

A Study of Factors affecting the Labour Productivity of construction projects In Sarawak

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Abstract: The problems of affecting the Labour productivity of construction industry in Sarawak has been an issue of concern to most G7 contractors and professionals. This paper attempts to establish the significant factors that affecting the Labour productivity by conducting a survey method that relates to construction problems which encountered on sites. Sibu consists of twenty-five (25) problems while Kuching consists of seventy-nine (79) problems that could affect construction Labour productivity were identified and proposed a suitable framework to improve the Labour productivity of construction projects in future Sarawak. A qualitative survey was conducted using questionnaires. Twenty-five (25) questionnaires in Sibu were disturbed out of which 25 were returned (100%) while One hundred and ninety-six (196) questionnaires in Kuching were disturbed out of which 79 were returned (40%). The problems were ranked in their answers in term of ‘lowest effect’, ‘low effect’, ‘average effect’, ‘high effect’ and ‘highest effect’. The analysis of the survey was performed using the importance index, standard deviation, ranking, hypothesis test- one sample mean and two sample mean. This study can be seen as a more detailed study to be carrying by future research on the issue of Labour productivity affecting of construction projects among G7 contractors in Sarawak.

Keywords: G7 contractors, Labour productivity.

1 INTRODUCTION

Time passed by and the problem of the Labour productivity become more globalize in construction industry. Productivity is one of the key components of every company's success and competitiveness in the market (Mojahed, 2005). There are various type of factors affecting the Labour productivity in construction site.

Zimbabwe is one of the countries under Southern Affrica. According to Zimstat (2014), the Zimbabwean construction industry's contribution to Gross Domestic Product (GDP) during the last quarter of 2013 stood at 3.59%. The problem due to lack of education and training for workers in Zimbabwe (Chigara and Moyo, 2014). The management training does not have experience to guide the workers during construction stage.

Gaze Strip is one of the countries under Middle Eastern Africa. The problem of Labour productivity in Gaza Strip has a serious issue that concern the most in leadership group (Enshassi, Mohamed, Mustafa and Mayer). Lack of Labour surveillance is caused

by misunderstanding between Labour and superintendents which has a high effect on Labour productivity. The Labour does not follow the instruction while working.

In Sarawak, the construction industry was facing the problems of slow payment of completed work in construction projects (Rolland Duat, 2014). Alaghbari et al., 2005 stated that the construction delayed which lead to the major problems were, costly, complex and risky problems has usually encountered in every construction project. Thus, some of the Labour become unproductive because salary until they bring bad attitudes to work.

Spain is one of the Europe's countries. According to Robles et al. (2014), the Spain construction industry's faced the factors of clarity of the drawings and project documents in the project category. Lack of clarity, incomplete drawings or technical problems were recognized among the factors affecting construction productivity. The Labour cannot start the works if the tender drawings are incomplete.

Nigeria is one of the countries that groups under West Africa The main issues that contribute to Labour productivity in the construction industry is the involvement of non-professionals (Olomolaiye et al., 1998). The building contracts are awarded to non-professional who turnover the agreement to professional at a lower price.

Hafez et al. (2014) stated that the Labour productivity is one of the important factors that can affect the physical progress of the construction project in Egypt, Northeast Africa. Normally, the clarity of technical specification are based with Labour in construction project. The clarity of technical specification related factor of incomplete drawings and alteration of drawings during construction. Labour rework is considered a critical factor on Labour productivity (Chigara and Moyo, 2014).

On the other hand, the India in construction industry was facing the problems of unavailability of material on time at workplace in construction industry (Thomas and Sudhakumar, 2014). The supplier Labour delay in material delivery to site are caused by untimely delivery to site due to traffic flow.

Moreover, Trinidad and Tobago are the countries that groups under South American. Hickson and Ellis (2013) said that the construction Labour productivity is also one of the important issues in Trinidad and Tobago. Poor of Labour supervision will lead to poor Labour performance on the completion time and scope of work of the construction project.

Thailand is the country that groups under Southeast Asia. Pornteokasemsant and Charoenpornpattana (2014) said that the construction Labour productivity play an important key role in Thailand. Thailand has faced the problem in reducing the Labour productivity due to inspection delay. The inspection delay may job progress and acute for jobs on the critical path. Delays and cost overruns will lead to the low Labour productivity.

2 LITERATURE REVIEW

Labour is a main key resource on building projects. In fact, the improving productivity is a major concern of any profit-oriented organization, on behalf of the effective and efficient resources into products in the market and identify business profitability (Robles et al, 2014). The productivity can be defined as a cause of competitive advantages. There are two type of measures productivity they are commonly used in construction industry (Jarkas and Bitar, 2012).

