

Factors Affecting Labor Productivity of the Construction Workers in Bangladesh

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DECLARATION

We hereby declare that this thesis is our original work and it has been written by us in its entirety. We have duly acknowledged all the sources of information which have been used in the thesis. This thesis has also not been submitted for any degree in any university previously.

OCTOBER, 2013

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Dedicated

To

Our Beloved Parents

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ABSTRACT

Productivity remains an intriguing subject and a dominant issue in the construction sector, promising cost savings and efficient usage of resources. Construction industry faces challenges to improve their productivity and the problems are usually associated with performance of labor if the construction is specially labor intensive. Without adequate and efficient manpower, it is impossible to carry out a construction project. It causes a lot of mishaps and disturbance to the whole construction operation, thus increasing the duration and cost of the project, which may not be feasible for the constructing company or owner. So it needs to be ensured that all the labors are giving their best input for the achievement of the project goals. However, labor's productivity and efficiency gets affected by some factors. These factors may either motivate the labors for showing better productivity or may demotivate them and stop them from giving their best effort. These factors can be controlled by taking necessary steps by the owner or constructing company. But in order to do so, the factors, that are affecting the building construction labor's productivity mostly, are required to be identified. But in Bangladesh, this issue has not given much attention. As a result, standard construction of a building in Bangladesh is still very time consuming and costly. This situation has motivated the study to identify, asses and determine the factors those are affecting the labor productivity of building construction sector of Bangladesh.

A questionnaire survey has been carried out to get the workers response and point of view about the management facilities of their job, and thus to identify the possible factors that have been affecting their productivity. Labors from various construction sites have been surveyed to get the response of the workers, and through which the factors affecting labor productivity have been identified. The results show that the factors identified have more or less strong impact on labor productivity. It is hoped that the study will be a guideline for various building construction projects to arrange proper management facilities for the labors to improve their productivity which will ensure the feasibility, cost efficiency and minimum duration.

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CHAPTER 1: INTRODUCTION

1.1 GENERAL

This chapter briefly discusses about the background of the study and states the importance of labour productivity in construction industry in Bangladesh. It also covers various problems regarding labour productivity faced in construction projects, what are the consequences if labour productivity in construction operation is not improved properly. The main objectives and the scope of this study are also mentioned in this chapter.

1.2 BACKGROUND

Construction industries in Bangladesh are facing many challenges, but one of the most important challenges is low productivity in terms of labor. Human resource such as labors for any construction needs to be productive and efficient. If not so, then it causes a lot of mishaps and disturbance to the whole construction operation, thus increasing the duration and cost of the project. Therefore, the objective of this research is to identify factors that are affecting construction labor productivity in Bangladesh.

Productivity is an average measure of the efficiency of production. It is a ratio of production output to what is required to produce it (inputs of capital, labour, land, energy, materials, etc.). We see that as a measure of the average productivity is often difficult to interpret correctly (Sepsarr; 2013). Growing labour productivity depends on three main factors: investment and saving in physical capital, new technology and human capital.

Labour productivity is extremely vital performance measurement tool within construction industry. Due to size of construction industry, productivity trends carry immense consequences for the economy as a whole. Productivity improvement in construction industry may have a significant impact on increasing GDP (Gross Domestic Product). Also, productivity growth is the key determinant of international competitiveness in the long term. Improving relative productivity improves a company's competitive position (Manjeri, Sunil; 2011). That is why, it is very

important to determine the factor affecting the labour productivity in our country so that we can improve our productivity growth which will improve our country's competitive position in the world.

1.3 PROBLEM IDENTIFICATION

As labour productivity improvement is a very important issue, many associations, institutions and researchers in developed countries have performed various researches and experiments to find out the factors that directly affects the labour productivity in construction industry. Their prime target is to find out and clarify these factors and to find out remedial measures to lessen their affects in labour productivity to improve construction productivity and efficiency. But some of the steps they have taken cannot be appropriately applicable in developing countries like Bangladesh and under developed countries like Ghana. For example, in the developed countries, the engineers have developed software called “Smart Plant Construction”, which allows the user to drag and drop components from 3-D model into a work package. These types of software automatically calculate man hours based on preconfigured rules of progress, along with drawings and materials. Also the users can filter materials in the 3-D model in the software to visualize if any materials are needed and required materials are available. It also shows the availability of materials on site, warehouse or in transit (Whitepaper; September, 2007). But in Bangladesh, these types of advanced technologies and sophisticated technologies are not widely available. Also the socio-economic conditions of this country prevent us from taking or adopting various steps or measures that may make labour productivity more efficient and economic. Moreover the working environment at construction sectors in this country is also very unpleasant and inadequate. As a result it can't help the overall project to produce an efficient outcome. Again, as Bangladesh is a tropical country, it goes through different weather conditions throughout the time of a year. This change also affects the labour productivity. So the factors they have identified might be different than the factors affecting labour productivity in our country. So various factors are needed to be identified that are related with the labour productivity of construction work in Bangladesh.

1.4 OBJECTIVE

The objectives of this study are as follows:

- a) To find out the factors directly affecting the labour productivity in construction sector.
- b) To find out positive and negative effect of those factors on labour productivity.
- c) To prioritize the factors according to their impact on productivity of construction labour in Bangladesh.

1.5 SCOPE OF THE STUDY

The study will focus on identifying factors affecting labour productivity of construction workers in Bangladesh. Specifically, the study will focus on labour in building construction. Though different construction works (e.g. building constructions, roads and highways, bridges and culverts, dams and barrages, heavy industry and so on) may have different factors that affect labour productivity, some factors are common in all construction works. Moreover, building construction is the most common type of construction work in Bangladesh and it is also a major part of the whole construction industry in our country. Hence, we have chosen this sector for our study. It will also give an overall scenario about the constraints in labour productivity in the construction sector in Bangladesh.

1.6 THESIS OUTLINE

The rest of the thesis has been organized as follows:

- Chapter 2 – Literature Review; the chapter discusses about labor productivity, factors affecting labor productivity and their mitigation process identified to improve labor productivity.
- Chapter 3 – Methodology; discusses the procedural steps of the study.

- Chapter 4 – Data Analysis And Result; it discusses the project description in detail, ranking of factors, list of positive and negative factors, comprising among various responses.

- Chapter 5 – Conclusion and Recommendation; discusses about the effectiveness of the study, and recommendations for future studies.

CHAPTER 2: LITERATURE REVIEW

2.1 GENERAL

This chapter discusses about the importance of labor productivity of the construction workers. What is labor productivity, why it is important to improve construction workers productivity, what are the identified factors that affecting labor productivity from past studies and researches etc are described in details. At the end of this chapter, this study aimed to identify factors that affecting labor productivity of the construction workers through a survey in Bangladesh. The results will be useful to improve labor productivity of construction workers in Bangladesh.

2.2 PRODUCTIVITY

Productivity is one of the most important issues in both developed and developing countries. It remains an intriguing subject and a dominant issue in the construction sector, promising cost savings and efficient usage of resources.

Productivity is a relationship between outputs and inputs. It rise when an increase in output occurs with a less than proportionate increase in inputs, or when the same output is produced with fewer inputs” (ILO, 2005a, p. 5).

Inputs include labor and capital, while output is typically measured in revenues and other GDP components such as business inventories. Productivity measures may be examined collectively (across the whole economy) or viewed industry by industry to examine trends in labor growth, wage levels and technological improvement.

2.3 LABOR PRODUCTIVITY

Productivity can be measured either in terms of all factors of production combined (total factor productivity) or in terms of labor productivity, which is defined as output per unitof labor input, measured either in terms of the number of persons employed or in terms of the number of hours worked (ILO, 2005a).

The formula for labor productivity is:

- Labor Productivity = Total Output / Total Input (No of persons employed × Total Productive Hours)

A simple example to clarify is given below:

- ❖ Let's suppose, on a specific day, at a project site 200 m³ of concrete were placed by 10 workers in a 7.5 hour shift, then the productivity index = $200/(10 \times 8) = 2.5$ m³/wh.

Labor Productivity is a measurement of economic growth of a country. Labor productivity measures the amount of goods and services produced by one hour of labor. More specifically, labor productivity measures the amount of real GDP (gross domestic product) produced per hour of labor. Growing labor productivity depends on three main factors: investment and saving in physical capital, new technology and human capital.

