Critical Factors of Success of Work Relationship between Main Contractor and Subcontractor in X Ltd. Steel Fabrication Company

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Abstract: Sub-contractor presence played an important part in the project success delivery of main contractors. Sub-contractor's work performance is often considered better than that of internal workforces. This fact was driving company's policy to handover bigger part of primary business process to sub-contractors. On the other hand, when subcontractor withdrew from the projects, meanwhile critical business parts were being handled by them, it would become very detrimental to the projects. This research will study further by analyzing variables based on construction projects. The variables are quality, time, cost, added by technical variables such as project execution and project management. This study used primary data which have been collected using questionnaire method. The respondents of questionnaire are fabrication services, assembly and assembly trial subcontractor's chief executive. Results of this work had revealed the most critical variables on this case about relation of the main contractor and service Sub-contractor Company. Improvement suggestions were given in order to maintain work relationship with the current and any future subcontractors who will be working together with X Ltd.

I. INTRODUCTION

The existence of subcontractors in project activities is very important. Many researchers identify subcontractors as a key contributor to success in construction projects. In the construction industry, subcontractors have been required to be able to meet the quality of the work, the best work services and the most competitive cost. So, with a variety of ways subcontractors trying to meet the need for these things. According Pack ham and others (2003), with the existence of partnership the time in a construction process can be reduced, consequently the better efficient they will be. X Ltd. is a national company and a sister company of an EPC (engineering, procurement, construction) company based in Surabaya. X Ltd. Have been performed a variety of steel fabrication jobs, in conducting its business X Ltd have cooperated with several subcontractors to complete any project. This was considered the most effective by the management of X Ltd., considering that X Ltd. itself is project-based company and not a mass product-based one, where the business the company move on the basis of project sit have been obtained. Because X Ltd. does not sell its goods in mass, every item they have produced were designed specially on the demand of the consumer. Specification of the request was contained in the contract between X Ltd. and consumers.

II. MATERIAL AND METHODS

Hansen (2017) described three important criteria that will continue to be considered throughout the entire stage of the project. These three criteria are will always be the focus of any construction projects: cost (how much it costs, the cost certainty), quality (standards, design, robustness and ease of work), time (speed of the project completion, certainty of project completion time).

There is a difference between the employment relationship and the partnership relationship. Business partnership is a legal relationship formed by an agreement between two or more person to run a business that is being owned together. So, it can be interpreted a partnership is a business with many owners, each of whom has invested in this business. Some partnerships include the individuals that working in the business, while others may include partners with limited participation and limited liability. While the working relationship is the legal relationship between employers with workers, or laborers, or employees based on employment agreements. Work relationships are abstract, while work agreements are concrete and real. That is to say that, the work relationship is the bond that comes from employment agreement.

Study (Research) Design: The framework for conducting this research starts from the identification of the problems that exist in X Ltd. Here after, from the field survey and the literature study the variables of success factor of work relationship between X Ltd. and subcontractor was obtained. With reference to those variables, the questionnaires were made and distributed to subcontractors that have been working in X Ltd. Factories. They were made as respondents and subcontractors' boss and workforce overseer in the field have been interviewed. After the data from the questionnaire was collected then data analysis and study were performed. The last stage is to deduce the rational conclusions from the results of research and suggestions for further research

Study Location: Plant II X Ltd.
Study Duration: January 2018-June 2018.
Sample size: 11 respondents from the leaders of workforce of Subcontractor Company that was representing 153 workers in factory of X Ltd. Object of research in this paper is the head of subcontractor of fabrication assembly and trial assembly that have been worked in X Ltd. workshop. This research is done with survey method using questionnaire to obtain the primary data. The distribution of questionnaires is done directly to each of the subcontractors 'heads who were within the work area and via email to the head of subcontractors who are not within the work area of X Ltd.
Based on the survey results obtained eleven respondents (the leaders) that were from the fabrication assembly and trial assembly services, and they were involved directly in the project. These subcontractors have an important role in the success of X Ltd.'s work projects because these subcontractors are the ones who have an immediate influence in performing the fabrication of assembly and trial assembly work.