2.1 Measures of Labour Productivity

Firstly, type of measure of productivity is the total factor productivity (TFP). Consequently, the productivity is commonly referred to as the ratio of output to input (Thomas and Sudhakumar, 2014). The first measure of productivity ratio is to measures an industry, organization and country input resources such as Labour, materials, machines, manpower and capital to produces good and services (Sumanth, 1984). TFP is represented as shown in Equation 1:

$$TFP = \frac{\text{Total output}}{\Sigma(\text{labour} + \text{materials} + \text{equipment} + \text{energy} + \text{capital})} \quad \text{Eq. 1}$$

The second measure of productivity is the partial factor productivity (PFP). Then, the Labour productivity can be used as a measure method of the industry productivity. The PFP measure of productivity can be defined as the ratio of output to Labour input. The output is measured as quantity installation while the Labour input is measured as Labour-hour. Hence, Labour productivity is represented as below in Equation 2:

$$\text{Labour productivity} = \frac{\text{Output quantity}}{\text{Labour hours}} \quad \text{Eq. 2}$$

2.2 Factors affecting Labour Productivity

From the previous study and research, the number of factors affecting the Labour productivity, there are still anonymous factors need to be further studied even in developed countries (Makulsawatudom and Emsley 2002). In this research, the study identified various factors influencing Labour productivity and grouped them according to their characteristics such as design, material tools and equipment, Labour, working time, project factor, quality, organization and external factor.

The Labour productivity factors affecting low productivity can be classified as Project-related factors, Human-related factors, materials and tools-related factors, management and organization-related factors, and Environment-related factors (Robles et al., 2014). Project-related factors, essentially, are characteristic of the construction industry, such as unclear

of the drawings and project documents, large project scale, changing of schedule, low impact site preparation and changing of schedule. Human-related factors refer to Labourers which involving the factors affecting the construction industry. Materials and tools-related factors usually refer to a lack of materials and equipment. Management and organization-related factors refer to a lack of management for techniques of the Labours. Environment-related factors refer to site of condition.

3 RESEARCH METHOD

3.1 Research Design

The research method employed was mainly quantitative method and qualitative method. The project will adopt a quantitative method through send questionnaire via email. The accuracy of the result will be affected by the number of respondents' feedback. While qualitative method is used to generate non-numerical data collection techniques and data analysis, such as investigation, interview organization theory studies, observation, conversation analysis, ethnographic research. However, the research is a cross-sectional study and used to survey method. It takes shorter time to carry out the research compare to longitudinal study. Research method can be known as research strategy. Strategy is a plan to achieve the goals in order to helps us to answer the research questions to meet research aim and objectives. In this research, it is used to collect data mainly about the factor affecting the Labour productivity and ranking of factors in Sarawak. The data are collected from the Grade 7 Company in Sarawak using online survey to ease of comparison for the success criteria. Through this survey method can allows me to control over the research process especially the range for the success criteria.

3.2 Sampling Frame

According to the official website of Construction Industry Development Board (CIDB), there are 424 Contractor Grade 7 Company in Sarawak. All Grade 7 Company in Sarawak. All Grade 7 Contractor Company must be register with CIDB so that they are legally established. The sampling frame for this research is the Grade 7 Contractors Company in Sibü and Kuching only. Out of 556, there are currently 24 number of Grade 7 Contractors Company in Sibü while 401 number of Grade 7 Contractors Company in Kuching. In order, to compare the factor affecting the Labour productivity between this two state. Moreover, the number of registered Grade 7 Contractors Company in Kuching is the largest compare to Sibü. The objective of this survey is to ranking the factor affecting Labour productivity to Sarawak G7 contractors.

3.3 Sampling Method

Both sampling method used for Sibü (target responses 1) and Kuching (target responses 2) are stratified sampling. Moreover, it is one of the probability sampling method. When this method is applied, stratified sample is distributed to all G7 Contractor Company in Sarawak. Different category of factors may give different rate for the definition of experience of company.

3.4 Sampling Size

The minimum sample size needs to be determined in order to achieve 95% confidence level and less than 5% margin of error for the results. Confidence level refers to the proportion of all possible samples, including the true population parameter can be. The higher percentage of confidence level gives more accuracy to the results of research. Margin of error is the tolerance of error in the research. Lower percentage of margin of error will give higher accuracy to the research. The minimum sample size is also verified using survey software, which is SurveyMonkey sample size calculator. The results obtained using the software is 23 and 196 respondents. Thus, sample size of 23 respondents is used in Sibul rather than 25 respondents. If the respondent more than one, it may not bring any disadvantages to the research. The lower number of respondent may reduce the confidence level of the data. While, the sample size of 401 respondents is used in Kuching rather than 400 respondents. Hence, the sample size of obtained from the questionnaires will be calculated to achieve 95% of confidence level. The random number generator (RNG) has been used to generate random numbers for the research. The purpose is to create a list of random numbers according to research specification. However, it is to generate the randomly select the representatives which participate in questionnaire survey. There are 24 out of 24 numbers of G7 contractors in Sibul while 196 out of 401 numbers of G7 contractors in Kuching have been chosen as the factor affecting the Labour productivity.