2.4 IMPORTANCE OF LABOR PRODUCTIVITY

Labor productivity plays a very important role in Civil Engineering sectors especially in the field of Construction. It is said that, “the construction industry must improve its efficiency and productivity substantially to stay competitive”. This means that the construction industry is necessarily to find out the root of factors which has been affecting the labor productivity at construction sector and the necessary ways of improvising it to make it more efficient and productive. The objectives to be achieved, the resources employed, the measures adopted and the benchmarks used for comparison give rise to different definitions of or perspectives on productivity. The common threads in all definitions or contextual interpretations of productivity relate to:

- Effectiveness: i.e. how effective is the leveraging of the resources to achieve the set objectives? E.g. a system can be adjudged productive in effectiveness context, if the set objectives are achieved through effective resource leverage.
- Efficiency: i.e. in achieving the set objectives, how efficient was the utilization of the scarce resources in the implementation process?

Improved labor productivity can result in higher earnings for workers, better working conditions, improved benefits and reduced working hours; these in turn can improve workers' job satisfaction and motivation.

The Asian Productivity Organization has cited that any improvement in construction productivity would make a substantial beneficial to the national economy. Higher production output, lower inflation rate and further productivity growth could be benefited from productivity improvement.

Productivity improvements can also be understood at different levels. The productivity of individuals may be reflected in employment rates, wage rates, stability of employment, job satisfaction or employability across jobs or industries. Productivity of enterprises, in addition to output per worker, may be measured in terms of market share and export performance. The benefits to societies from higher individual and enterprise productivity may be evident in increased competitiveness and employment or in a shift of employment from low to higher productivity sectors.

2.5 FACTORS AFFECTING LABOR PRODUCTIVITY IN DEVELOPED COUNTRIES

Labor productivity can be affected positively and negatively for various reasons. These reasons are also known as "FACTORS". There are various factors that influence productivity such as – technology used, government regulations, weather, unions, economic conditions and various internal environmental components (Shou Qing, 1999).

There are undue cost overruns, delays and loss of productivity associated with the delivery of major capital construction projects everywhere. Many researchers and practitioners have identified poor management practices that lead to poor performance such as scope changes, design errors and omissions, lack of proper planning and scheduling, improper management of tools, equipment, materials, and labor among many other factors. These researchers and practitioners have tried to overcome these challenges by providing their insights and recommendations, but these recommendations have yet to be implemented with tangible productivity and project predictability improvement (Jergeas; May 2009). Researchers and practitioners

around the world have provided several contributions related to improving the various aspects of construction productivity. Research is being performed world-wide in research centers on many areas related to construction productivity. These research centers include industry associations and academic institutions in Australia, Canada, United Kingdom, and the United States of America (Jergeas; May 2009). In Australia research work related to factors affecting productivity such as rework and worker's performance and motivation was performed by Edwards and Love (Edwards et al. 2007; Love et al. 2005) (Jergeas; May 2009).

Based on past researches, 113 factors affecting construction labor have been identified and were grouped into 15 groups according to their characteristics, namely:

1. Design (5 factors);
2. Execution plan (5 factors);
3. Material (8 factors);
4. Equipment (6 factors);
5. Labor (18 factors);
6. Health and safety (4 factors);
7. Supervision (6 factors);
8. Working time (6 factors);
9. Project factor (15 factors);
10. Quality (3 factors);
11. Financial (6 factors);
12. Leadership and coordination (5 factors);
13. Organization (12 factors);
14. owner/consultant (4 factors);
15. External factor (10 factors).

These factors are obtained from works by Oglesby et al. (1989); Sanders and Thomas (1991); Thomas (1992); Langford et al. (1995); Motwani et al. (1995); Lim and Alum (1995); Baba (1995); Zakeri et al. (1996); Lema (1995); Kaming et al. (1997); Olomolaiye et al. (1998); Thomas et al. (1999); Makulsawatudom and Emsley (2002); Ibbs (2005); Hanna et al. (2005); Nepal et al. (2006); Khoramshahi et al. (2006); Enshassi et al. (2007); Alinaitwe et al (2007); Weng-Tat (2007); Hanna et al. (2008); and Kazaz et al. (2008).

According to MCAA (Mechanical Contractors Association of America), they have highlighted 16 factors that have been impacting on Construction Crew Productivity/Labor productivity. The factors are:-

1. Overtime
2. Moral and attitude
3. Fatigue
4. Joint occupancy
5. Absenteeism and turnover
6. Errors and omissions
7. Reassignment of manpower
8. Late crew build up
9. Crew size inefficiency
10. Site access
11. Hazardous work area
12. Dilution of supervision
13. Weather and Season changes
14. Over Manning
15. Tool and Equipment shortage
16. Area of practice

The MCAA have come up with these factors but they couldn't give any specific and simple mitigation measures for these factors (Whitepaper; September, 2007).

University of Calgary research identified the relative importance of 51 productivity factors which were classified into three groups: Human, External, and Management.

The following are the productivity factors identified by Liberda et al. (2003) (Jergeas; May 2009).

❖ Human Factors:-

1. Experience and Skills.
2. Physical Limitations/Fatigue.
3. Worker's Motivation and Morale.
4. Absenteeism.

❖ External Factors:-

1. Unhealthy Working Conditions.
2. Congested Work Area.
3. Weather Conditions.
4. Changing in Plans and Specifications.

❖ Management Factors:-

1. Unsafe Working Conditions.
2. Unrealistic Schedule.
3. Overtime.
4. Poor Inspection.
5. Salary and Benefits.
6. Attitude to Workers.

Hewage (2007) conducted another research based on Liberda et al.'s (2003) fifty one factors affecting productivity. These factors were prioritized and clustered into nine categories. These categories are:

1. design and changes,
2. worker motivation,
3. inadequate communication,
4. worker skills,
5. non-availability of information,
6. lack of planning,
7. congested work areas,
8. inadequate supervision,
9. adverse weather conditions.

Although many researches have been done and produce the factors that affect productivity, there are still many productivity problems that remain unknown and need to be further investigated even in developed countries (Makulsawatudom and Emsley, 2002) and in developing countries. In addition, policies for increasing productivity are not necessarily the same in every country. Polat and Arditi (2005) showed that the critical factors in developed countries differ from that in developing countries.

2.6 IMPROVING LABOR PRODUCTIVITY

Poor productivity of construction workers is one of the causes of cost and time overruns in construction projects. The productivity of labor is particularly important especially in developing countries, where most of the building construction work is still on manual basis (Alinaitwe, Mwakali, Hansson; 06 March 2007).

USA based “The Modular Building Institute” has tried to improve construction productivity and efficiency with “Modular Construction”. Modular construction is that type of construction which is used to build Modular houses that are sectional prefabricated buildings, or houses, that consist of multiple sections called modules. The modules are six sided boxes constructed in a remote facility, then delivered to their intended site of use. Using a crane, the modules are set onto the building's foundation and joined together to make a single residential, or commercial, building. “The Modular Building Institute” has come up with five major theories to improve the efficiency and productivity of a construction work. They are:-

- A. Widespread deployment and use of interoperable technology applications, also called Building Information Modeling (BIM).
- B. Improved job-site efficiency through more effective interfacing of people, processes, materials, equipment, and information.
- C. Greater use of prefabrication, preassembly, modularization, and off-site fabrication techniques and processes.
- D. Innovative, widespread use of demonstration installations.
- E. Effective performance measurement to drive efficiency and support innovation.

These theories that “The Modular Building Institute” has developed can be effectively applied to the developed countries like USA but for developing countries like Bangladesh and under developed countries like Ghana, these theories cannot be applicable.

In Canada, we can see that although the construction industry represents a substantial portion of Alberta's as well as Canada's economy, the performance and improvement in construction productivity over the past 20 years has been declining (Choy, 2004).

The decline in Alberta is consistent with the decline of construction productivity in North America over the past three decades. The decline has been reported by many researchers such as (Business Roundtable (BRT), 1989; Dozzi and AbouRizk, 1993; Hewage and Ruwanpura, 2006; Sharpe, 2006) (Jergeas; May 2009).

