 | 5  |
| 4. Jobs get faster when everyone knows their role.                                  | 27 | 14 | 9  | 0  |
| 5. Weather affects individual performance.                                          | 26 | 16 | 6  | 2  |
| 6. History of accidents in a workplace makes a worker hesitate.                     | 7  | 13 | 20 | 10 |
| 7. Working in the high-end part of a high-rise building makes a worker hesitate.    | 2  | 27 | 17 | 4  |
| 8. Awareness of emergency procedure makes a worker perform at his full potential.   | 13 | 24 | 12 | 1  |
| 9. Fall arresters make you work effectively while climbing ladders.                 | 14 | 18 | 17 | 1  |
| 10. Worker perform efficiently when they have enough rest or given proper schedule. | 17 | 17 | 12 | 4  |

### B. Statistical Treatment of Data

Through the use of Statistical Package for Social Sciences (SPSS), statistical measurement was applied to the data set. The Spearman's Rank Correlation Coefficient ( $\rho$ ) was computed in the determination of the correlation between the level of awareness and perception of workers on safety in general and their performance on site.

The correlation of each level with the performance of the workers was computed using SPSS at 5% significance. The values of the coefficient could be interpreted in different ways. If the correlation coefficient is near the value of zero (0), the two variables of interest are poorly correlated; thus, a value near one (1) indicates a strong correlation. If the correlation coefficient is positive, the two variables are directly correlated; thus, if the correlation coefficient is negative, the two variables are inversely correlated.

Table.5. Spearman's Rank Correlation Coefficient between the Perception of Workers on Safety and their Level of Performance

| Spearman's Rank Correlation Coefficient ( $\rho$ ) | Performance |
|----------------------------------------------------|-------------|
| Level 1                                            | - 0.162     |
| Level 2                                            | + 0.057     |
| Level 3                                            | + 0.140     |

Based on the value of the correlation coefficient obtained for the level of awareness or perception of workers on site on the

presence of hazard and risk in relation to the workers' performance, which is equivalent to  $-0.162$ , it could be said that the performance of the workers is affected poorly by their perception of the present hazard and risks. This value indicates that the more aware the workers of these risks, their level of performance on their assigned workload decreases. This could be affected by the fact that people tend to prefer safer workplaces. Seeing as the construction site is full of hazards, being exposed to these hazards would put the workers at risk.

The value of the correlation coefficient obtained for the level of awareness or perception of workers on site on the presence of safety procedure in relation to the workers' performance is equivalent to  $0.057$ ; thus, these variables are poorly correlated. This value indicates that their being aware of the safety procedures on site will not greatly affect the performance of the workers.

Based on the value of the correlation coefficient obtained for the level of awareness or perception of workers on the implementation of these safety protocols in relation to the workers' performance, which is equivalent to  $0.140$ , it could be said that the performance of the workers is affected directly by the workers. This value indicates that the more aware the workers of the implementation of these safety procedures, their level of performance on their assigned workload increases. This could be affected by the fact that people tend to prefer safer workplaces.

### V. CONCLUSIONS

From the survey of 50 construction workers on different construction sites in Pampanga, the correlation between their level of awareness on safety, in general, and their level of performance was determined.

The awareness on the issue of safety on site was divided into three parameters: (1) awareness on the presence of hazard and risks; (2) awareness on the presence of safety protocols; and (3) awareness on the implementation or application of safety procedures on site. These variables were correlated with the level of performance of these workers.

Using the Statistical Package for Social Sciences (SPSS), the Spearman's Rank Correlation Coefficient ( $\rho$ ) was computed in pairing the three levels of awareness on safety with that of the level of performance of workers. The three levels, in relation to the performance, yielded the following coefficient values:  $-0.162$ ,  $0.057$ , and  $0.140$ .

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This means that Levels 1 and 3 are strongly correlated with the workers' level of performance; however, Level 1 is inversely correlated while Level 3 is directly correlated. On the other hand, Level 2 indicates a poor correlation with the level of performance.

From here, it could be concluded that workers respond greatly when they are aware that the safety protocols and procedures are properly implemented on site. It is not enough that they simply know that there is a safety measure. It must be executed to ensure their safety.

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