3.5 Design of Questionnaire

The research methodology was based on a literature review in order to analyze existing scientific articles regarding factors affecting Labour productivity of construction in Sarawak. Total of 26 factors were identified through previous research together with input, revision and modifications by local experts. The main instrument of collecting data from Grade 7 contractors companies was a structured questionnaire survey. All the questionnaires are sent through internet. Participants were required to rate the statements as to their effect on Labour productivity of construction in Sarawak taking into account time, cost and quality of Labours work based on their own experience on construction sites. For this research, the five-point Likert scale ranging from “1” lowest effect to “5” highest effect from respondents which used to assess the individual’s performance or opinion of the given question. In this study, respondents were required to rate the factors affecting Labour productivity on a scale from “1,” lowest effect, “2” low effect, “3,” average effect; “4,” High effect to “5,” highest effect..

3.6 Data Collection

Choose an online questionnaire data collection tool. In this research, self-administered questionnaire was chosen because it can reach a large number of potential respondents in a variety of locations, especially using the mail or online questionnaires responses. The aim of pilot test is to minimizing inevitable problems of converting the design of the questionnaire into reality. The survey was piloted on a small scale in order to ensure the questionnaire’s readability, accuracy, and comprehensiveness to the participants. Consequently, the effectiveness of the initial pilot study will be validated through this process with suggestions from experts before launching the survey. The feedback of the pilot study should assist to complete the questionnaire as the main research and preparation. The questions will be in the center of the target problem.

3.7 Data Analysis

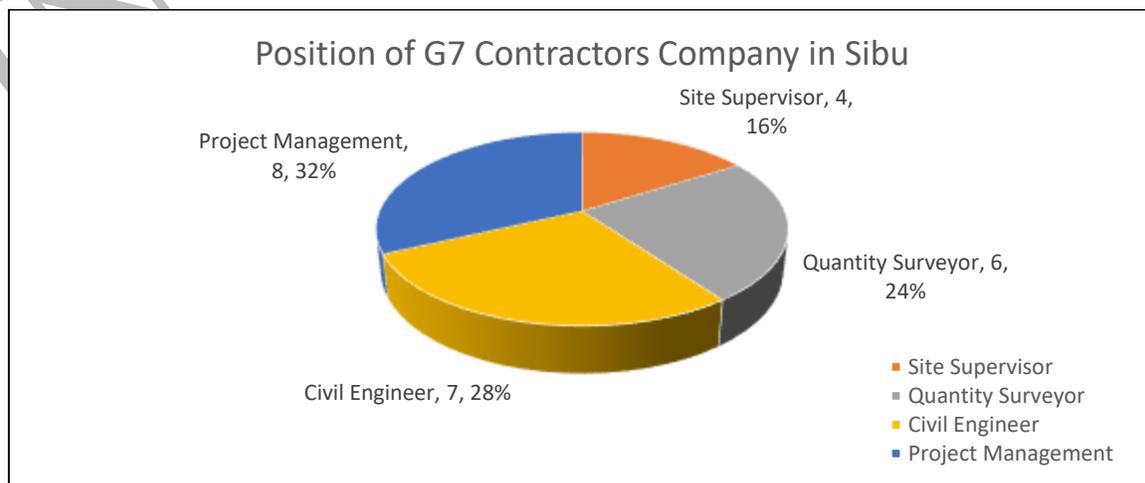
The analysis of the questionnaire is to ensure the ranking factor affecting Labour productivity in construction industry and the respondent's opinion in relation to factors that happened on site. The respondents consisted of professional contractor from Contractor Company only. Besides that, by rating the lowest effect and highest effect from respondents to each question within the questionnaire. It can be done by counting the number of the respondents who answered the lowest effect and the highest effect. The data analysis also uses statistical software such as Microsoft Excel, statdisk and SPSS tool. Another way to analyze the data is by ranking the factors affecting Labour productivity in Sarawak construction industry. The data analysis is conducted by using the method such as Descriptive Data Analysis, t-test to determine between one sample means and t-test to determine between two independent sample means.

4 RESEULTS ANALYSIS AND DISCUSSIONS

4.1 Respondents' Demographics

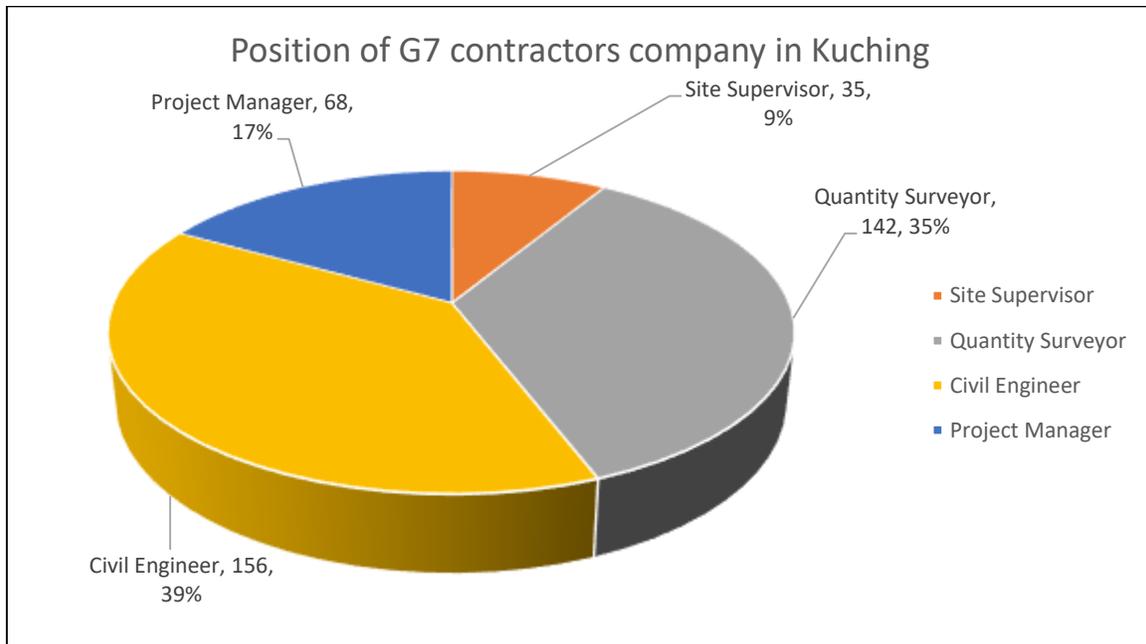
Out of 25 and 79 respondents from Sibul and Kuching, all of the respondents are participated and submitted their responses for the online survey. Basically, 26 factors negatively affecting Labour productivity of construction projects in Sarawak have been identified and ranked according to their importance. The respondents who are under Construction Industry Development Board (CIDB) which is G7 contractors from Sibul and Kuching.

Figure 1. The position of G7 Contractors Company in Sibul



The results show the percentage for respondents from Project Management is the highest compare to other respondents, which is 32%. Through this research, all the respondents participate in online survey due to size of population. This mean the feedback obtained from G7 Contractors Company has higher accuracy to determine the factors affecting Labour productivity in Sibul compare to other position. Then, the second high percentage is the Civil Engineer (28%), followed by the Quantity Surveyor (24%). Lastly, the Site Supervisor have the lowest percentage of response, which is 16%.

Figure 2. The position of G7 Contractors Company in Kuching



The results show that the percentage for respondents from Civil Engineer is the highest compare to other respondents, which is 38.90%. Out of 401 number of respondents, there are 79 number of respondents participate in the online survey. The size of population may affect the factors affecting Labour productivity of construction projects in Kuching. This means the feedback obtained from Project Manager has higher accuracy result to represent the Project Manager in Kuching compare to other respondents.

4.2 Factors Affecting Labour Productivity

There are 26 factors into 6 groups of the factors affecting Labour productivity in Sarawak Construction Industry. To finding regarding to the ranking and average mean were analyzed. The ranks were allocated from highest affecting Labour productivity to lowest.

Table 1. Category of Factors Affecting Labour Productivity in Sib

Factors affecting Labour Productivity	Average of mean	Rank	Remark*
Pre-Construction Activities	3.98	1	Imp.
Management & organization Category	3.71	2	Imp.
Project Category	3.73	3	Imp.

Materials and tools Category	3.71	4	Imp
Human Category	3.66	5	Imp.
Environment Category	3.56	6	Imp.

Table 1 shows the finding of the present study in Sibul, “pre-construction activities” was ranked as highest among the group of factors Labour productivity with mean of 3.98. The “management and organization category” was ranked as second highest factors with mean of 3.93 which remarks as important factors. Then, the followed by “project category” was ranked as third highest factors with mean of 3.73. Besides that, the “materials and tools category” and “human category” were ranked as important with the mean of 3.71 and 3.65 respectively. Lastly, the “environment category” was ranked the lowest factors with mean of 3.56.

Table 2. Category of Factors Affecting Labour Productivity in Kuching

Factors affecting Labour productivity	Average mean	Rank	Remark
Management & organization Activities	4.03	1	Imp.
Pre-construction activities Category	4.01	2	Imp.
Materials & tools Category	3.75	3	Imp.
Human Category	3.65	4	Imp.
Environment Category	3.49	5	Moderately Imp.
Project Category	3.44	6	Moderately Imp.

Table 2 will show the ranks of group of factors affecting Labour productivity in Kuching. The ranking among the group of factors Labour productivity between Sibul and Kuching are totally different. The ranks were allocated from the highest to the lowest affecting

Labour productivity of construction projects. From the Table 4.3.2 will show that the “management and organization category” was ranked as highest among the group of factors Labour productivity with the mean of 4.03. The “pre-construction activities” and “materials and tools category” were ranked as important factors with mean of 4.01 and 3.75. The following ranks was the “human category” was ranked with the mean of 3.65. Thus, the “environment category” and “project category” were as moderate important factors affecting Labour productivity of construction projects with the mean of 3.49 and 3.44.

Pre-construction Activities Related Factors

“Pre-construction activities” was ranked at first highest with the mean of 3.98 and 4.01 as important in the overall groups of factors affecting Labour productivity in Sibul and Kuching construction industry.

Table 3. Rank of Pre-construction Activities in Sibul

OVER ALL RII AND RANKING OF FACTORS IN THE PRE-CONSTRUCTION ACTIVITIES			
Rank	Code	Factor	Overall RII (%)
1	A1	Inefficiency project planning & inaccurate design	80.00%
2	A2	Poor selection of type and method of construction	79.20%

Table 4. Rank of Pre-construction Activities in Kuching

OVER ALL RII AND RANKING OF FACTORS IN THE PRE-CONSTRUCTION ACTIVITIES			
Rank	Code	Factor	Overall RII (%)
1	A2	Poor selection of type and method of construction	81.01%
2	A1	Inefficiency project planning & inaccurate design	77.22%

Based on Table 3 ranked with a RII of 80.00%, A1 was ranked at first highest in the pre-construction activities in Sibul. While, Table 4 shows ranked with a RII of 81.01%, A2 was ranked at first highest in the pre-construction activities in Kuching. Different factors in different states which rated by the respondents in G7 Contractors Company. This factor as the most important in the overall groups of factors affecting Labour productivity in Sarawak construction industry.

Project Category

“Project category” was ranked at third highest in Sibul with the mean of 3.73 while the factors of “Project category” was ranked with the mean of 3.44 in Kuching.

Table 5. Rank of Project Category in Sibul

OVERALL RII AND RANKING OF FACTORS IN THE PROJECT CATEGORY

Rank	Code	Factor	Overall RII (%)
1	B4	Alteration of design during project execution	78.40%
2	B1	Unclear of the design drawing & project document	76.80%
3	B3	Changing of schedule	75.20%
4	B5	Low impact site preparation	74.40%
6	B2	Large project scale	68.00%

Table 6. Rank of Project Category in Kuching

OVERALL RII AND RANKING OF FACTORS IN THE PROJECT CATEGORY

Rank	Code	Factor	Overall RII (%)
1	B3	Changing of schedule	75.19%
2	B5	Low impact site preparation	73.16%
3	B1	Unclear of the design drawing & project document	72.91%
4	B4	Alteration of design during project execution	69.87%
6	B2	Large project scale	63.80%

Based on Table 5 and Table 6, the rank of B4 in Sibul is highest position than Kuching with a relative with a relative index of 78.40% and 69.87% which rated by most of the respondents in Sibul. The rank of B4 in Sibul is highest position than Kuching with a relative with a relative index of 78.40% and 69.87% which rated by most of the respondents in Sibul. Furthermore, it were obtained a 8th and 22nd position when all 26 factors surveyed are considered. The alteration of design may affects the Labour productivity in terms of costs and schedule. Besides that, the design of the project's main source of conflict is a continuous change by owner, affect the quality and productivity, and impact the project schedule and cost (Alarcon and Mardones, 1998). Alteration of design may cause additional work and rework in construction industry. The main reason for the rework was found to change orders, design error or lack of project definition. Lack of clarity, incomplete drawings or technical understanding further major construction one of the influence factors of Labour productivity.

Human Category Related Factors

The perceived importance according to the RIIs and ranking of the 26 factors which grouped under the human category. The mean of human category in Sibul and Kuching are 3.66 and 3.65.

Table 7. Rank of Human Category in Sibul

OVER ALL RII AND RANKING OF FACTORS IN THE HUMAN CATEGORY

Rank	Code	Factor	Overall RII (%)
1	C1	Insufficient skill and experience of workers	78.40%
2	C5	Labor absenteeism	77.60%
3	C4	Working Overtime	72.00%
4	C3	Poor labor motivation	70.40%
5	C2	Inability to adapt to change and new environment	67.20%

Table 8. Rank of Human Category in Kuching

OVER ALL RII AND RANKING OF FACTORS IN THE HUMAN CATEGORY

Rank	Code	Factor	Overall RII (%)
1	C1	Insufficient skill and experience of workers	77.72%
2	C3	Poor labor motivation	75.19%
3	C4	Working Overtime	73.42%
4	C5	Labour absenteeism	70.13%
5	C2	Inability to adapt to change and new environment	69.87%

First factor classified under this category was C1, with a RIIs of 78.40% and 77.72% in Sibul and Kuching. Furthermore, among all 26 factors, they were ranked 9th and 7th, corresponding. As any work cannot be accomplished without human category, this factor has very high impact on Labour productivity in Sarawak construction industry. In this study, Sibul has lack of “insufficient skill and experience of workers” compare to Kuching. The problems is caused by inexperienced contractor hired the Labour that is lack of skill with low paid. The Labour productivity rate depends on the skill and experience of the Labour. Lack of high skilled-Labour may decrease the quality of work. Kaming et al. 1997 concluded that lack of skill and experience of workers may lead to miscommunication and unclear instruction may be conductive to the project.

Management and Organization Category Related Factor

The perceived importance according to the RIIs and ranking of the 43 factors which grouped under the management and organizational category are shown in Table 9 and Table 10. The mean of management and organization category in Sibul and Kuching are 3.93 and 4.03.

Table 9. Rank of Management and Organization Category in Sibul

OVERALL RII AND RANKING OF FACTORS IN THE MANAGEMENT & ORGANIZATION CATEGORY

Rank	Code	Factor	Overall RII (%)
1	D4	Inadequate planning	83.20%
2	D1	Lack of knowledge and experience to control the teamwork on site	82.40%
3	D3	Poor communication between main contractors & sub-contractors	81.60%
4	D2	Delays in payment to workers	79.20%
5	D5	Poor in labor performance	77.60%
6	D6	Rework	67.20%

Table 10. Rank of Management and Organization Category in Kuching

OVERALL RII AND RANKING OF FACTORS IN THE MANAGEMENT & ORGANIZATION CATEGORY

Rank	Code	Factor	Overall RII (%)
1	D3	Poor communication between main contractors & sub-contractors	86.58%
2	D1	Lack of knowledge and experience to control the teamwork on site	83.29%
3	D4	Inadequate planning	82.28%
4	D2	Delays in payment to workers	80.00%
5	D5	Poor in labor performance	76.71%
6	D6	Rework	73.42%

First factor classified under this category was D4, with a RIIs of 83.20% and 82.28% and also among all 26 factors surveyed. The factors of “adequate planning” in Sibu construction is higher compare to Kuching construction industry. Robles et al (2014) stated that the inadequate planning refers to the incompatibility and restrictions when planning or arrange activities in the future. Labour productivity is not improve in construction industry. Many tasks not completely according to the work plan, work overload, work output, the number of work hours expended. The inexperienced project manager has lack of knowledge in planning work plan through Microsoft project tools.

Materials and tools Category Related Factors

Table 11 and Table 12 shows the RIIs and ranks of the 4 factors in Sibu and Kuching are classified under the materials and tools category. The mean of Sibu and Kuching are 3.71 and 3.75.

Table 11. Rank of Materials and Tools Category in Sibu

OVERALL RII AND RANKING OF FACTORS IN THE MATERIALS AND TOOLS CATEGORY

Rank	Code	Factor	Overall RII (%)
1	E4	Low quality of materials	77.60%
2	E2	Shortage of tools or equipment	74.40%
3	E3	Lack of suitability or adequacy of plant & equipment	73.60%
4	E1	Shortage or late supply of materials	71.20%

Table 12. Rank of Materials and Tools Category in Kuching

OVERALL RII AND RANKING OF FACTORS IN THE MATERIALS AND TOOLS CATEGORY			
Rank	Code	Factor	Overall RII (%)
1	E3	Lack of suitability or adequacy of plant & equipment	77.47%
2	E1	Shortage or late supply of materials	76.96%
3	E2	Shortage of tools or equipment	75.70%
4	E4	Low quality of materials	71.39%

E4, with a RII in Sibul of 77.60% was classified first under this category while E4, with a RII in Kuching of 71.39% although 2nd and 20th among of 26 factors surveyed. As any work without the necessary materials, the factors affect the construction Labour productivity is very high. The result in this 2 state may be reasonable because it is a very proportion of materials need to provide external providers which not fulfill with their delivery agreements in terms of quality and time. In Sibul, the low quality of material increase the cost and maintenance of building construction project. Increase the price of all kinds of building materials in Sarawak also adversely affected the construction activities. The contractors purchase the building materials in low quality with economic prices.