Subjects & selection method: In this research, the elements of success factors that affect in the working relationship between X Ltd. and subcontractors would be sought. These variables would be elaborated to obtain the elements of factors that would later show the indicators of variables that was the most critical and influential to the success of work relationship between X Ltd. and subcontractors. Elements of each variable were used in this study. Success factor variables were used, referring to the project variables of quality, time and cost. In addition to the technical variables of the project execution to see what factors that affected the execution of the project and management variables to see what factors that have been affecting, when it was viewed from the management of X Ltd. and that of subcontractors

Procedure methodology
The data collection in this study was conducted by using questionnaires and interviews. Respondents in this study were from all subcontractors who currently work in the factory X Ltd. Data analysis done by using Microsoft -Excel program. To know the value of each factor, the stages should be done are: Descriptive analysis, standard deviation, focus group discussion (FGD) and managerial implications. After the data analysis phase was done, it would get the elements of each critical factor that affects the working relationship between the main contractor and subcontractors. Furthermore, to provide solutions on the working relationship between the main contractor and subcontractors, it is necessary to conduct FGD process involving both parties, namely X Ltd. as the main contractor and subcontractor of assembly and assembly service. Based on the results of questionnaires calculation from primary data and FGD conducted, then analysis would be done to give proposal for management of X Ltd. concerning work relationship between subcontractors and X Ltd. as main contractor. This proposal is expected to have a positive impact on the sustainability of cooperation between X Ltd. and subcontractor, so as to create a better and harmonious work relationship.
The analysis that is referred to in this stage is the mean analysis. Mean analysis is used to give an overview of respondent characteristics. This analysis is also used to obtain a sequence of factor variables that are important and influential in the work relationship between X Ltd. and Subcontractors. Mean is the number obtained by dividing the number of values by the number of respondents. The greater the mean value the greater the effect that is given and in vice versa, the smaller the mean value the smaller the effect is. To know the critical factor of the elements that already existed then the statistical approach was used with standard deviation calculation of each element factor. If the smaller the value of standard deviation then the condition of respondents is more relatively homogeneous and vice versa.

III. RESULT
Descriptive analysis was done on the results of the questionnaire that was obtained, its use is to facilitate the interpretation of survey results that have been done. Descriptive analysis can describe the answers to the results of the questionnaire that have been done with the analysis of mean and standard deviation. The mean and standard deviation analysis was performed using Cartesian diagram, with mean as X axis and standard deviation as Y axis. Variable reduction was done by looking at the order of the mean data having the largest

value and the smallest standard deviation value. It denotes the deviation of data values in small averages. If in the variable reduction stage that was based on the ordering of the largest mean value and the smallest standard deviation value exist variables that exceed the number of respondents, it implies that the existing data has a data variance value that is relatively the same or homogeneous. Then what is done is to look at the order of the largest mean value in the area. This refers to the greatest value of the respondents. Variables to be included in the next analysis can be seen in the graph of the mean and standard deviation. The graphs are divided into four quadrants: quadrant one, quadrant two, quadrant three and quadrant four, where the sequence form the best is quadrant one, quadrant two, quadrant three and quadrant four respectively that was based on the largest value ordering on the mean and the smallest value in the standard deviation.

Quality
Based on the primary data from the questionnaire, the data that were obtained:

Factor	mean	st-dev
1.3	4.45	0.69
1.4	4.36	0.50
1.6	4.27	0.79
1.5	4.09	1.04
1.2	4.00	0.63
1.1	3.73	0.79

The critical factor element was ranked from the factor element 1.3that have the largest mean value of 4.45 and the standard deviation value of 0.69. That factor's factual meaning is the subcontractor has sufficient knowledge and information about the quality of the desired work result. In the graph of the average quality variable, the mean value is 4.15 and the average value of the standard deviation is 0.74. Consequently, the critical factor of success of the work relationship on the element of quality lies in quadrant one, where the mean factor element is greater than the average of mean and the standard deviation value of a factor element is smaller than average value of it.
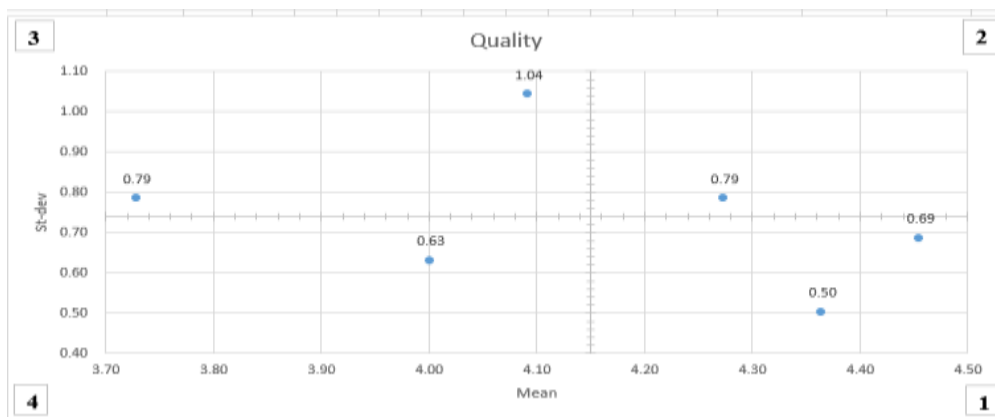
Two element factors existing quadrant one, namely:
1. subcontractors have sufficient knowledge and information about the quality of the desired work (1.3)
2. subcontractors have the required technical capabilities for the completion of work (1.4)
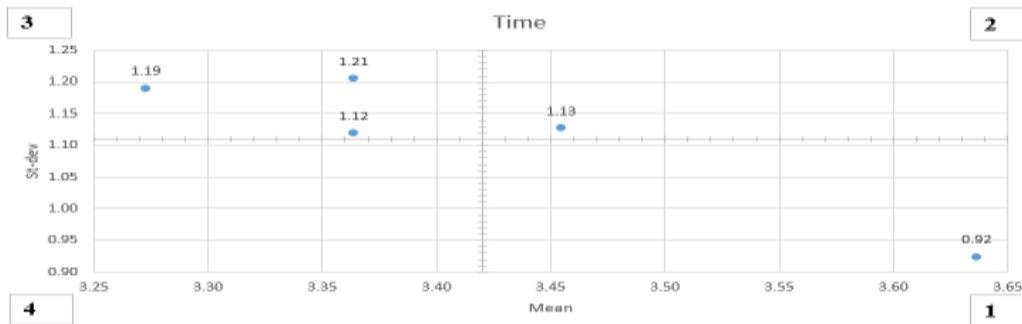
Time
Based on the primary data from the questionnaire, the data that were obtained:

Factor	mean	st-dev
2.3	3.64	0.92
2.4	3.45	1.13
2.2	3.36	1.12
2.1	3.36	1.21
2.5	3.27	1.19

The critical factor element was ranked from factor element 2.3 that have largest mean value of 3.64 and the standard deviation value of 0.92. The factor's factual meaning is the work equipment that was provided

helps the process of completion of subcontractor work to the maximum. In the graph of time variable, the average of mean value is 3,42 and the average value of standard deviation 1,11. Consequently, the critical factor of success of work relationship on element of time lies in quadrant one, where mean value is bigger than its average, likewise the standard deviation too.


In quadrant one only exists one factor that is the work equipment factor element provided to assist the completion process of subcontractor work maximally (2.3)

Cost
Based on the primary data from the questionnaire, the data that were obtained:

Factor	mean	st-dev
3.5	4.00	0.63
3.2	3.91	0.30
3.4	3.91	1.14
3.3	3.73	1.19
3.6	3.00	1.10
3.1	2.91	1.22

The ranking of critical factor element was based on factor element 3.5 that have the largest mean value of 4 and the standard deviation value of 0.63. The factor factual meaning is the subcontractor has arranged and properly planned the financing of each project. In the graph of the cost variable, the average of mean value is 3.58 and the average of standard deviation is 0.93.So, the critical factor of success of the working relationship on the quality element lies in quadrant one, where the mean value is greater than its average and similarly the standard deviation.
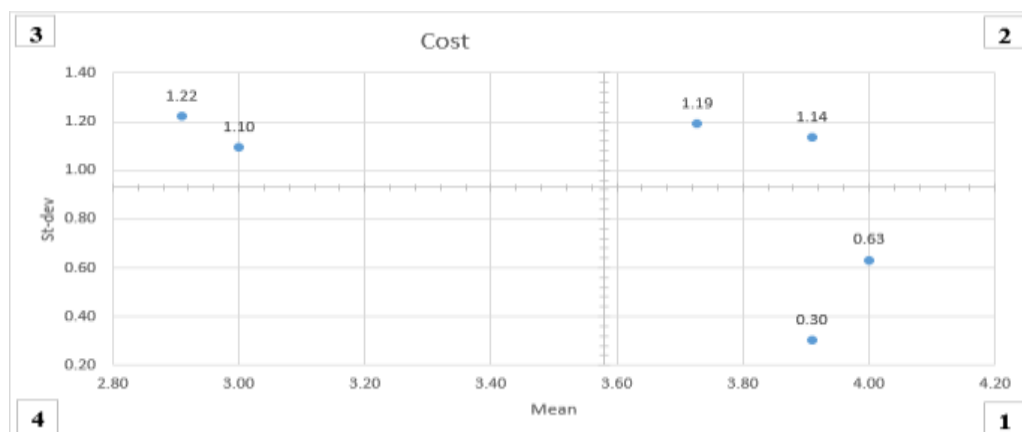
The result of mean and standard deviation on cost variable in figure 4.3 is obtained: In quadrant one, there are element factors of:

1. Subcontractors already manage and plan well the financing of each project (3.5)
2. the volume of work acquired in accordance with the ability of subcontractors (3.2)

Technical Implementation of Work
Based on the primary data from the questionnaire, the data that were obtained:

Factor	mean	st-dev
4.3	4.18	0.60
4.4	4.00	0.77
4.1	3.73	1.19
4.2	3.64	0.92
4.5	3.64	1.29
4.6	3.55	0.69
4.7	3.45	1.21
4.8	3.09	0.94

The critical factor element ranked from element 4.3 that have the largest mean value of 4.18 and the standard deviation value of 0.6.This factor factually means the subcontractor can communicate well to the management regarding the conditions and constraints of the work encountered. In the graph of the technical variables of the project implementation, the mean value is 3.66 and the mean value of the standard deviation is 0.95.So, the critical factor of success of the working relationship on the element of quality lies in quadrant one, where the mean value is greater than its average and the standard deviation value is too.
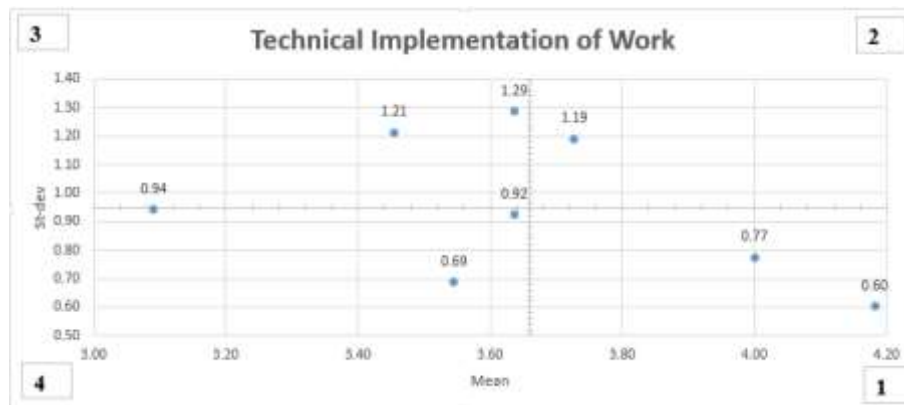
In quadrant one the existing factor element are:
1. subcontractors can communicate well with the management team regarding the conditions and constraints of the work encountered (4.3)
2. good coordination between the subcontractors and the management team to make decisions and solving the problems that were faced by subcontractors and management (4.4)
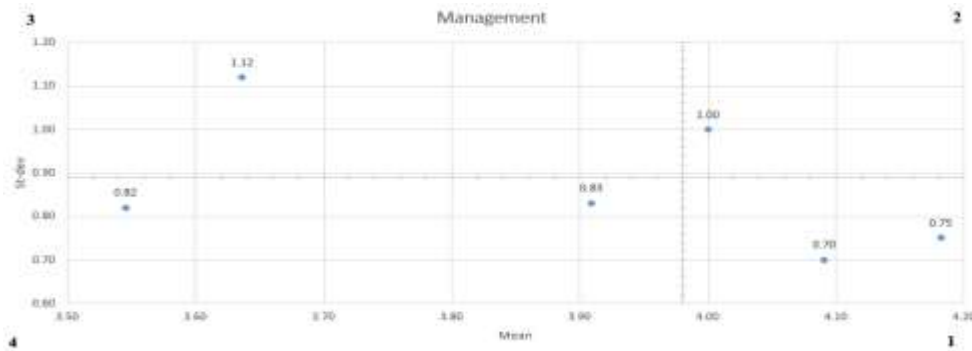
Management
Based on the primary data from the questionnaire, the data that were obtained:

Factor	mean	st-dev
5.1	4.18	0.75
5.3	4.09	0.70
5.5	4.00	1.00
5.2	3.91	0.83
5.6	3.64	1.12
5.4	3.55	0.82

Critical factor elements ranked from element 5.1 that have the largest mean value of 4.18 and the standard deviation value of 0.75. This factor is understood factually as communication and coordination between subcontractors and management is well established, always systematic and solid in the process of acceleration of work. In the graph of management variable, the average mean value is 3.89 and the average of the standard deviation of 0.87.So, the critical factor of success of the working relationship on the quality

element lies in quadrants one and four, where the mean value is greater than its average and the standard deviation value too.

In quadrant one, the existing factor element are:
1. Communication and coordination between the subcontractors and the management team is well established, systematic and solid in the process of accelerating work (5.1)
2. The management team involves subcontractors in job completion strategies (5.3)

IV. DISCUSSION

After a descriptive analysis was done, the scientific argument was obtained from each element that is considered to determine the critical factors of success of cooperation relationships between the main contractor and subcontractors, following discussion of research results

In the element factor of quality obtained average mean value of 4.15. The greater the mean value means the greater the effect given and in vice versa, the smaller the mean value the smaller the effect is. So, with that assumption the mean value that was greater than the average of mean was selected. It's obtained from each variable of the factor. The larger mean values are variable 1.3, 1.4 and 1.6. In the element of quality factor, the average standard deviation value is 0.74. The smaller the standard of deviation value the more relatively homogeneous the condition of the respondent is and vice versa, the greater the standard deviation value the more relatively heterogeneous the respondents' condition is. So, with that assumption, the standard deviation value that's chosen is smaller than the average standard deviation that was obtained from each factor variable. The smaller standard deviation values are variable 1.2, 1.3 and 1.4.

In the element factor of time, average mean value of 3.42 was obtained. The greater the mean value, the greater the effect given is and vice versa, the smaller the mean value the smaller the effect is. So, with that assumption, the mean value greater than the average of mean was selected. It's obtained from each variable of the factor. The larger mean values are variables 2.3 and 2.4. In the element factor of quality, average standard deviation value is 1.11. The smaller the value of standard deviation, the more relatively homogeneous the condition of respondents is and vice versa. The greater the standard deviation value, the more relatively heterogeneous the condition of respondents is. So, with that assumption, the standard deviation value that's chosen is smaller than the average standard deviation that was obtained from each factor variable.

In the element factor of cost, the average mean value that was obtained is 3.58. The greater the mean value, the greater the effect that is given and in vice versa, the smaller the mean value the smaller the effect is. So, with that assumption, the mean value greater than the average of mean was selected. It's obtained from each variable of the factor. The larger mean value is variable 3.2; 3.3; 3.4 and 3.5. In the element factor of cost, the standard deviation value is 0,93. The smaller the value of standard deviation, the more relatively homogeneous the condition of respondents is and vice versa. The greater the standard deviation value, the more relatively heterogeneous the condition of respondents is. So, with that assumption, the standard deviation value that's chosen is smaller than the average standard deviation that was obtained from each factor variable.

In the element factor of technical implementation of work, average mean value of 3.66 was obtained. The greater the mean value, the greater the effect that is given and in vice versa, the smaller the mean value the smaller the effect is. So, with that assumption, the mean value greater than the average of mean was selected. It's obtained from each variable of the factor. The larger mean values are variables 4.3 and 4.4. In the element factor technical implementation of work, the standard deviation value is0.95. The smaller the value of standard deviation, the more relatively homogeneous the condition of respondents is and vice versa. The greater the standard deviation value, the more relatively heterogeneous the condition of respondents is. So, with that assumption, the standard deviation value that's chosen is smaller than the average standard deviation that was obtained from each factor variable. The smaller standard deviation values are variable 4.2, 4.3, 4.4, 4.6 and 4.8

In the element factor of management, average mean value of 3.89 was obtained. The greater the mean value, the greater the effect that is given and in vice versa, the smaller the mean value the smaller the effect is. So, with that assumption, the mean value greater than the average of mean was selected. It's obtained from each variable of the factor. The larger mean value is variable 5.1; 5.2; 5.3 and 5.5 In the element factor of management, the standard deviation mean value is 0.87. The smaller the value of standard deviation, the more relatively homogeneous the condition of respondents is and vice versa. The greater the standard deviation value, the more relatively heterogeneous the condition of respondents is. So, with that assumption, the standard deviation value that's chosen is smaller than the average standard deviation that was obtained from each factor variable. The smaller standard deviation values are variable 5.1, 5.2, 5.3 and 5.4.

V. CONCLUSION
To be able to establish a more harmonious work relationship between X Ltd. and subcontractors of fabrication assembly and trial assembly several factors should be considered, namely:
1. Quality, with critical factor elements: Subcontractor knowledge and information on the quality of desired work outcomes and subcontractor technical capabilities that's required for completion of work.
2. Time, with critical elements of work equipment that's provided to assist the completion process of subcontractor work to the maximum.
3. Costs, with elements of critical factors: Planning of subcontractor financing and volume of work received under the capabilities of subcontractors.
4. Technical Implementation, with elements of critical factors: Communication between subcontractors and management team on the conditions and constraints of the work encountered and good coordination between subcontractors and management team to make decisions and solve problems faced by subcontractors and management
5. Management, with elements of critical factors: Communication and coordination between subcontractors and good, systematic and solid management in the process of acceleration of work and management team's support to subcontractors in the completion of work.

REFERENCES
[1]. Berdikari, AJ, Hartanto, AB, Andi, (2015), Fabrication and Erection Inspection on Steel Construction Building Project P1-P2 Univ. of Petra Surabaya, Magister Theses, Petra Christian University Surabaya.
[2]. Ervianto, WI, (2005), Construction Project Management (Revised Edition), Andi, Yogyakarta.
[3]. Hansen, S (2017), Construction's Contract Management "Practical Guidance on Managing Construction Projects", 3rd ed., Gramedia, Jakarta.
[4]. Hardianto, A., (2015), Analysis of Time Management and Cost Management of Hotel Development Project with Network CPM, Case Study of Batiqa Hotel Palembang, Muhammadiyah University of Surakarta.
[5]. Messiah, YA, Lona, LHP, Sina, DAT, (2013) Time and Cost Control of Construction Works as the Impact of Design Change, Case Study of Irrigation Oenaem, Biboki Selatan District, North Central Timor District, Journal of Civil Engineering Vol II No. 2, University of Nusa CendanaKupang.
[6]. