Analysis of Factors Affecting Labor Productivity on Construction Projects in the City of San Fernando, Pampanga: A Quantitative Study

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Abstract- ***In every work, there is a significant factor in the construction sector that could affect the labor productivity of workers. This is utilized in construction planning and scheduling, cost control, worker performance, estimating, and accounting. The most difficult issue in the construction sector is the productivity rate since it has an impact on worker productivity and construction quality. The loss of productivity is a result of several causes, including those related to labor, external factors, management, resources, and other factors. In fact, these factors frequently result in further disruptions that influence production and are out of the contractor's direct control, resulting in lost output or the need for more work hours to complete. The purpose of this study is to pinpoint the variables affecting labor productivity in the City of San Fernando, Pampanga. To understand the typical factors at play and be able to identify which of all the variables is the most important, it will be computed to establish what factor has the most impact on the labor productivity of employees and professionals. Additionally, a quantitative approach will be used to gather data. The proponents of the study thereof conclude all the gathered data from the City of San Fernando, Pampanga using a quantitative study claimed the ranks of those forty-two (42) factors are affecting the laborer's productivity in construction projects in the said city. Furthermore, the top factor garnering forty-two-point eighty-six percent (42.86%) under the Resources Factors, which is the "Increase in the price of materials" affects the labor productivity in CSFP. In addition to this, the proponents of the study organize a framework of recommendations and/or options of intervention for the company and company-client against the fluctuation of material costs. Furthermore, this framework of recommendation can help companies to be systemized, organized, and updated within its internal factors onto the external factors such as market price increase. While the company-client framework will give them options to consider in dealing with such a market price increase. Hence, a recommendation was suggested by the proponents to future researchers, use mixed method, expound your borderline, consider more factors on labor productivity, and analyze the impact of the increased price of materials.***

I. THE PROBLEM AND A REVIEW OF RELATED LITERATURES AND STUDIES

1.1 Introduction

A decent working environment is crucial in the construction industry since it can impact employees' labor productivity. Every work has components, and these can have both minor and major effects. Studies about the construction industry are widely available, and some of these studies have a connection to project management. Additionally, studies that examined issues or other elements influencing the workers' efficiency were conducted. As a result, the authors of this work introduce quantitative research by examining variables that affect labor productivity.

After evaluating a wealth of material pertinent to this topic, numerous studies show the necessity of identifying factors affecting construction and/or labor efficiency. In international Mahesh Madan Gundecha's 2012 study, the factors influencing construction works were considered. Aman Agrawal and Srijeet Halder conducted the same investigation in 2019 and produced a paper that supports the

production-related parameters. Ghate, R. Prachi, Mr. Minde, Parvin R., and others were also present. Dr. Jayeshkumar Pitroda researched the variables affecting construction productivity in 2018 and 2016.

Three cognitive studies on labor productivity were conducted in the Philippines. A 2019 study in Nueva Ecija by Vanez et al. demonstrated the importance of age and compensation for worker productivity. In contrast, a study by Quezon et al. in 2021 in the Cagayan Valley Region revealed that the presence of health workers on the job is the biggest obstacle to worker productivity, while a study by Dy et al. in 2021 in the National Capital Region found that the experience and skills of the laborers have the greatest impact on worker productivity.

The construction industry faces challenges with relevant problems relating to labor productivity. There are numerous ways to implement and quantify the damages from poor labor productivity in construction. This paper aims to identify the factors affecting labor productivity in construction projects. Moreover, the authors of this study thus propose the updated concept of "Analysis of Factors Affecting Labor Productivity on Construction Projects in the City of San Fernando, Pampanga: A Quantitative Study" that could impact construction engineering and management regarding the variables affecting the effectiveness and productivity of diversified building projects.

1.1.1. Productivity in General

Productivity in general (Kenton, 2022) is the measurement of the input and output of works done by the workers in a specific period of time. It also indicates here that when productivity fails to grow significantly, it limits potential gains in wages, corporate profits, and living standards. In short, productivity in construction have domino effects. If we don't pay attention to it, the whole construction will suffer.

1.1.2. Productivity in Construction Industry

According to the Engineering journal of (Alexandria, 2011), there are numerous ways to define productivity. Productivity in the construction industry is typically understood to refer to labor productivity, or the amount of work completed or produced per worker-hour. Man-hours per unit (unit rate), which is the opposite of labor productivity, is also frequently used. The main focus of productivity especially in construction is the labor work. Wherein it is needed to measure for us to know the productivity of each of our workers. Measuring it will give us the insight on how productive the workers are.

The ratio of manufacturing output to the necessary procedures and associated effort is used to calculate productivity (Assignar, 2017). The efforts and necessary procedures done by the workers are very important to know their productivity capacity. In this case, each of them must possess a dedicated heart and mind in their Job for them to be more motivated and be productive.

1.2 Review of Related Studies

In developing nations, productivity loss in the construction sector is a significant problem due to the lack of documented data for project estimation, planning, and management. Poor management is the main reason for low labor outputs, and the authors discovered that one barrier to increasing intense labor production is a lack of goal alignment and attention to the labor force. An improvement in productivity might directly result in a decrease in labor costs (Bamfo-Agyei, Emmanuel, 2022). Moreover, the productivity rates of the construction process are crucial to both site engineers and planning engineers. It could be used to track worker performance, determine the amount of labor needed for a project to plan, monitor, and predict costs (Hany Ismail, MSC, PMP, 2014).

According to Leonard Kimberlee (2019), General contractors employ both professional and unskilled personnel to carry out particular duties in order to accomplish a job. Framers, finishers, and everyone in between are considered crew members. Many general contractors neglect to estimate man-hour productivity, but they should. In addition to aiding in project bidding and labor cost management, it can also be useful in the event of a loss when a general contractor must calculate the productivity costs for a legal action or insurance claim.

The work completed divided by the number of workers used to complete the task is known as labor productivity. A day, week, or months' worth of labor productivity is measured. It provides evidence of the

workers' productivity. Labor planning also benefits from the calculation of labor productivity (Ali, Shabez, 2022).

Another important idea in building planning is labor productivity, which directly affects the triple constraint; time, cost, and quality (SerdarUlubeyli, AynurKazaz, BayramEr, 2014). Work change, disturbances, and rework are all highly correlated with lower labor performance. When changes are made, efficiency is lost by an average of 30%. The absence of resources and knowledge and having to do the work out of order are the two most important sorts of disruptions. These interruptions cause a daily efficiency loss of between 25% and 50%. (Thomas, Randolf H. & Napolitan, Carmen I., 2018).

It can be said that Work-life balance (WLB) policies have a favorable effect on how well the sector performs. When WLB rules are adopted in various businesses, it will aid in boosting the concerned company's productivity. Lack of WLB rules in construction enterprises may contribute to reduced employee turnover. To maintain a healthy work-life balance, the corporation should take care of its employees' burden. Construction companies that take into account each worker's individuality and pay close attention to WLB policies and programs are likely to reduce worker family work conflict and, as a result, can boost productivity (Apraku et al., 2020).

Based on the study conducted by Shehata and El-Gohary (2012), it is not important to maximize workload, output, or working hours without adhering to the work plan in order to increase productivity. Instead, the most important thing is to keep a consistent workflow so that you can match the task to your capabilities (work hours).

One of the tips that suggested by Trekker Group (2017) with regards to productivity is that analyze each job's productivity, paying special attention to when it starts to deteriorate. Soon, patterns should start to show up that pinpoint certain elements of your process, specific pieces of equipment, or other elements that cause slowdowns.

One of the key factors affecting output is the workers' experience, skill, and age. Efficiency and productivity will also be impacted by other factors, such as the management style and motivation of labor supervisors, the scale and complexity of the job, and the utilization of sophisticated equipment for the project (Builtlogy, 2018).

In the study of A. R. S. Sri Susmitha, K. Hemantha Raja, and SS. Asadi of "A Statistical Approach for Ranking Factors Impacting the Timeline of Residential Construction Projects Using Important Index Method (IMPI)", The research methodology of this study contains two stages. The first stage includes a literature search and questionnaire survey. The literature review is collected through articles, internet and international project management journals. (IJCIET Volume 9, Issue 5, May 2018.

1.2.1. Similar Study from other Countries

According in the study of Gundecha (2012) in USA, there are a lot of factors that can affect the workers' productivity. Whereas Gundecha considered the following factors which are Manpower Factor, External Factors, Communication Factors, Resource Factors, and Miscellaneous Factors. Moreover, a Relative Importance Index (RII) was used to rank up the factors affecting labor productivity. The findings found out that material shortage (Resource Factor) is ranked first in which this factor affects the most in the productivity of the workers. Then Shortage of power and/or water supply (Miscellaneous Factor) ranked second. The overall ranking for group factors, Miscellaneous Factors ranked first followed by Resource Factors. In related to this, a study conducted in India (Gopal et al., 2016), there are nine (9) identified groups pertains to factors affecting labor productivity in construction industry, it includes the Workforce factor, Management team, Psychological, Schedule compression, Material/Equipment, Supervision, Safety, External, and Miscellaneous factor. Lack of skill and experience ranked first under Workforce Group, having an R.I.I 86.48% among the 54 factors. Consequently, it is the most significant factor influencing the creation of labor productivity the worker's incompetence and lack of expertise became a factor disruption of the work process. Late payment (Psychological Group) was ranked second, then it was next by Poor health of the worker (Workforce Group). In addition, inefficient crew

composition ranked first among the factors that was studied by (Kukreja et al., 2020).

In Bangladesh a study was conducted by UKDiss (2021), the element with the highest mean value among the others is "sufficient salary," which indicates that the majority of the laborers concur that they would not feel motivated to perform their jobs effectively without it. Fitness is next with higher value of mean, followed by experience. Workers with more experience can provide better service in the least amount of time. Additionally, personnel with less experience in the construction industry who lack training are unable to operate effectively, wasting both time and money.

A study of Patel and Pitroda (2018) entitled Analysis of Labour Productivity in Building Construction in the Central Gujarat, computed the frequency index (FI), relative importance index (RII), and severity index (SI). Too much workload is the most common factor that appeared in the study. Shortage of material ranked first in the RII. Lastly, with regards to severity index, the frequent changes design was the severe among all the factors.

1.2.2 Similar Study from the Philippines

A study in Nueva Ecija, Philippines was conducted regarding on the factors affecting laborer's productivity. There are two (2) factors that mainly affect the productivity of workers, these are age and monthly compensation. Moreover, the age of workers in the construction business ranges from 20 to 39 years of age. It says that mature laborers with high monthly income are more productive than the younger ones. To determine the findings, the researchers of this study used a descriptive-survey technique, with a questionnaire serving as the primary instrument and being completed by both the workers and their supervisors, who served as the study's respondents. A rating of 3.83 and 3.74, respectively, given by the workers' supervisors and themselves, were both considered Above Average, which means that the productivity sometimes exceeds standards or expectations or has advanced knowledge. (Banez et al., 2019)

There is a study entitled "Analysis of Influential Factors Affecting Workers' Productivity on Highway Construction Projects during Covid-19 Pandemic in Cagayan Valley Region, Philippines". The factors they considered in this study are in a group, wherein they rank the factors using RII. Management, work force, supervision, schedule compression, material/equipment, health & safety, and motivation are the group factors. Those group had a subcategory wherein "No health worker in the project site" ranked first among all the 53 factors that were identified with a 0.97 RII, this factor is under the health & safety group. Moreover, among the seven (7) group factors, health & safety ranked first also with RII of 0.81. (Quezon et al., 2021)

There are thirty-four (34) factors that were considered in the study conducted in NCR, Philippines. Moreover, they were categorized into four (4) groups, it includes the human/labor, management, technological, and Covid-19. To find the ten (10) significant factors the researchers used an RII to rank the factors. According to findings, one of the significant factors that affects labor productivity during pandemic is the laborers experience and skill. (Dy et al., 2021)

Table 1.2. Factors Affecting Labor Productivity based on Previous Study

Group Factors	Sub-Factors
Manpower (Mahesh Madan Gundecha, 2012)	Lack of Experience Absenteeism Alcoholism Misunderstanding among labors Age Lack of competition between the labors Disloyalty

	Personal problems
External (Mahesh Madan Gundecha, 2012)	Supervision delays Variation in the drawings Incompetent drawings Rework Design changes Inspection delays from the authorities Payment delays Complex designs in the provided drawings Implementation of government laws Training sessions
Management (Quezon et al., 2021)	Lack of leadership skill Poor relationship between labor supervisor Lack of labor surveillance Lack of periodic meeting with laborers Poor communication and coordination Improper planning & scheduling of work Construction managers lack of leadership Violation of safety laws Variation orders Misunderstanding between the agency & constractor
Resource (Mahesh Madan Gundecha, 2012)	Lack of required construction material Lack of required construction tools/equipment Insufficient lighting Poor site condition Differing site condition from plan Material storage location Poor access within construction site Quality of required work Inadequate transportation facilities for workers Inadequate construction material Increase in the price of material Shortage of water and/or power supply
Miscellaneous (Mahesh Madan Gundecha, 2012)	Accidents during construction Weather conditions Working overtime Project objective is not well defined

1.3 Statement of the Problem

In every work there is a significant factor in the construction sector that could affect the labor productivity of workers. This is utilized in construction planning and scheduling, cost control, worker performance, estimating, and accounting. The most difficult issue in the construction sector is the productivity rate since it has an impact on worker productivity and construction quality. The loss of productivity is a re sult of several causes, including those related to labor, external factors, management, resources, and other factors. In fact, these factors frequently result in further disruptions that influence production and are out of the contractor's direct control, resulting in lost output or the need for more work hours to complete.

According to Will Kenton 2022, there is a directly proportional relationship between productivity and profit. If the workers' productivity is excellent, the

profit will increase, and more clients will come to the company. While, if the workers' productivity is poor, less profit will be generated. Labor productivity affects the overall credibility of the company. The more problems appear, the less credible a company become. Hence, it is important to determine the factors that affect the productivity of workers to have a knowledge of where the company is lacking in terms of their labor services.

1.4 Objective of the Study

The general objective of the study is to determine and analyze the factors affecting the labor productivity on construction projects in the City of San Fernando, Pampanga.

The following below are the specific objective:

1.4.1 To identify the factor/s that most affect the labor productivity on construction projects in the City of San Fernando, Pampanga.

1.4.2 To calculate the importance index, frequency index, and severity index of factors affecting the labor productivity of construction projects in the City of San Fernando, Pampanga.

1.4.3 To develop a framework of recommendation to mitigate the problems affecting labor productivity.

1.5 Significance of the Study

This research will provide new insights into the project management in construction and what factors affect the productivity of workers at construction sites. The success of this study has a huge impact to the following sectors:

1.5.1 Construction Industry. The construction industry will benefit the findings of this study and its recommendation. They would be able to consider these factors to evaluate, assess and correctly manage their professionals. These factors are essential in the core value of the construction institution, as it is vital to construction bidding.

1.5.2 Researchers. The study will be beneficial to the researcher as they will be able to gain new perception about the factors that affect the labors productivity. The findings to this study may help the researcher to understand more the scenarios in the constructions site as they enter in the future. They will be also able to address and solve the same problem if ever they decide to pursue project management in the future.

1.5.3 Future Researchers. Future Researcher can use the research as a reference to their study. The research will provide baseline data and related studies they needed. Also, the analysis that is presented in this study will convey beneficial information for future research that will explore the various topics in project management.

1.6 Scope and Limitations

The primary concern of this study is to analyze the variables influencing labor productivity on building projects in the City of San Fernando. The researchers will also need data from related studies. The following operational components were listed by the researchers using previous studies and researchers as a guide: Manpower Factors, External Factors, Management Factors, Resource Factors, and Miscellaneous Factors. The only computations required to determine which factor accounts for most of the factors listed are IMPI, FI, and SI.

The study also restricts the workers' productivity rates and does not address issues that are not necessarily related to the study. To acquire information for the study, researchers conduct interviews and questions.

The study is limited only to construction projects in the City of San Fernando, Pampanga, where in the target respondents should be employed in the construction company in CSFP. The research does not cover the other factors affecting labor productivity that are not mentioned above. Also, it does not address other issues that take place inside the construction site.

11.7 Conceptual Framework

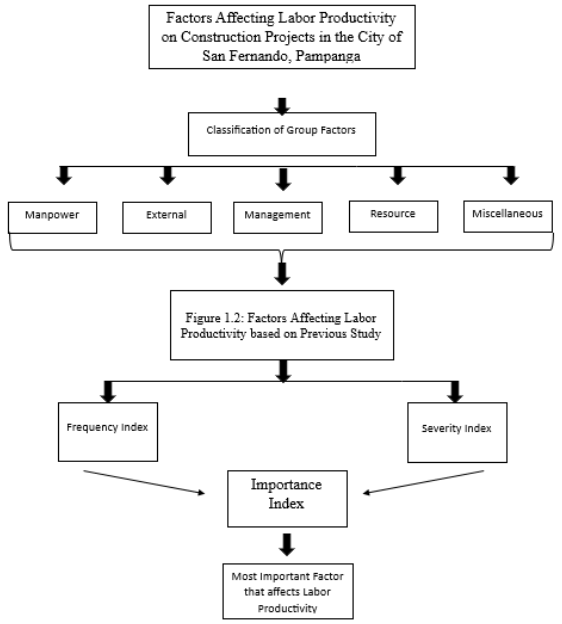

Figure 1.7. Research Paradigm

1.8 Definition of Terms

In this section, proponents provide a definition of terms for the better understanding of readers in the terminologies that was used in this paper. Some of the key terms from this study are included below.

Adhering- to act in the way that is required by (something, such as a rule, belief, or promise).

Construction- Build or take apart bracing, scaffolding, and temporary structures. Dig trenches, backfill holes, or compact earth to prepare for construction. Operate or tend equipment and machines used in construction.

Deteriorate- mean the falling from a higher to a lower level in quality, character, or vitality.

Frequency Index (FI)- is an index to determine the frequency of use of learning spaces that are classified according to the levels of use which are minimal, optimal, and maximal use of critical applications.

Labor Productivity- Labor productivity is defined as real output per labor hour, and growth in labor productivity is measured as the change in this ratio over time.

Labor work- practical work, especially when it involves hard physical effort.

Man-hour per unit- Man-hours, also called person-hours, are the unit of measure that is used in project management to measure the efforts needed to complete a task.

Neglect- a situation in which you do not give enough care or attention to someone or something, or the state of not receiving enough care or attention.

Project bidding- Construction bidding is the process of submitting a proposal (tender) to undertake or manage the undertaking of a construction project. The process starts with a cost estimate from blueprints and material take offs.

Project estimation- is the process of forecasting the time, cost, and resources needed to deliver a project. It typically happens during project initiation and/or planning and takes the project's scope, deadlines, and potential risks into account.

Project management- is the application of processes, methods, skills, knowledge, and experience to achieve specific project objectives according to the project acceptance criteria within agreed parameters. Project management has final deliverables that are constrained to a finite timescale and budget.

Relative Important Index (RII)- is used to determine the relative importance of quality factors involved.

Severity Index (SI)- is a composite indicator that measures the severity of humanitarian crises against a common scale.

Sophisticated- having a good understanding of the way people behave and/or a good knowledge of culture and fashion.

Workers' Efficiency- refers to the ability of an employee to perform his/her job effectively and efficiently. Efficiency depends upon several factors such as motivation, skills, knowledge, experience, etc. Work-life balance (WLB)- refers to an equilibrium state, where one effectively balances work or career demands and those of their personal life.

Workload- the amount of work to be done, especially by a particular person or machine in a period of time.

II. METHODOLOGY

In the study entitled "Analysis of Factors Affecting Labor Productivity on Construction Projects in the City of San Fernando, Pampanga: A Quantitative Study," which contains three (3) phases that must be taken into account, this part is introduced and elaborated on the methodology used. Phase one (1) focuses on the methodological framework, phase two (2) discusses data collection, and phase three (3) deals with data analysis and evaluation.

2.1 Phase – 1 Methodological Framework

The methodological framework of this paper shows the systemized basis for the study. It shows the subsections under each phase.

Table 2.1. Methodology Phases

Phase 1	Methodological Framework Research Design Research Locale Selection of Participants Research Instruments
Phase 2	Data Collection Data Requested from Local Government Units (LGUs) Data Gathered from Internet or Online Sources Data Gathering Procedure Research Ethics
Phase 3	Data Analysis and Evaluation Statistical Analysis

2.1.1 Research Design

The purpose of this study was to pinpoint the variables affecting worker productivity in the city of San Fernando, Pampanga. In order to understand the typical factors at play and be able to identify which of all the variables was the most serious, that was computed to establish what factor has the most impact on the labor productivity of employees and professionals. Additionally, a quantitative approach was used to gather data.

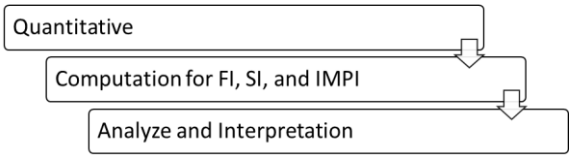

Figure 2.1.1. Sequential Explanatory

2.1.2 Research Locale

The study was conducted in the city of San Fernando, a first-class component and capital of the province of Pampanga, Philippines. It is known as the economic center of the region. The researchers visited each participant's firm for the distribution of the questionnaires. The sampling participants were taken through the Slovin's formula.

2.1.3 Selection of Participants

The construction companies in the city of San Fernando, Pampanga, are the participants in this study. Using Slovin's formula, the statistician estimated the quantitative sample size to have a 95% confidence level and a 5% margin of error. The participants were chosen using the convenient sampling technique.

$$n = \frac{N}{(1+Ne^2)}$$

Where:
n = no. of samples
N = Total population
e = error margin / margin of error
Computation of sample size:

$$n = \frac{408}{(1+(408)(0.05)^2}$$
$$n = 202$$

2.1.4 Research Instruments

The study entails the usage of a quantitative approach to gather data, and this step was integrated by the proponents in conducting a survey and done via questionnaire distribution. As a result, the questions were derived from the related literature of this study.

In addition, the RRLs that are used to formulate the questions was considered (section 1.2.1); relying on the study of Dr. Jayeshkumar Pitroda in 2018, he integrated different studies in constructing his questionnaires, just as Aman Agrawal and Srijeet Halder did in 2019. Consequently, the questionnaire

that is used in the study is also based on different studies, specifically the study of Mahesh Madan Gundecha in 2012, entitled "Study of Factors Affecting Labor Productivity at a Building Construction in the USA: WEB Survey."

Moreover, in the study of A. R. S. Sri Susmitha, K. Hemantha Raja, and SS. Asadi entitled "A Statistical Approach for Ranking Factors Impacting the Timeline of Residential Construction Projects Using the Important Index Method (IMPI)," this will be considered as the basis for formulating the survey questionnaire and methods.

Hence, the survey questionnaires were categorized based on other studies, and the results was computed using different methods such as IMPI, SI, and FI.

2.2 Phase - 2 Data Collection

Data collection is the process of acquiring information with regards to the data needed in the study. There are four (4) subcategories in this phase. These are data requested from local government units (LGUs), data gathered from internet or online sources, data gathering procedure, and research ethics. With this, proponents will easily identify and get the data based on the process that was provided in this study.

2.2.1 Data Requested from Local Government Units (LGUs)

The researchers requested a concrete number of all Construction firms in the City of San Fernando, Pampanga. In which, the proponents used those lists of construction company to navigate the target respondents.

2.2.2 Data Gathered from Internet or Online Sources

The proponents used the internet to acquire information that served as basis in this study. The information was based on published thesis and books that can be found in internet. In finding RRL, internet is very helpful to easily find a related study. Moreover, researchers disregarded the unreliable websites and/or pages that are known for bias and untrue research. Also, the information from the internet will be cited properly using APA format.

2.2.3 Data Gathering Procedure

2.2.3.1 Data collection was done through a paper survey. The research instruments for the study were survey questions the researchers developed. The questionnaire is divided into five (5) areas based on the elements affecting labor productivity: manpower, external, management, resource, and miscellaneous. The survey's questions used a nominal scale.

2.2.3.2 The questionnaire was validated by a consultant or subject-matter expert in the field.

2.2.3.3 A letter of consent was provided together with the survey questionnaire. This product is created and distributed to construction firms in and around San Fernando, Pampanga.

2.2.3.4 The questionnaires were gathered.

2.2.4 Research Ethics

The most important aspect of conducting research is ensuring its well-being. By treating them seriously and allowing the participant to leave the conversation if they felt uncomfortable, the fundamentals research ethics principles such as respect for individuals, beneficence, fairness, and regard for communities will be followed.

Privacy, confidentiality, and anonymity about Republic Act 10173, also known as the Data Privacy Act of 2012, are the primary and most significant factors in the study. The sources that are used in this study were cited and acknowledged. On the other hand, the sources in this study were correctly acknowledged and credited. Lastly, the study was conducted objectively.

2.3 Phase 3 – Data Analysis and Evaluation

Data analysis and evaluation used to rank, study, and make an analysis to the collected data. The researcher employs sequential steps to organize the respondent data in a systematic manner. In this phase, the proponents discussed the statistical analysis.

2.3.1 Statistical Analysis

This provide a summary of analysis methods that was used to perform this research. Responses on distributed questionnaire were analyzed statically with

the data requirements of this study. The following was used to assess the data:

1. Tally the survey results.
2. Using the following methods IMPI, FI, and SI
3. Using the formula of Important Index Method (IMPI)

Important Index% = [F.I% x S.I%]/100

a. FI stands for Frequency Index
b. SI stands for Severity Index

4. Next is the FI (Frequency index)
5. To determine the most frequent factor, the formula is.

$$\text{Frequency Index\%} = \frac{\sum a\left(\frac{n}{N}\right)(100)}{4}$$

6. Lastly, Severity Index (SI)

$$\text{Severity Index\%} = \frac{\sum a\left(\frac{n}{N}\right)(100)}{4}$$

7. After identifying the sequence in factors affecting construction industry, it is time to analyze and evaluate the data.

Where:
a – Weightage given to each response (ranges from 1 to 4)
n – Frequency of the response
N – Total no. of responses"

III. PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

This chapter shows the data gathered from different construction companies in the City of San Fernando, Pampanga, where the target respondents of this study are project managers, project engineers, architects, operator engineers, or any authorized professionals who manage and handle construction projects. Moreover, the proponents provide an analysis and interpretation of data. In line with this, proponents used the Frequency Index and Severity Index to get the Important Index of factors affecting labor productivity on construction projects. In addition, the tables below are the representation of the gathered data.

i. Demographic

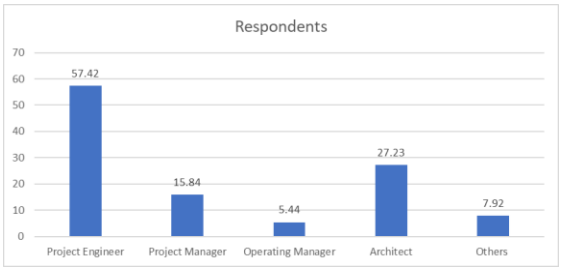

Figure 3.1. The Percentage of the Respondents Who Responded in the Survey

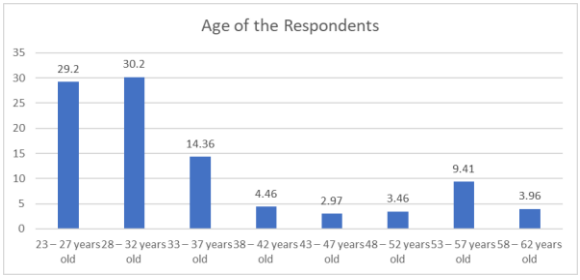

Figure 3.2. The Percentage of the Respondents' Age Who Responded in the Survey

Figure 3.3. The Percentage of the Respondents' Based on Years of Professional Experience

Figure 3.4. *The Percentage of the Respondents' Based on their Monthly Income*

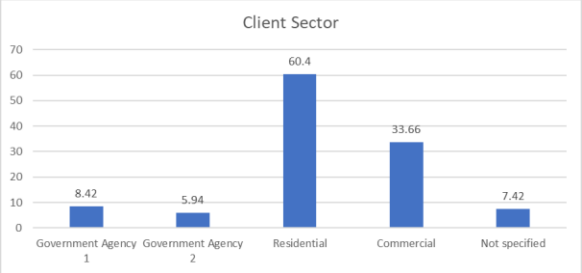

Figure 3.5. The Percentage of Type of Construction Projects of the Respondents

The charts above show the general information of the respondents. Majority of respondents are project engineer aging from 23-27 and 28-32 years old with a percentage of twenty-nine-point two percent (29.2%) and thirty point twenty percent (30.20%), respectively. Moreover, most of them are working in the span of 2-5 years in the field. In which the common monthly income of the respondents is Php. 40,001.00 and above. Then, most of the ongoing projects that they are encountered is residential with a percentage of sixty-point forty percent (60.40%).

ii. Frequency Index, Severity Index, and Important Index

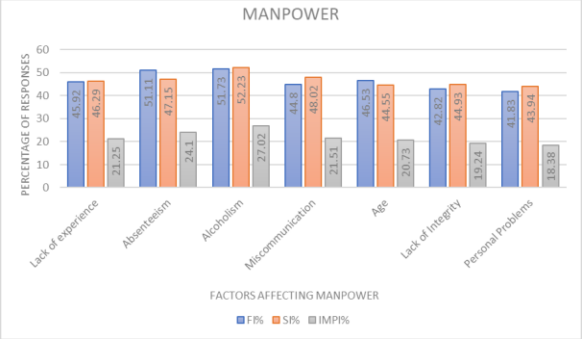

Figure 3.6. Results of Manpower based on FI, SI, IMPI

Alcoholism has the highest percentage which has a 27.02% importance index value under the man-power factor. Alcoholism is rank third among eight factors under the man-power group (Gundecha, M.M. 2012). According to the Alcohol Rehab Guide Organization, when a worker is struggling with alcohol use, it not only affects the individual, but also those around them supervisors, coworkers, and project team members. An employee's drinking habits can affect companies, regardless of how large or small the organization may be. Those who live with an alcoholic are more at risk of suffering from workplace problems. Drinking alcoholic beverages may not only increase the possibility of employees getting injured, but it can also lead to more on-the-job accidents. Additionally, alcohol can cause a lack of concentration and coordination in an employee's work performance. This reduces productivity, which in turn impacts business goals and objectives.

Personal Problems has a lowest percentage under the man-power group which has an 18.38% of importance index. In the study of Gundecha, M.M. 2012) personal problems also got the lowest percentage under man-power group. This result needs to be justified because personal problems cause mental disturbance for laborers, and thus can affect labor safety.

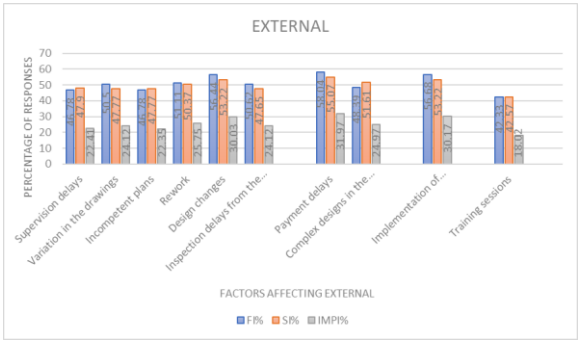

Figure 3.7. Results of External based on FI, SI, IMP

Under the external factor, payment delays got the highest percentage. It occurs in the study of UKDiss (2021). "Sufficient salary" has the highest mean value among other factors, which means most laborers agreed that without sufficient salary, they do not feel encouraged to work properly. Because all the laborers live below the poverty line, and this is their only source of income to meet their basic needs. In addition, it was shown in the previous study entitled "Factor Affecting Labour Productivity In Construction Projects", implementing government laws was ranked 3rd in the external group. For most projects, government authorities refer to specific versions and construction standards of their design. Sometimes, government authorities, who have documented standards for design and construction, may decide to revise those standards after the job was awarded based on a previous version, thus affecting the overall labor

productivity of the building construction (Mandloi, 2022).

Training sessions are the least factors that occur. In the study of Mandloi (2022) training sessions ranked seventh (third to the last) in the external group, stated that persons entering the construction industry directly from high school usually start as inexperienced in construction industry or as laborers. They can learn from their job quickly by collaborating closely with experienced people. Whereas, skilled laborers, such as carpenters, bricklayers, plumbers, and other construction trade specialists, most often get their formal instruction by attending a local technical school or through an employer provided training program.

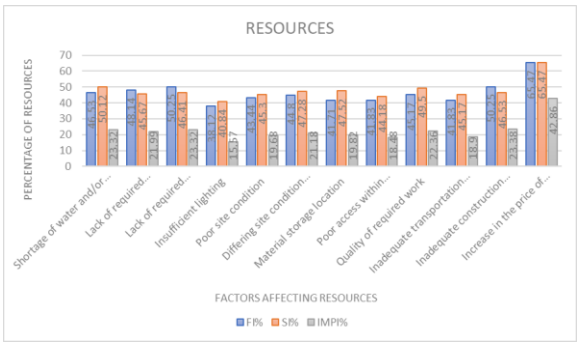

Figure 3.8. Results of Resources based on FI, SI, IMPI

Increase in the price of materials ranked first based on their value in the important index, where in it garner 42.86%. Also, it was shown to the prevision study of Susmitha, Raja & Asadi 2018, escalation of material prices is the most major factor based on important index due to the inflation that happened around the world (Business World, 2023). Furthermore, the continuing inflation in the country affects cost of living that radiates in the construction fields, where the cost of materials are inconsistently high and can lead delay of work, this shows that when the units are fixed the duration of works can be increase nor decrease depending on the work load, but when the work is fixed and the units or the materials are decreasing or insufficient the duration of work increases and when the duration of work is fixed the materials are decreasing the work is also increasing (Clarizanablement, 2021). In contrast, the least factor that accumulates lowest IMPI is insufficient lighting with a value of 15.57%. It means that the construction companies in CSFP that have construction projects have not experienced the effects of insufficient lighting in the workplace. However, according to Waris M. 2017, inadequate lighting can cause various accidents. Moreover, it is important to consider the surroundings of the field to secure the safety of workers, and to not lower the progress of the production.

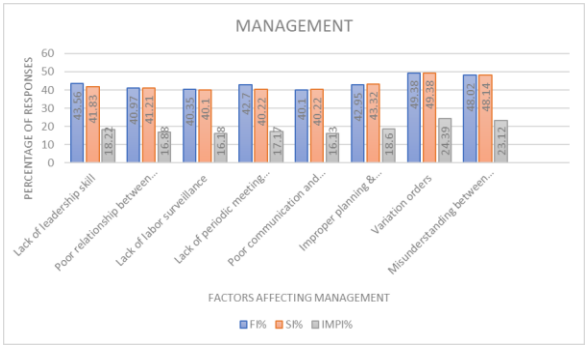

Figure 3.9. Results of Management based on FI, SI, IMPI

In this management factor there are seven (7) factors that affect labor productivity on construction projects. Moreover, variation order ranked first (1st) in the management group, in it has 24.39% IMPI. In relation to this, according to the study of Quezon and Ibanez 2021, the variation order rank 6th on under the management factor which has 71%. According to the Mashwama et., al 2022, variation order was inevitable in construction projects, it affects the productivity and the project cost. Also, the more variation order has in construction projects, the more it affects the labor productivity, and it cause delay in the work. In addition, variations orders continue to pose a serious threat to the construction industry, since they contribute to time and cost overruns, therefore, affecting the contract price of the project.

On the other hand, poor communication and coordination got the lowest IMPI with a value of 16.13%. But, based on the previous study of Quezon and Ibanez 2021, poor communication and coordination ranked third (3rd). The effects of it are cost overrun, high accident rate, and wrong execution of activities, and rework and design occurrence (Sofolohan et., al 2021).

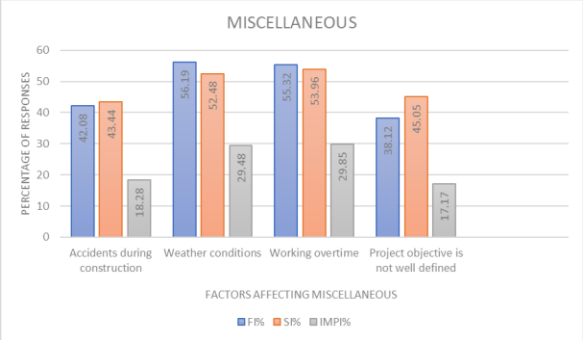

Figure 3.10. Results of Miscellaneous based on FI, SI, IMPI

As seen with this, Working Overtime ranked first with a percentage of 29.85% in Important Index under Miscellaneous factor. In the study of (Rabenu, 2022) It also demonstrates that working overtime or working overtime for a longer period reduces productivity as the number of hours worked per week rises. Additionally, people who work longer shifts each day have less chances for recovery, and overworked workers are more likely to experience burnout.

The factor who gained the second highest percentage under Miscellaneous factors is the Weather Conditions. In line with this, there are results from other research studies that showed results that weather conditions really can affect labor productivity. It states here that for every 1°C increase in temperature, the percentage of real working hours decreases by an average of 0.57 percent. Reduced worker irritation, anxiety, and nerve and muscle excitability could lead to more accidents and lower labor productivity (Li et al., 2009). An example of this decrease in labor productivity is when the absence of sunlight and the darker surroundings tell the brain to unwind and rest. Employees could get tired more quickly and become more easily distracted. However, because there are fewer outside distractions in cloudy conditions, most people might be able to concentrate better.

The factor which has the least percentage under Miscellaneous factors is the “project objectives is not well defined” with a total percentage of 17.17% only. It is inevitable that it comes to the mind of the proponents and respondents why is the project objective is not well defined ranked at the bottom. A study from (Poso, 2007) The civil engineers assessed their own level of competence as moderate, with managerial skills coming in first. Although Civil Engineers here in the Philippines have a moderate level of confidence, its managerial skills ranked in First. It shows here that Filipino engineers are good in managing their workers that leads to not leaving the workers with not well-defined project objectives. It helps to enlighten the proponents and the respondents because the project objective is not well-defined rank at the bottom.

Table 3.1. Ranked Tally Results on Factors Affecting Labor Productivity on Construction Projects

Rank	Factors	IMPI%
1	Increase in the price of material	42.86
2	Payment delays	31.97
3	Implementation of government laws	30.17
4	Design changes	30.03
5	Working overtime	29.85
6	Weather conditions	29.48
7	Alcoholism	27.02
8	Rework	25.75
9	Complex designs in the provided drawings	24.97
10	Variation orders	24.39
11	Variation in the drawings	24.12
11	Inspection delays from the authorities	24.12
13	Absenteeism	24.1
14	Inadequate construction material	23.38
15	Lack of required construction tools/equipment	23.32
15	Shortage of water and/or power supply	23.32
17	Misunderstanding between the agency & contractor	23.12
18	Supervision delays	22.41
19	Quality of required work	22.36
20	Incompetent plans	22.35
21	Lack of required construction material	21.99
22	Miscommunication	21.51
23	Lack of experience	21.25
24	Differing site condition from plan	21.18
25	Violation of safety laws	21.08

26	Age	20.73
27	Material storage location	19.82
28	Poor site condition	19.68
29	Lack of Integrity	19.24
30	Inadequate transportation facilities for workers	18.9
31	Improper planning & scheduling of work	18.6
32	Poor access within construction site	18.48
33	Personal Problems	18.38
34	Accidents during construction	18.28
35	Lack of leadership skill	18.22
36	Training sessions	18.02
37	Lack of periodic meeting with laborers	17.17
37	Project objective is not well defined	17.17
39	Poor relationship between labor supervisor	16.88
40	Lack of labor surveillance	16.18
41	Poor communication and coordination	16.13
42	Insufficient lighting	15.57

After gathering data and tallying all the results from all the factors that affects the labor productivity on constructions projects, The proponents have produced these following results. With the forty-two (42) ranked factors, the proponents of the study thereof conclude the following tally results in which the number one factor is Increase in the price of material having forty-two-point eighty-six percent (42.86%), followed by the payment delays having thirty-one-point ninety-seven percent (31.97%) and the third one is the Implementation of government laws having thirty-point-seventeen percent (30.17%).

Increase in the price of material has a significant impact in labor productivity because it affects the entire construction projects. According to the blog posted by the Surety Place which is the "Rise in Material Costs and How they are Affecting the Construction Industry" stated that according to the Minneapolis fed poll for rising building material costs are affecting project demands and earning in the construction sector. In addition to this by the Pinoy Builder site, posted blog entitled "Higher Material Prices: How Does it Affect the Construction Cost Budget?" claimed that the continuous rising of material cost leads to shutdown of constructions, and postponed or canceled of construction projects (Bueno, Feliz Grace, 2022).

Payment delays ranked second (2nd) in all factors which means that it has a role in the construction projects, however, companies need to consider this factor. In previous study of Gunduz et., al 2022 it shown that payment delays come in second place among the top 10 factors. Overdue payment influences every aspect of a building project and causes workflow disruption. For instance, employees' productivity will decrease if their salaries will not be on time and that might result in inefficient work.

The third (3rd) rank in major factor that affects labor productivity on construction projects in the City of San Fernando, Pampanga is implementation of government laws. Government laws are especially important in doing construction projects, it makes the building safe after considering the building standards. However, according to the responses of the respondents in the CSFP, implementation of government laws has a huge contribution in affecting the labor productivity on construction projects.

Furthermore, for the minor factors that can also affect the labor productivity where also tabulated and ranked in the last three in the list, for the third one Lack labor surveillance with sixteen-point-eighteen percent (16.18%), second is Poor communication and coordination having sixteen-point-thirteen percent (16.13%) and lastly, we have the lowest percentage having only fifteen-point-fifty-seven (15.75%) in the importance index.

Lack of surveillance ranked forty (40) among all factors in which it classified as one of the minor factors that affects labor productivity on construction projects. This result implies that most assigned licensed engineers on the field in CSFP are on hands in checking the works of the laborers in the site. According to the Indeed Career Guide (2023), project monitoring is important because they can be able to know what the construction project progresses if it is progressing on time or if there is a delay in the work,

for them to mitigate the problem that occur in the construction site. Also, it is important to monitor the materials in the field because this is the fundamental in doing construction.

Lastly, poor communication and coordination, and insufficient lighting ranked forty-one (41) and forty-two, respectively. These two factors are minor factors that affect labor productivity. It simply says that they are mostly not affecting the labor productivity in CSFP. According to Gerardi 2022, the key to construction project success is cultivating the best communication techniques. The communication process affects every stage of building. When not done correctly, it has financial, safety, and reputational consequences. A positive culture in a project can thrive by creating appropriate channels and simplifying communication techniques. Proper communication fosters trust, which is a critical component for achieving the best possible project outcomes. While insufficient lighting accumulates the least IMPI, it is important to consider the surroundings in the workplace to avoid the hazard that may occur in the site (Wariz M. 2017).

Based on the results of this study, the proponents create a framework of recommendations to provide solutions on the most factor that affects the labor productivity on construction projects in CSFP.

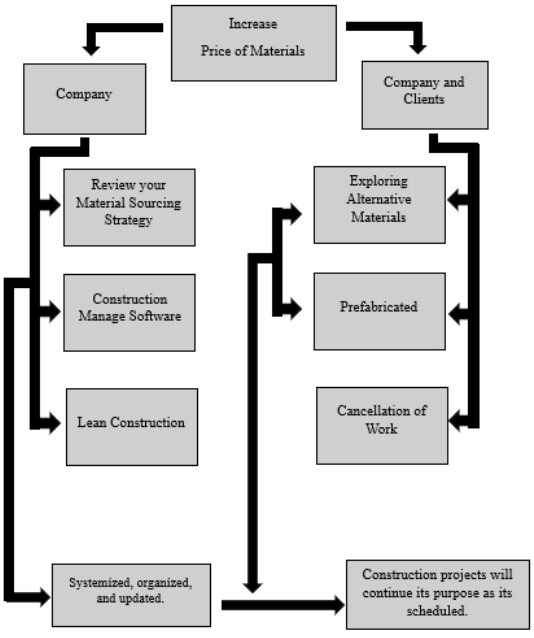

Figure 3.11. Framework of Recommendation

Company Options

Option 1. Review your Material Sourcing Strategy

Different projects need varied materials; however, these materials can be difficult to find nor to produce that could lead to higher prices of each production. Option one could be a great start for a new strategy, it is by finding new materials into different countries. Moreover, locating where the material originated can be a factor for more durability and lower costs. In line with this negotiation will start to lower the price of certain materials. (Jas Nijjar, 2021)

Table 3.2. Pros and Cons in the Option One (1) under Company

PROS	CONS
Lower Prices - Prices may vary on the negotiated terms or contracts. More Option - Finding materials from different countries will give you different options on certain materials.	Delay in Delivery - One of the problems can be Delay of Delivery depending on the material itself or the country it came from.

Option 2. Construction Manage Software

It is a platform technology created to perform for businesses and this platform helps you with the flow of your work. This Construction Manage Software is a strategy to put you in rapport of work, which could play a vital role for your supply and logistic. (archdesk.com)

Table 3.3. Pros and Cons in the Option Two (2) under Company

PROS	CONS
Organize - By purchasing the software it will help you organize your workflow, by end-to-end process. Less Hassle - In locating your work details, Software will help you with everything such as review your data,	Costly - By having Construction Management Software will have you to pay ranging from 10,000php to 50,000php depending on the number users.

understanding your problems and diving your workloads. Reduce Work Duration - With the help of software, the workload can be done more easily resulting in faster and efficient works.	

Option 3. Lean Construction

Refers to the combination of practical development and research to adopt principles in the construction process. Moreover, also refers to managing and improving the processes involved in construction by maximizing the value at minimal costs and considering the customer needs. It helps attain the sustainability objectives of a project. (Gerardi, Jeff, 2021).

Table 3.4. Pros and Cons in the Option Three (3) under Company

PROS	CONS
Systemize work - Using Lean Construction means following certain principles such as value, value stream, flow, pull, continuous improvement.	

Company and Client Options

Option 1. Exploring Alternative Materials

According to Halik and McCarron 2021, extending the material option into newly developed materials for every component of building, from the foundation to the multiple systems and interior building materials, can aid in cost control of the project.

Table 3.5 Pros and Cons in the Option One (1) under Company and Clients

PROS	CONS
Cost of Materials – compared to the traditional building materials, alternative materials cheaper. Eco-Friendly – this materials goal is mostly to reduce waste and go for green. This method gained popularity nowadays due to the low impact to the nature.	New to market Difficult to install- selected laborers can use this method, it is difficult to ensure that the structure can last safely and efficiently. Building Code - most of the larger countries are not accepting this method. It takes more work to get the plan approve.

Option 2. Prefabricated

Prefabricated materials enable the company to lessen the work duration. Using prefabricated components in construction projects, there will be little to zero waste (Nijjar, 2021).

Table 3.6. Pros and Cons in the Option Two (2) under Company and Clients

PROS	CONS
Reduce labor cost- adopting prefabricated materials does not require more manpower. It will lessen the need of more laborer as it is easy to assemble and use. No to waste- as stated on the research paper of Najjar 2021, prefabricated has little to zero waste due to material is already assembled and doesn't require proper performance. Mitigate cost of material	Difficult to transport- most of the materials are already assembled it is more difficult to transfer it from one point to another. New to market- doesn't have the client trust, some of the company doesn't accept this kind of method.

Option 3. Cancellation of Work

More clients will be inclined to postpone or cancel the project construction due to higher price of materials (Bueno, Feliz Grace 2022). "Projects are being canceled as owners hope to 'wait it out,'" Tran, 2021.

IV. SUMMARY, CONCLUSION, AND RECOMMENDATION

4.1 Summary and Conclusion

In brief, all the tallied results were considered as factors that affect the effectiveness of labor

productivity in the construction field, bordering the City of San Fernando, Pampanga. As a result, the proponents of the study conclude the increase in the price of materials is the number one factor that can affect the labor productivity in CSFP. Moreover, this factor can be seen in different RRLs. In the similar study of Gundencha Mahesh was conclude that "Lack of required construction materials" is the number one factor that affects productivity, while in the related study of A. R. S. Sri Susmitha, K. Hemantha Raja and SS. Asad states that "Escalation of materials price" is the top factor that affect productivity. However, in other similar studies used in this paper has different results which were; "Lack of skill and experience" by Gopal et al., in 2016, "sufficient salary," by UKDiss in 2021, "Frequent changes in the design" by Dr. Jayeshkumar Pitroda in 2018. Whereas the similar study from the Philippines also has different results such as "Productivity of workers, ranging from 20 – 39 years of age." By Banez in 2019, "No health worker in the project site" by Quezon in 2021 and "Laborers experience and skill" by Dy in 2021.

In the summary of this papers and the proponents of the study thereof conclude all the gathered data from the City of San Fernando, Pampanga using quantitative study claimed the ranks of those forty-two (42) factors are affecting the laborer's productivity in construction projects in the said city. Furthermore, the top factor garnering forty-two-point eighty-six percent (42.86%) under the Resources Factors, which is the "Increase in the price of materials" affects the productivity in CSFP. In addition to this, the proponents of the study organize a framework of recommendations and/or options of intervention for the company and company-client against the fluctuation of material costs. Furthermore, this framework of recommendation can help companies to be systemized, organized, and updated within its internal factors onto the external factors such as market price increase. While in the company-client framework will give them options to consider in dealing with such a market price increase.

4.2 Recommendation

In line with this paper, the proponents of the study therefore conclude these following recommendations as this research paper can be expound into more usable and suitable for larger scale such as its scope and limitation.

1. Use mixed method (Quantitative and Qualitative Methods).
2. Expound your borderline.
3. Consider more factors on labor productivity such as delivery of materials.
4. Analyze the impact of the increase in the price of materials.
5. Consider or identify if the construction companies are PCAB accredited.

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