A research project to develop, test and validate better work practices and tools, and to improve the productivity of future construction projects in Alberta and Canada is ongoing at the University of Calgary. The research project is titled “Top Ten Targets for Improving Construction Productivity” (CRCPM, 2009). Following are the top ten targets being investigated.

1. Highly motivated, and satisfied workforce.
2. Best practices model for supervision.
3. Better working relationship model between sub-contractors and the main contractor.
4. Efficient materials, tools, and equipment management.
5. Tool time optimization by adopting best work practices.
6. Optimize work practices and workface planning.
7. Information technology based on-site communication framework.
8. Better integration between site and office management.
9. Weather related issues.
10. Project stakeholder issues – owner, architect, changes, etc.

The Center for Construction Industry Studies (CCIS) also in the US has published many studies relating to improving construction productivity. These studies relate to workforce challenges, assignment and allocation optimization of workforce. The Construction Users Roundtable (CURT) publications, on the other hand, included the following relevant works dealing with many aspects of construction productivity.

1. Construction Productivity Measurement.
2. Construction Labor Motivation.
3. Improving Construction Safety Performance.
4. First & Second Line Supervisory Training.
5. Project Management Education & Academic Relations.

6. Application of Modern Management Systems.
7. Contractual Arrangements.
8. Integrating Construction Resources & Tech.
9. Construction Technology Needs & Priorities.
10. Exclusive Jurisdiction in Construction.
11. Scheduled Overtime Effect on Construction Projects.
12. Contractor Supervision in Unionized Construction.
13. Constraints Imposed by Collective Bargaining Agreements.
14. Local Labor Practices .
15. Absenteeism & Turnover.
16. Impact of Local Union Politics.
17. Use of Journeymen in the Union Sector.
18. Government Limitations on Training Innovations.
19. Utilization of Vocational Education in Construction Training.
20. Training Problems in Open Shop Construction.
21. Labor Supply Information.
22. Administration & Enforcement of Building Codes & Regulations.

Several other components related to construction management must also be considered to increase productivity. Some of these components are discussed here (Chao, 1997).

1. Assign or recruit the right people to do the job or provide training to improve workers' ability and skill.
2. Adopt motivational or personnel management measures to boost workers' morale. For example, tie compensation to performance; ensure that pay, fringe benefits, safety, and working conditions are all at least adequate; and enlarge the jobs to include challenge, variety, wholeness, and self-regulation.
3. Use project scheduling techniques such as computer-aided construction project management (CPM) to optimize the times of related activities and make sure that works, tools, and materials allow continuous task performance so as to reduce the idleness of the labor force to a minimum.
4. Keep simple and efficient the communication among employees as well as with related parties.

5. Make the employees know that they are important to the organization and involve them in the making of decisions affecting their jobs such as method improvements.
6. Conduct productivity/performance study at the activity/operation level to produce benchmarks and to develop scientific models as part of the study to describe the detailed tasks performed for an activity/operation by individual or group in order to find out problem areas and propose ways to improve. In general, to improve labor productivity factors which affect productivity negatively should be overcome and positive factors should be obtained adequately.

2.7 SUMMARY

In this chapter definition of productivity and labor productivity, importance of productivity, identified factors from the past researches discussed in short brief. Most of the previous studies have mainly focused on the identification of different factors affecting labor productivity in developed countries like USA, Canada. But for developing countries like Bangladesh all of these factors may not be applicable in priority basis because of different conditions available here and also policies for increasing productivity are not necessarily the same in every country. Moreover there are still many productivity problems left that remain unknown and need to be further investigated.

The aim of this research study is to identify factors affecting labor productivity of construction workers in construction projects, whether those factors are affecting the productivity positively or negatively and prioritize the factors according to their impact on the total productivity in Bangladesh. This study is a continuation of an ongoing effort to improve the construction productivity for delivering the best possible economical results from construction projects in Bangladesh.

CHAPTER 3: METHODOLOGY

3.1 GENERAL

This segment deals about the procedures followed to conduct the study, which describes about how problems are identified and factors chosen which affect labor productivity. A survey will be carried out and analysis will be conducted. After the analysis, output will be generated and conclusion will be made.

3.2 METHODOLOGY

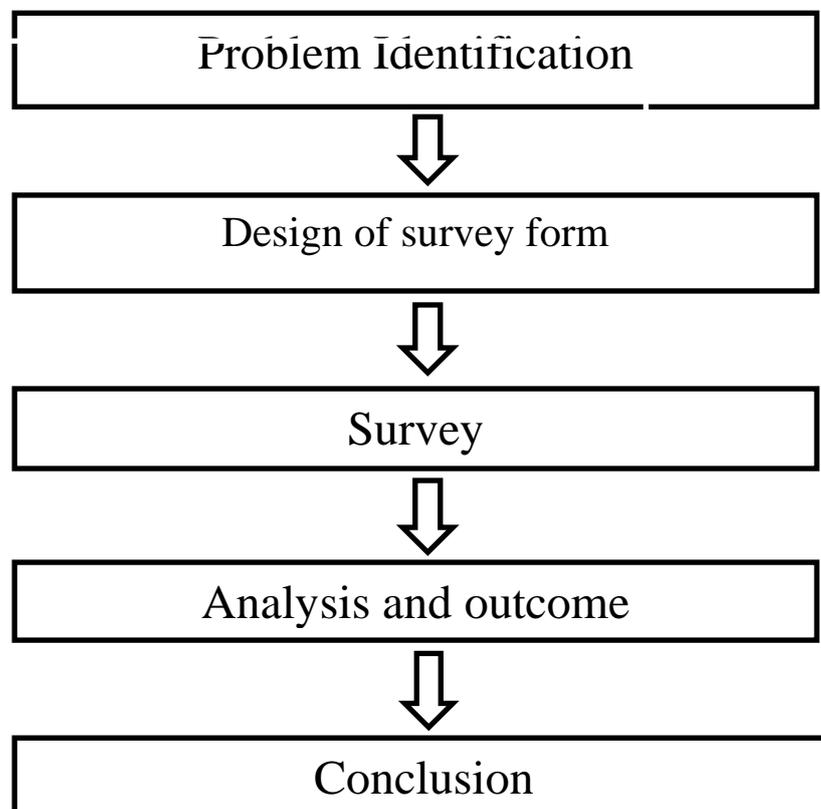


Figure 3.1: Flowchart of the methodology of the study

Figure 3.1 shows the methodological flowchart of the study that includes problem identification, factors chosen, survey, analysis, output and conclusion. The topics are described in detail below.

3.2.1 Problem Identification

Construction industry is facing problems associated with productivity and the problems are usually associated with performance of labor which means the labor productivity. The performance of labor is affected by many factors. This study will focus on identifying the factors that directly affects the labor productivity in construction sectors of Bangladesh.

Some of the factors identified by the developed countries may not be appropriately applicable in developing countries like Bangladesh and under developed countries like Ghana. In developed countries, advanced and sophisticated technologies are being used in construction projects to increase labor productivity. But in Bangladesh, these types of technologies are not available. Also the socio-economic conditions of this country prevent us from taking or adopting various steps or measures that may make labor productivity more efficient and economic. The general working conditions at construction sectors and also different weather conditions throughout the time of a year also affects the labor productivity. So factors needed to be identified via questionnaire surveying which can easily be connected with the labor productivity of construction site in our country.

3.2.2 Design of Survey form

Several approaches have been adopted in relation to the classification of factors affecting construction productivity. To determine the key factors that affect the labor productivity most in construction sites of Bangladesh, questionnaire surveying method was selected as the prime method. This type of surveying is most suitable to collect and investigate data required for this study, because:

- It is easy,
- Less time consuming than other methods and
- Desired responses from the key personnel are much easier to get.

The factors which identified from research works done in developed countries are used as a basis for preparing a questionnaire. With identification of factors influencing construction productivity being based on a careful review of literature and considering the general working conditions and other aspects, the survey form is designed. Some of the factors are very much eligible for our country such as

workhour, overtime, experience, skill, sufficient salary, unsafe and unhealthy working conditions, safety, training, compensation and so on. So, these factors include for making the survey. (N: B: Questionnaire survey form attached at appendix)

3.2.3 Survey

Survey was made through questionnaire will be distributed to respondents who involve in various types of building construction works in wide area in Bangladesh. The respondents are people who work as: mason, carpenter, steel bender, plumber, electrician, painter, rod binder, welder, polish mistry, Mosaic mistry etc. They work at construction companies in Bangladesh both in private and government.

3.2.4 Analysis and Output

By performing the survey, we have seen some factors that we have assumed for this study to be affecting the labor productivity in Bangladesh, have a large negative impact. Some of the factors are not compatible with our country. Survey shows that factors such as lack of experience and skills, absenteeism, unsafe and unhealthy working condition, overtime, salary, poor inspection are affecting negatively on the worker's attitude to work which ultimately causes a reduction in labor productivity at construction sites. Also training is not provided to labors on most of the construction projects in Bangladesh, which also hampers the labor productivity. After completion of the questionnaire survey in different sites, all the necessary information and data are put in Microsoft excel for analysis. The results obtained from the data analysis will be explained in detail.

3.2.5 Conclusion

The necessity of this study will be described in conclusion. How people can be benefitted using the output of this study to improve labor productivity in construction sites at Bangladesh will be discussed in detail. Possible enhancement of this study will also be recommended.

CHAPTER 4: DATA ANALYSIS AND RESULT

4.1 GENERAL

This chapter discusses how the data were collected and analyzed. Based on the analysis, the factors will be identified which affects labor productivity in Bangladesh. Then they will be ranked according to their impact on labor productivity and efficiency.

4.2 DESIGN OF SURVEY FORM AND DATA COLLECTION

To identify the factors that are affecting construction labors' productivity, we have conducted a survey among the construction workers. The survey was made through a questionnaire. For preparing the questionnaire, the factors which were identified from research works done in developed countries are used as a basis. Based on a careful review of literature and considering the general working conditions and other aspects, the survey form is designed. For example, the general working conditions at construction sectors in this country is poor and inadequate, as a result it can't help the overall project to produce an efficient outcome. Again, as Bangladesh is a tropical country, it goes through different weather conditions throughout the time of a year. This change also affects the labour productivity. So the factors they have identified won't be much applicable according to the present perspective of our country. So factors needed to be identified via questionnaire surveying which can easily be connected with the labour productivity of construction site in our country.

The survey form is divided in to 5 major categories. They are:- (1) personal and work related characteristics, (2) supervisor's capability, (3) level of agreement, (4) compensation and benefits, (5) factors influencing labour productivity & efficiency. (N: B: Questionnaire survey form attached at appendix)

The survey locations are IUT campus, Board bazar, Borobari, Uttara, Kalabagan, Azimpur, Lokkhi bazar, Shahbag, Bangla motor, Farmgate, Puranapolton, Malibagh, Rampura , Mirpur And somewhere in Puran Dhaka, Cox's bazar, Dinajpur etc. Survey form distributed to the respondents who involve in various types of building construction works in wide area in Bangladesh. The respondents are people who work

as: mason, carpenter, steel bender, plumber, electrician, painter, rod binder, welder, polish mistry, Mosaic mistry etc.

4.3 DATA ANALYSIS

After completion of the questionnaire survey in different sites, all the necessary information and data are put in Microsoft excel for analysis.

At first, the respondents were categorized into 4 groups based on their age:

- a) workers whose ages are below 20 years
- b) workers whose ages are between 21-30 years
- c) workers whose ages are between 31-40 years
- d) workers whose ages are greater than 40 years

Numbers of total participants of the survey were found:

- a) Age below 20 = 18
- b) Age between 21-30 = 40
- c) Age between 31-40 = 32
- d) Age above 40 = 12

Total = 102

The Survey form is consisted of 5 parts. Among these 5 parts, the 1st part was about the workers general information. The rest were about various factors that affect the construction labor's productivity in Bangladesh. So for calculation, the later four topics of the questionnaire survey were considered.

Part B, C and D are arranged by asking question about their supervisor, Level of agreement and Compensation & Benefits. These are marked by Very satisfied (4), Satisfied (3), Neutral (2), Dissatisfied (1), Very dissatisfied (0).

Part E contains worker's agreement with the "Factors influencing labor productivity and efficiency" which is marked by Strongly agree (4), Agree (3), Uncertain (2), Disagree (1), Strongly disagree (0).

After sorting out the number of participants according to their answers, mean value of the answer for each factors were determined using the equation below:

$$\text{Mean} = (B * X1 + C * X2 + D * X3 + E * X4 + F * X5)/(B + C + D + E + F)$$

Where, B = No. of participants answering Very Satisfied or Strongly Agree

C = No. of participants answering Satisfied or Agree

D = No. of participants answering Neutral or Mean

E = No. of participants answering Dissatisfied or Disagree

F = No. of participants answering Very Dissatisfied or Strongly Disagree

And, X1 = Numerical Factor of Very Satisfied or Strongly Agree category [4]

X2 = Numerical Factor of Satisfied or Agree category [3]

X3 = Numerical Factor of Neutral or Uncertain category [2]

X4 = Numerical Factor of Dissatisfied or Disagree category [1]

X5 = Numerical Factor of Very Dissatisfied or Strongly Disagree category[0]

Now, as for example, considering the total number of participants is 102. Among these people, 21 have answered “strongly agree”, 58 have answered “agree”, 16 have answered “neutral”, 7 have answered “disagree” and 0 have answered “strongly disagree” in the factor called “work hour” (From Part E). We have also considered the numerical factors for “strongly agree”, “agree”, “neutral”, “disagree” and “strongly disagree” are respectively 4,3,2,1 and 0.

Now, from the formula of mean value, we find the mean value to be 2.911764, which is in the range between 3(satisfied) and 2(neutral). So from the mean value, we can say that average number of participants are generally satisfied or neutral (but mostly satisfied, cause 2.911764 is more closer to 3 than 2). Similarly other means of different factors also calculated.

After getting all the mean value, a ranking of the factors can be shown according to their maximum to minimum value of the mean.

Table 4.1: Ranking of Factors regarding the Supervisor of a project

Factors	Mean	Rank
Your supervisor's management capabilities	2.823	1
Overall relationship with your supervisor	2.803	2
Communication with your supervisor	2.774	3
leadership qualities of your supervisor	2.745	4
Your supervisor's active involvement in your career	2.617	5
provided adequate support from supervisor	2.539	6
feel encouraged by your supervisor	2.539	7
Recognition received from your supervisor	2.411	8

Table 4.2: Ranking of Factors regarding Level of Agreement

Factors	Mean	Rank
Working at winter	2.941	1
Overall satisfaction with your job	2.666	2
Role of different personnel involved	2.5	3
Working at summer	2.47	4
Workload	2.215	5
Ability to influence day-to-day company success	2.166	6
Overtime amount	2.029	7
Overtime payment	1.921	8
Involved in decision-making at workplace	1.892	9
Salary	1.764	10
Personal protective equipment(PPE) provide	1.725	11
Opportunity to use new technologies	1.715	12
Frequency and amount of bonuses	1.66	13
Connection between pay and performance	1.66	14
Access to company-sponsored training & seminars	1.529	15
Benefits	1.480	16
Working at rainy season	1.480	17
Security/stock options/pension plans	1.460	18
Worksite safety training provide	1.362	19

Table 4.3: Ranking of Factors regarding Compensation and Benefits

Factors	Mean	Rank
Job security	1.764	1
Job market competitiveness of salary	1.509	2
Retirement program	1.480	3
Medical insurance package	1.411	4
Prescription drug coverage	1.274	5

Table 4.4: Ranking of Factors influencing Labor productivity and efficiency

Factors	Mean	Rank
Sufficient salary	3.49	1
Fitness	3.35	2
Experience	3.25	3
Enough equipment provide	3.20	4
Training	3.16	5
Job security	3.03	6
Necessary compensation provide	3.01	7
Supervisor's capability	2.96	8
Work hour	2.91	9
Worksite safety	2.87	10
Overtime	2.83	11
Season	2.75	12
Role of different personnel	2.69	13
Education	2.40	14
Stock options/pension plans	2.37	15

The result from table 4.1, 4.2, 4.3, 4.4 shows that, the ranking based on the mean. It can be said that the top ranked factors has more impacts while the lower ranked factors has less impacts on labor productivity. Factors that have mean value above or near 3, represent worker's level of satisfaction & agreement with it. On the other hand, factors that have mean value lower or near 1, represent worker's level of

dissatisfaction & disagreement with it. For example, sufficient salary, Fitness, Experience, Training, Job security etc are the top ranked factors, have larger impacts. On the other hand, Stock options/ Pension plans, Education, Role of different personnel's etc are the low ranked factors, have less impacts.

In respect of Bangladesh, “sufficient salary” has the highest mean value among other factors which means most of the labors agreed that this is the most influencing factor on their productivity and efficiency. They believe that without sufficient salary, they don't feel encouraged to work properly. Because almost all of the labors live below the poverty line and this is their only source of income to meet their basic needs. The factor “Fitness” ranked 2nd place among the ranking of the factors. It has a mean value of 3.35 which means most of the labors agreed about this factors influence on their work. According to the labors, to make the work done it is most important to have a proper fitness. If anyone is sick or of poor health, they fail to give full effort or may be absent from work. “Experience” is the 3rd ranked factor having the man value of 3.25, which means most of the labors agree with its influence on their productivity. Experienced workers can understand the magnitude of tasks they are imposed upon and can serve more efficiently within the best possible time. The next factor in the ranking is “sufficient equipment provided”. According to the labors, with the help of sufficient and required equipment, tasks can be done easily, without any errors and loss of time. Again, without training, workers who have no or very less experience about the jobs they are imposed upon, cannot function properly or efficiently rather kills a lot of time and money. Thus, most of the workers agreed with the influence of the factor “Training” on their productivity and efficiency as a result having the mean value of 3.16 and ranked 5th among the ranking of factors. Similarly, the other factors have been ranked according to their mean value which expresses their magnitude influence on the productivity and efficiency of the labors.

These factors are influencing both positively and negatively which are categorized below:

Table 4.5: List of Positive and Negative Factors according to Labor’s responses

Factor for Positive Response	Factor for Negative Response
Your supervisor's management capabilities	Overtime payment
Overall relationship with your supervisor	Involved in decision-making at workplace
Communication with your supervisor	Salary
leadership qualities of your supervisor	Personal protective equipment(PPE) provide
Your supervisor's active involvement in your career	Opportunity to use new technologies
provided adequate support from supervisor	Frequency and amount of bonuses
feel encouraged by your supervisor	Connection between pay and performance
Recognition received from your supervisor	Access to company-sponsored training&seminars
Working at winter	Benefits
Overall satisfaction with your job	Working at rainy season
Role of different personnel involved	Security/stock options/pension plans
Working at summer	Worksite safety training provide
Workload	Job security
Ability to influence day-to-day company success	Job market competitiveness of salary
Overtime amount	Retirement program
	Medical insurance package
	Prescription drug coverage

Table 4.5 is based on the mean value where mean value above 2 is counted as the positive factor and below 2 is counted as negative factor.

From the analysis, “prescription drug coverage & medical insurance package” has lowest mean value of worker’s responses. These negative responses represent their dissatisfaction about medical facilities. Lack of proper treatment and lack of drug coverage leads to weakness of the body and moreover absenteeism. It hampers the

flow of tasks very much in our country. Again “worksite safety” is another negative response. Most of working sites has lack of proper safety measures which leads to accidents very often. Moreover worker’s feel insecure in this type of sites. So the growth of work reduces. Another important factor which found as negative response is the “stock options / pension plans”. These are the extra benefits which often provide in developed countries. But most of construction companies of Bangladesh have no planning of such facilities. So workers get worried and furious about their future. It increase mental pressure and hence decreases labor productivity. Similarly job security, salary, job market competitiveness, PPE provide, opportunity to use new technologies etc. are categorized as mostly negative responses given by workers. These slowdown labor productivity & efficiency. We should be careful about these factors to improve labor productivity & efficiency.

After determining the mean values of all the factors we have calculated the standard Deviation by using the formula below:-

$$S = \sqrt{\frac{1}{N} [(x_1 - \mu)^2 \times n_1 + \dots \dots \dots + (x_n - \mu)^2 \times n_r]}$$

$$N = n_1 + n_2 + n_3 + \dots \dots \dots + n_n$$

Where, N = Total Number of Participants,
 μ = Mean Value.

The value of this standard deviation indicates different views of the different respondents. One respondent may response positively or show agreements while other respondent response negatively or show disagreement with the similar factors. So variations happen there in case of response. To measure these variations (how much deviated) standard deviation is calculated.

For example, in case of factor “work hour”, we see the value of standard deviation is 0.7934, which is closer to 1. This means that there is variation in the participant’s answers. 21 of them strongly agreed with impact of the factor, 58 of them agreed, 16 of them remain neutral (gave no answer), 7 of them disagreed and none of them strongly disagreed. From these numbers, it can be said that their opinions are

distributed over the strongly agree, agree, neutral and disagree. Again the mean value for this factor is 2.9117, which is closer to the numerical factor 3, which expresses the “Agree” part. So we can say from the mean value that most of the participant agreed with this factor and again from the standard deviation value, it can be said that a large number of participants also strongly agreed, disagreed or remained neutral. Now, considering the factor “pay and performance”, we see that the mean value is 1.667 (closer to 2) and standard deviation is 0.98352. This means most of the participants remained neutral but a large number of them are also satisfied, dissatisfied and very dissatisfied. On the other hand, considering the factor “sufficient salary”, we see that the mean value is 3.4901 and standard deviation is 0.55563, which means most of the participants are agreed with this factor and some of them strongly agreed. But from the standard deviation, we can say that very few participants are neutral, disagreed or strongly disagreed in this factor (in this case, only 1 participant disagreed and none are neutral or strongly disagreed). From the analysis, it can be said that factors like Stock options, season, Education, Worksite safety etc. deviated much. While factors like sufficient salary, Experience, Fitness, Training etc. have deviated less in case of worker’s responses.

4.4 COMPARISON BETWEEN TOTAL RESPONSES AND AGE WISE RESPONSES

The respondents are now categorized into groups based on their age.

Numbers of total participants of the survey were found:

- a) Age below 20 = 18
- b) Age between 21-30 = 40
- c) Age between 31-40= 32
- d) Age above 40= 12

Total = 102

Table 4.6: Comparison among total response and Age wise response of Factors regarding the Supervisor of a project

Factors	Mean (Total)	Mean (Age below 20)	Mean (Age 21-30)	Mean (Age 31-40)	Mean (Age Over 40)
Your supervisor's management capabilities	2.823	2.66	2.87	2.78	3.0
Overall relationship with your supervisor	2.803	2.66	2.9	2.68	3.0
Communication with your supervisor	2.774	2.61	2.87	2.68	2.91
leadership qualities of your supervisor	2.745	2.66	2.8	2.59	3.08
Your supervisor's active involvement	2.617	2.16	2.7	2.71	2.75
provided adequate support from supervisor	2.539	2.38	2.57	2.59	2.5
feel encouraged by your supervisor	2.539	2.5	2.62	2.53	2.33
Recognition received from your supervisor	2.411	2.22	2.5	2.37	2.5

The result from table 4.6 shows that, the above data analysis we have found that there is a little variation in supervisor's management capabilities from age below 20 to age over 40. The mean value represent that overall workers are satisfied (82% satisfied, 18% neutral) with the supervisor's management capabilities where age over 40 are more satisfied (100% satisfied) that age between below 20 to 40. Again we have found the same result in overall relationship with supervisors. There is a little variation in leadership qualities of supervisor. Age over 40 are satisfied with the leadership qualities of supervisor (8% very satisfied, 92% satisfied) where mean value is satisfied (75% satisfied, 25% neutral). From these data analysis we have noticed that experienced workers have a good understanding with the supervisors and they can give the output what the supervisors want where the young workers don't follow the supervisors and they want to work according to their plan.

Table 4.7: Comparison among total response and Age wise response of Factors regarding Level of Agreement

Factors	Mean (Total)	Mean (Age below 20)	Mean (Age 21-30)	Mean (Age 31-40)	Mean (Age Over 40)
Working at winter	2.941	3.05	2.92	2.84	3.08
Overall satisfaction with your job	2.666	2.77	2.67	2.53	2.83
Role of different personnel involved	2.5	2.5	2.6	2.18	3.0
Working at summer	2.47	2.88	2.35	2.25	2.83
Workload	2.215	2.27	2.3	1.93	2.58
Ability to influence day-to-day company success	2.166	2.22	2.2	2.12	2.08
Overtime amount	2.029	2.16	2.17	1.68	2.25
Overtime payment	1.921	2.16	2.05	1.62	1.91
Involved in decision-making	1.892	1.77	1.95	1.71	2.33
Salary	1.764	1.83	1.72	1.53	2.41
Personal protective equipment(PPE) provide	1.725	1.77	1.72	1.75	1.58
Opportunity to use new technologies	1.715	1.83	1.67	1.59	2.0
Frequency and amount of bonuses	1.66	1.61	1.65	1.43	2.41
Connection between pay and performance	1.66	1.66	1.57	1.53	2.33
Access to company-sponsored training & seminars	1.529	1.23	1.45	1.78	1.41
Benefits	1.480	1.38	1.27	1.56	2.08
Working at rainy season	1,480	1.61	1.52	1.40	1.33
Stock options/pension plans	1.460	1.05	1.45	1.53	1.91
Worksite safety training provide	1.362	1.27	1.35	1.46	1.25

From table 4.7, the data analysis of Factors regarding Level of Agreement we have noticed that seasonal working plays a vital role on productivity. Workers are satisfied working at winter season. The mean value represent that overall are satisfied (94% satisfied, 6% neutral). But age below 20 and over 40 are very satisfied working at winter season. There is a little variation in overtime amount and overtime payment. The mean value represent that the workers are neutral with the overtime amount, where age below 20 are satisfied with the overtime amount (16% satisfied, 84% neutral), age between 21 to 30 are also satisfied with the overtime amount (17% satisfied, 83% neutral), but age between 31 to 40 are dissatisfied with the overtime amount (68% neutral, 32% dissatisfied) again age over 40 are satisfied with the overtime amount (25% are satisfied, 75% are neutral). We have found a huge variation in overtime payment. The mean value represents that overall workers are dissatisfied with the overtime payment (92% neutral, 8% dissatisfied). Where age below 20 are satisfied (16% satisfied, 84% neutral). Workers aged between 21 to 30 are also satisfied (5% satisfied, 95% neutral). But age between 31 to 40 are dissatisfied (62% neutral, 38% dissatisfied). Again age over 40 are also dissatisfied (91% neutral, 9% dissatisfied). There is a little variation in salary. The mean value represents that the workers are dissatisfied with the salary (76% neutral, 14% dissatisfied). Age below 20 to 40 are also dissatisfied with the mean value but age over 40 are satisfied (41% satisfied, 59% neutral).

Table 4.8: Comparison among total response and Age wise response of Factors regarding Compensation and Benefits

Factors	Mean (Total)	Mean (Age below 20)	Mean (Age 21-30)	Mean (Age 31-40)	Mean (Age Over 40)
Job security	1.764	1.94	1.67	1.71	1.91
Job market competitiveness of salary	1.509	1.44	1.57	1.21	2.16
Retirement program	1.480	1.11	1.52	1.43	2.0
Medical insurance package	1.411	1.38	1.3	1.43	1.75
Prescription drug coverage	1.274	1.27	1.2	1.31	1.41

From table 4.8, the data analysis we have found a little variation in job market competitiveness of salary. The mean value indicates that the workers are dissatisfied with the job market competitiveness of salary (51% neutral, 49% dissatisfied). Age below 20 to 40 are also dissatisfied but age over 40 are satisfied (16% satisfied, 84% neutral). Again we have found the same result in case of “Retirement Program”. Age below 20 to 40 are dissatisfied where the mean value also represents the same (48% satisfied, 52% neutral). But ages over 40 are neutral with the retirement program.

Table 4.9: Comparison among total response and Age wise response of Factors influencing Labor productivity and efficiency

Factors	Mean (Total)	Mean (Age below 20)	Mean (Age 21-30)	Mean (Age 31-40)	Mean (Age Over 40)
Sufficient salary	3.49	3.55	3.3	3.56	3.83
Fitness	3.35	3.5	3.12	3.5	3.5
Experience	3.25	2.88	3.15	3.5	3.46
Enough equipment provide	3.20	3.11	3.17	3.25	3.33
Training	3.16	2.83	3.05	3.34	3.58
Job security	3.03	3.05	2.9	3.18	3.08
Necessary compensation provide	3.01	3.00	2.87	3.15	3.16
Supervisor’s capability	2.96	2.72	2.9	3.03	3.33
Work hour	2.91	3.11	2.97	2.90	2.41
Worksite safety	2.87	2.77	2.6	3.15	3.16
Overtime	2.83	2.88	2.82	2.93	2.5
Season	2.75	3.05	2.57	2.96	2.33
Role of different personnel	2.69	2.72	2.52	2.87	2.75
Education	2.40	2.55	2.3	2.40	2.5
Stock options/pension plans	2.37	2.38	2.07	2.68	2.5

From Table 4.9, we have found a little variation in experience with the mean value that represents the agreement of the workers (25% strongly agreed, 75% agreed). Age 20 to over 40 are strongly agreed that experience is necessary for improvement of the productivity. But in case of age below 20, we have found that 12% workers are neutral and 82% are agreed with it. Training is also important for productivity. We have found the average workers are agreed with it (16% strongly agreed, 84% agreed). Again we have found a little variation in age below 20. Among them 83% are agreed that training is needed but 17% are neutral. There is a significant variation in supervisor's capability. The mean value represents that 96% are agreed and 4% are neutral in Supervisor's capability. Age below 20 to 30 follows the mean value but age between 31 to 40 we have found 3% are strongly agreed and 97% are agreed, again age over 40 we have found 33% are strongly agreed and 67% are agreed with it. There is a significant variation in "work site safety". The mean value represents that 87% are agreed and 13% are neutral with it. Where age below 20 to 30 the workers are agreed with it. But age 31 to over 40 workers are strongly agreed with it. They think worksite safety is must for construction work.

4.5 COMPARISON BETWEEN TOTAL RESPONSES AND OCCUPATION WISE RESPONSES

The respondents are now categorized into groups based on their occupation.

Numbers of total participants of the survey were found:

- a) Head mason = 6
 - b) Assistant mason = 20
 - c) Welder = 17
 - d) Rod binder = 13
 - e) Plumber = 12
 - f) Painter = 10
 - g) Electrician = 7
 - h) Pipe binder = 6
 - i) Mosaic mistri = 4
 - j) Steel binder = 2
 - k) Others = 5
- Total = 102

For analysis, highest 4 categories that means Assistant mason (20), Welder (17), Rod binder (13), Plumber (12) are best chosen. Total respondents are 62. By using the same formula of measuring mean value used previously all the mean values calculated. From these again a ranking of the factors can be shown according to their maximum to minimum value of the mean.

Table 4.10: Comparison among total response and Occupation wise response of Factors regarding the Supervisor of a project

Factors	Mean (Total)	Mean (Assistant Mason)	Mean (Welder)	Mean (Rod Binder)	Mean (Plumber)
Your supervisor's management capabilities	2.823	2.8	2.23	2.15	2.5
Overall relationship with your supervisor	2.803	2.1	2.41	2.30	2.08
Communication with your supervisor	2.774	2.6	2.64	2.38	2.66
leadership qualities of your supervisor	2.745	2.7	2.29	2.38	2.5
Your supervisor's active involvement in your career	2.617	2.4	2.11	2.38	2.08
provided adequate support from supervisor	2.539	2.35	2.47	2.07	2
feel encouraged by your supervisor	2.539	2.65	2.47	2.23	1.75
Recognition received from your supervisor	2.411	2.25	2.05	2.07	2

Table 4.11: Comparison among total response and Occupation wise response of Factors regarding Level of Agreement

Factors	Mean (Total)	Mean (Assistant Mason)	Mean (Welder)	Mean (Rod Binder)	Mean (Plumber)
Working at winter	2.941	1.95	1.64	2.07	2.33
Overall satisfaction with job	2.666	2.25	2.35	1.76	1.91
Role of different personnel	2.5	2.15	2.17	2.30	2.08
Working at summer	2.47	2.00	2	2.30	1.66
Workload	2.215	2.15	2.11	2.30	1.91
Ability to influence day-to-day company success	2.166	2.15	1.94	1.84	2.00
Overtime amount	2.029	2.22	2	2.07	1.66
Overtime payment	1.921	2	2	1.84	1.91
Involved in decision-making	1.892	2	2.17	1.76	1.83
Salary	1.764	1.95	1.76	1.76	1.91
Personal protective equipment(PPE) provide	1.725	2	2	1.53	1.58
Opportunity to use new technologies	1.715	2.25	2.17	2.46	1.91
Frequency and amount of bonuses	1.66	2.2	1.76	1.69	1.91
Connection between pay and performance	1.66	2.05	1.70	1.69	2.00
Access to company-sponsored training & seminars	1.529	1.95	1.70	1.61	1.5
Benefits	1.480	1.9	1.82	1.92	1.58
Working at rainy season	1,480	2.3	2.23	2	1.91
Security/stock options/pension plans	1.460	1.7	1.64	2.07	2.25
Worksite safety training provide	1.362	2.5	2.35	2.07	1.75

Table 4.12: Comparison among total response and Occupation wise response of Factors regarding Compensation and Benefits

Factors	Mean (Total)	Mean (Assistant Mason)	Mean (Welder)	Mean (Rod Binder)	Mean (Plumber)
Job security	1.764	2.2	2.17	1.53	1.83
Job market competitiveness of salary	1.509	1.75	1.29	1.61	1.83
Retirement program	1.480	1.55	1.58	1.61	1.33
Medical insurance package	1.411	1.55	1.41	1.69	1.91
Prescription drug coverage	1.274	1.85	1.76	1.69	1.5

Table 4.13: Comparison among total response and Age wise response of Factors influencing Labor productivity and efficiency

Factors	Mean (Total)	Mean (Assistant Mason)	Mean (Welder)	Mean (Rod Binder)	Mean (Plumber)
Sufficient salary	3.49	2.3	2.76	2	2.41
Fitness	3.35	2.2	1.88	1.92	2.08
Experience	3.25	2.4	2.58	2	1.91
Enough equipment provide	3.20	2.55	2.35	2	1.91
Training	3.16	2.55	2.23	2.07	2.33
Job security	3.03	2.55	2.29	2.23	1.83
Necessary compensation provide	3.01	2.45	2.52	2.76	2
Supervisor's capability	2.96	2.1	2	2.46	2.33
Work hour	2.91	2.2	2.70	2.53	2.25
Worksite safety	2.87	2.05	2.17	2.15	2.16

Overtime	2.83	2.3	2.82	2.69	2.58
Season	2.75	2.05	2.17	2.07	1.58
Role of different personnel	2.69	2.35	2	2.30	1.83
Education	2.40	1.85	1.88	2.23	2.00
Stock options/pension plans	2.37	2.05	2.29	1.76	2.25

From the table 4.10, we can see that the total mean values according to age wise classification of labors, are not equal with the individual mean values of work wise classification. For example, if we consider the factor “Supervisor’s management capabilities”, we can see that the total mean value is 2.823. This means that most of the labors of all age are satisfied with their supervisor’s management capabilities and few of them gave no specified answer or remained neutral. But the mean values for labors classified as “Welders” and “Rod Binders”, respectively 2.23 and 2.15, shows a large variation from the original total mean value. The value 2.23 represents that most of welders don’t want to talk about their supervisor’s capabilities and remained neutral whereas very few number of them showed satisfaction. Same explanation goes for the rod binders, but in this case, the mean value 2.15 means less satisfied workers than of those in welding occupation.

Again from table 4.11, the factor “Working at winter” shows the total mean value of 2.941 whereas the mean values from “Welder” and “Rod Binder” category are respectively 1.64 and 2.07. This means in the total age wise calculation, almost all of the labors showed their satisfaction towards working in winter. But in case of welders, around 60% of the total welders’ answers were neutral whereas the other 40% showed their dissatisfaction at working in this season. On the other hand, almost all of the rod binders showed neither satisfaction nor dissatisfaction at working in this season.

4.6SUMMARY

These results show us how the identified factors are affecting the labor productivity and efficiency at the construction sector of Bangladesh. The ranking of the factor indicates the importance and magnitudes of their effect on the productivity of the labors. These factors also expose the role of various subsectors such as safety management, supervision by authority, terms of agreement and conditions and other benefits and compensation of the construction sector of Bangladesh. As for example, site supervisor's management capabilities have been ranked as the number 1 factor in the subsector of supervision of a site. Due to the lacking of supervisor's management capabilities, the pre-determined work schedule that was assessed to be feasible for the construction of a project, may gone astray. Again the efficient management of a site supervisor may influence the labors to execute the construction process in time and thus it reduces the costs. Not only the ranking of the factors were determined, but also comparisons of response of various types of labors were also done to determine each type of point of view about the leading factors. So, it can be said that these factors and their magnitude of impacts need to be considered during any kind of building construction projects and to take necessary steps to improve the factors that affect the labor productivity positively and to eradicate those negative factors.

CHAPTER 5: CONCLUSION AND RECOMMENDATION

5.1 GENERAL

This chapter summarizes the research procedures and outcomes of the study. The effectiveness of the study and how people can be benefited from this study are discussed in short. Possible enhancements of this study and future research guideline are also mentioned in the recommendation part.

5.2 FACTORS AFFECTING LABOR PRODUCTIVITY

Productivity is considered the main value-adding function within the construction sector. The aim of this research was to identify factors affecting labor productivity in building projects, and to rank these according to their relative importance from responses of the workers of the construction industry of Bangladesh.

The study covered construction sites at IUT campus, Board bazar, Borobari, Uttara, Kalabagan, Azimpur, Lokkhi bazar, Shahbag, Bangla motor, Farmgate, Puranapolton, Malibagh, Rampura, Mirpur and somewhere in Puran Dhaka, Cox's bazar, Dinajpur etc. A total of thirty eight (38) sites were visited. These sites were scattered in four (4) of the regions of Bangladesh namely Dhaka, Gazipur, Dinajpur and Cox's Bazar. Survey form distributed to the respondents who involve in various types of building construction works in wide area in Bangladesh. Based on a careful review of literature and considering the general working conditions and other aspects, the survey form / questionnaire is designed. The questionnaire contained 59 items. Majority of these were in the form of rating scale of satisfaction or agreement type. Other questions were asked for factual information such as years spent in present organization, educational qualification, career, working experience, age and sex etc. The respondents are people who work as: mason, carpenter, steel bender, plumber, electrician, painter, rod binder, welder, polish mistry, Mosaic mistry etc. A total of 103 respondents gave their opinion in this regard. After completion of the questionnaire survey in different sites, all the necessary information and data are put in Microsoft excel for analysis. Simple percentages and frequencies were generated for the various responses from the questionnaire to identify the factors that affect construction labor productivity.

5.3 OUTCOME OF THE STUDY

A total of 47 factors were identified in this study, with identification of factors influencing construction productivity being based on a careful review of literature and suggestions from local experts in building construction. 15 factors are chosen most significant through worker's responses. The results indicated that the main 15 factors affecting labor productivity are:

1. Sufficient salary,
2. Fitness,
3. Experience,
4. Enough equipment provide,
5. Training,
6. Job security,
7. Necessary compensation provide,
8. Supervisor's capability,
9. Work hour,
10. Worksite safety,
11. Overtime,
12. Season,
13. Role of different personnel,
14. Education,
15. Stock options/pension plans.

Other 32 factors are related to their supervisor, level of agreement and compensations & benefits. It is also ranked them according to their relative importance.

In respect of Bangladesh, "sufficient salary" has the highest mean value among other factors which means most of the labors agreed that without sufficient salary, they don't feel encouraged to work properly. Because almost all of the labors live below the poverty line and this is their only source of income to meet their basic needs. Again, "Experience" is the 3rd ranked factor that most of the labors agree with its influence on their productivity. Experienced workers can serve more efficiently within the best possible time. Also, without training, workers who have less experience in construction sector, can't function efficiently and kills a lot of time and money.

After the ranking of factors, worker's responses were considered to determine the factors they are satisfied and dissatisfied about. "Worksite safety" is a negative response, which indicates the dissatisfaction of workers about the lacking of proper safety measures which leads to accidents very often. On the other hand, "Your supervisor's management capabilities" is a factor the workers admitted to have a positive impact on their works. A good and experienced supervisor can manage the whole construction procedure and labor's input to productivity very efficiently without any waste of time or money. A qualified supervisor also influences and encourages the labors go on with their job without any kind of hesitations and remissness.

5.4 RECOMMENDATIONS

On the basis of the outcomes of this research, it can, moreover, be inferred that labors have an essential contribution to make to enhance the productivity of operatives and therefore achieve better value for money. However they should seek to improve on the following:

- 1) Labors of all types need to be motivated via any kind of schemes or programs by the authority to facilitate their input towards achieving the goals of a construction project.
- 2) It is necessary to conduct training courses and seminars in the topics that will improve productivity in construction projects.
- 3) Contracting companies have to conduct productivity studies at the activity/operation level, such as studying factors affecting labor productivity and labor productivity measurement to describe the detailed tasks performed for an activity / operation by individual or group.
- 4) There is the need for employers to provide an improved working condition for their employees to motivate them to do good work and in the long run give them satisfaction.
- 5) Should provide more safety equipment between the laborers to work flawlessly and without fear.
- 6) Site supervisors with whom workers come into contact with most of the day are to ensure their continuous encouragement to workers, provide support and involve workers in decision making at the workplace.

- 7) Employers of construction workers are to look into the pay structure of workers relative to the amount of work they do as this was a serious concern of workers concerning their satisfaction.
- 8) Aside these, the management personnel are to develop various incentive schemes such as the good overtime payment and performance bonuses. These incentive schemes should be attractive enough to reduce worker's dissatisfaction. Moreover compensation & other benefits should be given to the workers.

5.5 EFFECTIVENESS OF THE STUDY

It is a common interest among contractors, consultants, employers, and policy makers in Bangladesh to improve the productivity level of the construction sector. The outcomes of this study can assist achieving this goal by focusing and acting upon the most significant factors perceived to affect the efficiency of labor.

The outcomes of this research fill a gap in knowledge of factors affecting labor productivity in Bangladesh. It can be used to provide contractors, consultants, employers, and policy maker's guidance for focusing, acting upon, and controlling the most significant factors perceived to influence the efficiency of operatives. Still, it is further recommended to replicate the study, taking into consideration, the perceptions of employers and designers/ engineers in addition to contractors to assess the level of agreement with the factors according to their rankings and corroborate the findings of this research. Thus, all of these things can improve the productivity of labor of the construction industry in an environment of ever-increasing demand for lower cost and faster delivery of constructed facilities.

5.6 LIMITATIONS AND DIRECTION FOR FUTURE RESEARCH

However this study covered a particular scope hence the need for a further research into other areas in the construction industry concerning factors affecting construction worker's labor productivity. The following recommendations are suggested for future research:

- 1) The sample respondents for this study were only from building construction sites of Bangladesh. Future studies may conduct a survey on other construction sites like roads & highways, several water structures etc with the association and compare the findings with this one.
- 2) The scope of this research was limited to respondents who worked as laborers only. Future research may utilize similar methods and procedures to conduct research on other personnel in the industry such as contractors, consultants, employers, and policy makers etc.
- 3) Because of the shortage of time this research was limited to number of respondents not much bigger enough to get proper findings. So if there is much time, future studies can conduct with more respondents for more accuracy.

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APPENDIX

**QUESTIONNAIRE SURVEY FORM REGARDING
“LABOUR PRODUCTIVITY”**

Please answer the questions as frankly as possible by ticking (v) as appropriate :

Part A: Personal and work related characteristics:

1. Gender: A. Male () B. Female ()
2. Age in years: A. <20 () B. 21-30 () C. 31-40 () D. >40 ()
3. Level of Education: A. Primary B. JSC () C. SSC () D. HSC ()
E. Polytechnic () F. Other (please specify)
4. Career / Occupation: A. Mason () B. Carpenter () C. Steel bender ()
D. Plumber () E. Electrician () F. Painter ()
G. Rod binder () H. Welder () I. Polish mistry ()
J. Mosaic mistry () K. Other
5. What influenced your career choice: A. Status of profession () B. Family / Tradition ()
C. Salary () D. Security () E. Others (please specify)
6. Experience in Construction Industry: A. <2years () B. 2-5 years () C. 6-8 years () D. 8+ years ()
7. Experience in Present organization: A. <2years () B. 2-5 years () C. 6-8 years () D. 8+ years ()
8. working hour per day: A. <2hr () B. 2-5hr () C. 6-8 hr () D. 9-12 hr ()
9. Overtime per day: A. <2hr () B. 2-5hr () C. 6-8 hr () D. 9-12 hr ()
10. Salary per day in taka: A. <200 () B. 200-400 () C. 400-600 () D. 600-800 ()
E. Other (please specify)
11. Salary per day for overtime: A. <200 () B. 200-400 () C. 400-600 () D. 600-800 ()
E. Other (please specify)
12. Long term goal is to continue as a construction worker: A. Strongly Agree () B. Agree ()
C. Uncertain () D. Disagree () E. Strongly disagree ()

Part B: Your Supervisor :

	Very satisfied	satisfied	Neutral	dissatisfied	Very dissatisfied
1. leadership qualities of your supervisor	()	()	()	()	()
2. Your supervisor's management capabilities	()	()	()	()	()
3. Your supervisor's active involvement	()	()	()	()	()
4. Communication with your supervisor	()	()	()	()	()
5. provided adequate support from supervisor	()	()	()	()	()
6. feel encouraged by your supervisor	()	()	()	()	()
7. Recognition received from your supervisor	()	()	()	()	()
8. Your overall relationship with your supervisor	()	()	()	()	()

Part C: Please indicate your level of agreement with each of the following state:

	Very satisfied	satisfied	Neutral	dissatisfied	Very dissatisfied
1. Salary	()	()	()	()	()
2. Benefits	()	()	()	()	()
3. Frequency and amount of bonuses	()	()	()	()	()
4. Connection between pay and performance	()	()	()	()	()
5. Security/stock options/pension plans	()	()	()	()	()
6. Workload	()	()	()	()	()
7. Overtime amount	()	()	()	()	()
8. Overtime payment	()	()	()	()	()
9. Working at summer	()	()	()	()	()
10. Working at rainy season	()	()	()	()	()
11. Working at winter	()	()	()	()	()
12. Role of different personnel involved	()	()	()	()	()
13. Workside safety training provide	()	()	()	()	()
14. Personal protective equipment(PPE) provide	()	()	()	()	()

15. Involved in decision-making at workplace () () () () ()
16. Ability to influence day-to-day company success() () () () ()
17. Opportunity to use new technologies () () () () ()
18. .Access to company-sponsored training () () () () ()
&seminars
- 19 .Overall satisfaction with your job () () () () ()

Part D: Compensation and Benefits:

- | | Very satisfied | satisfied | Neutral | dissatisfied | Very dissatisfied |
|---|----------------|-----------|---------|--------------|-------------------|
| 1. Medical insurance package | () | () | () | () | () |
| 2. Prescription drug coverage | () | () | () | () | () |
| 3. Job security | () | () | () | () | () |
| 4. Retirement program | () | () | () | () | () |
| 5. Job market competitiveness of salary | () | () | () | () | () |

Part E: Factors influencing labour productivity & efficiency:

	Strongly agree	Agree	Uncertain	Disagree
Strongly disagree				
1. Work hour:	()	()	()	()
2. Overtime:	()	()	()	()
3. Experience:	()	()	()	()
4. Sufficient salary:	()	()	()	()
5. Fitness:	()	()	()	()
6. Education:	()	()	()	()
7. Workside safety:	()	()	()	()
8. Supervisor's capability:	()	()	()	()
9. Role of different personnel:	()	()	()	()
10. Job security:	()	()	()	()
11. Training:	()	()	()	()
12. Season:	()	()	()	()
13. Enough equipment provide:	()	()	()	()
14. Necessary compensation provide:	()	()	()	()
15. Stock options/pension plans:	()	()	()	()

Comment (if any):