Environment Category Related Factors

The perceived importance according to the RIIs and ranking of the 26 factors which grouped under the environment category are shown in Table 13 and Table 14. The mean of environment category in Sibul and Kuching are 3.56 and 3.49.

Table 13. Rank of Environment Category in Sibul

OVERALL RII AND RANKING OF FACTORS IN THE ENVIRONMENT CATEGORY			
Rank	Code	Factor	Overall RII (%)
1	F2	Heavy rain	84.80%
2	F4	Poor site conditions	76.00%
3	F1	Night work	64.80%
4	F3	Air humidity	59.20%

Table 14. Rank of Environment Category in Kuching

OVERALL RII AND RANKING OF FACTORS IN THE ENVIRONMENT CATEGORY			
Rank	Code	Factor	Overall RII (%)
1	F2	Heavy rain	82.03%
2	F4	Poor site conditions	76.46%
3	F1	Night work	67.59%
4	F3	Air humidity	55.19%

F2 were ranked with the highest RII within environment category. In fact, with a RIIs of 84.80% and 82.03%, it were also considered by the respondents ranked the 1st factor among all surveyed factors which influence more on construction Labour productivity. In Sarawak, it is a tropical country and has a rainy season spanning most of the year. The wet season is inevitable and can reduce the output on site. For example, the rainy season may cause the external works such as formwork, painting and plastering cannot carry out. The Labour is usually less cooperation on a rainy day and workers use occasions to be absent or leave early, although there is no direct impact conditions to their tasks. The construction work may affect the completion date which stated in the contract.

Therefore, Table 15 and Table 16 are shows the corresponding RIIs and ranks of the 26 surveyed factors in Sarawak.

Table 15. Ranking of all factors surveyed in Sibul

OVERALL RII AND RANKING ALL FACTORS SURVEYED

Rank	Code	Factor	Overall RII (%)
1	F26	Heavy Rain	84.80%
2	D16	Inadequate planning	83.20%
3	D13	Lack of knowledge and experience to control the teamwork on site	82.40%
4	D15	Poor communication between main contractors & sub-contractors	81.60%
5	A1	Inefficiency project planning & inaccurate design	80.00%
6	A2	Poor selection of type & method of construction	79.20%
7	D14	Delays in payment to workers	79.20%
8	B6	Alteration of design during project execution	78.40%
9	C8	Insufficient skill and experience of workers	78.40%
10	D17	Poor in labor performance	77.60%
11	C12	Labor absenteeism	77.60%
12	E22	Low quality of materials	77.60%
13	B3	Unclear of design drawing & project document	76.80%
14	F26	Poor site conditions	76.00%
15	B5	Changing of schedule	75.20%
16	B7	Low impact site preparation	74.40%
17	E20	Shortage of tools or equipment	74.40%
18	E21	Lack of suitability or adequacy of plant & equipment	73.60%
19	C11	Working overtime	72.00%
20	E19	Shortage or late supply of materials	71.20%
21	C10	Poor labor motivation	70.40%
22	B4	Large project scale	68.00%
23	D18	Rework	67.20%
24	C9	Inability to adapt to change and new environment	67.20%
25	F23	Night work	64.80%
26	F27	Air Humidity	59.20%

Table 16. Ranking of all factors surveyed in Kuching

OVERALL RII AND RANKING ALL FACTORS SURVEYED

Rank	Code	Factor	Overall RII (%)
1	D15	Poor communication between main contractors & sub-contractors	86.58%
2	D18	Lack of knowledge and experience to control the teamwork on site	83.29%
3	D16	Inadequate planning	82.28%
4	F24	Heavy rain	82.03%
5	A2	Poor selection of type & method of construction	81.01%
6	D14	Delays in payment to workers	80.00%
7	C8	Insufficient skill and experience of workers	77.72%
8	E21	Lack of suitability or adequacy of plant & equipment	77.47%
9	A1	Inefficiency project planning & inaccurate design	77.22%
10	E19	Shortage or late supply of materials	76.96%
11	D17	Poor in labor performance	76.71%
12	F26	Poor site conditions	76.46%
13	E20	Shortage of tools or equipment	75.70%
14	B5	Changing of schedule	75.19%
15	C10	Poor labor motivation	75.19%
16	C11	Working overtime	73.42%
17	D18	Rework	73.42%
18	B7	Low impact site preparation	73.42%
19	B3	Unclear of the design drawing & project document	73.42%
20	E22	Low quality of materials	71.39%
21	C12	Labour absenteeism	70.13%
22	B6	Alteration of design during project execution	69.87%
23	C9	Inability to adapt to change & new environment	69.87%
24	F23	Night work	67.59%
25	B4	Large project scale	63.80%
26	F25	Air humidity	55.19%

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4.3 Hypothesis test- One Sample Mean

Hypothesis testing is testing the claims process properties of the population. The hypothesis test discusses how to make such tests of hypothesis about the population mean, μ . It is conducted to test the claim from each factors category whether there is any significant difference for the perception of Labour productivity between one factors category in Sarawak construction industry. There are some components being used in hypothesis test, which are Null hypothesis and Alternative hypothesis.

Table 17. Indication for strength of evidence

Significance value, α	Strength of evidence
0.05	Strong
0.01	Very strong
0.001	Extremely strong

The significant value, α used is 0.05 as shown in Table 17. When $\alpha = 0.05$, it means the evidence is strong. Table 18 shows that Type 1 error occurs when a true null hypothesis, H_0 is rejected. However, a Type 11 error occurs when a false null hypothesis is not rejected.

Table 18. Table of error conditions

Condition of null hypothesis	Failed to reject H_0	Rejects H_0
H_0 is true	Correct decision $(1-\alpha)$	Type 1 error α
H_0 is false	Type 11 error β	Correct decision $(1-\beta)$

4.4 Hypothesis Test- Two Independent Sample Mean

Hypothesis testing is testing the claims process properties of the population. It is conducted to test the claim from each factors category whether there is any significant difference for the perceptions of Labour productivity between two factors in Sarawak. The samples in this test are independent which means the sample values from one population are not related to or somehow naturally paired or matched with the sample values from the other population.

5.0 CONCLUSION

Based on the findings, G7 contractors in Sibul also agreed that the Labour productivity will affect the factor of changing of schedule (Factor B3). The contractors have poor in preparing the work plan in term of time. However, it is time consuming if there is a critical path happened and the delayed of work will cause the competition date as stated in the contract. A suitable framework to improve the Labour productivity of construction projects is large project scale (Factor B2) in construction industry. The contractors should manage well his financial resources and manpower to the project. In order to protect their cash flow overrun.

6.0 References

1. Mojahed Shahriyar (2005), "A Project Improvement System for Effective Management of Construction Projects", New York; McGraw Hill Inc.
2. B.G. Hickson and L.A. Ellis (2013), *Factors affecting Construction Labour Productivity in Trinidad and Tobago*. The Journal of the Association of Professional Engineers of Trinidad and Tobago Vol.42, No.1
3. Chigara T and Moyo T, 2014. Factors affecting labour productivity on building projects in Zimbabwe. International Journal of Architecture, Engineering and Construction. 3 (1): 57-65 *An Empirical Investigation of Factors Affecting Construction Sector Labour Productivity in Zimbabwe*.
4. Enshassi, A., Mohamed, S., Mustafa, Z.A., & Mayer, P.E. (2007). Factors affecting labour productivity in building projects in the Gaza Strip. Journal of Civil Engineering & Management XIII(4), 245-254.
5. Harrison Yan, Rolland Duat (2014), *Causes of time delay in construction Sarawak, Malaysia*. Faculty of Civil Engineering and Earth Resources, Universiti Malaysia Pahang
6. Alaghbari W.A.M. (2005). "Factors Affecting Construction Speed of Industrialized Building Systems in Malaysia", Master Thesis, University Putra Malaysia, UPM Serdang 43400, Selangor, Malaysia.
7. Robles TF, Slatcher RB, Trombello JM, McGinn MM. Marital quality and health: A meta-analytic review. Psychological Bulletin. 2014;140:140–187
8. Peter F Kaming, Gary D Holt, Simon T Kometa, Paul O Olomolaiye. (1998) Severity diagnosis of productivity problems—a reliability analysis. *International Journal of Project Management* 16:2, pages 107-113.

9. Anu V. Thomas and J. Sudhakumar (2014), *Factors Influencing Construction Labour Productivity: An Indian Case Study*. *Journal of Construction in Developing Countries*, 19(1), 53–68
10. Sumanth, D. J., & Yavuz, F. P. (1984). A formal approach to productivity planning in companies. *Engineering Management International*, 2(4), 219-227. DOI: 10.1016/0167-5419(84)90043-7
11. Makulsawatudom, A., & Emsley, M. (2002). Critical factors influencing construction productivity in Thailand. In *Proceedings of the 10th International CIB Symposium of the W65 Commission on Organisation and Management of Construction: Construction Innovation and Global Competitiveness*. University of Cincinnati (pp. 1446-1456)
12. Alarcon and Mardones, 1998, L.F. Alarcon, D.A. Mardones Improving the Design-Construction Interface. *Proceedings IGLC '98.6TH Annual Conference of the International Group of Lean Construction*. Guaruja Brazil (1998)
13. P.F., Olomolaiye, P.O., Holt G. and Harris, F. C. (1997), Factors influencing Construction time and cost overruns on high-rise projects in Indonesia, *Journal of Construction Management and Economic*, Vol. 15, No.1, pp83-94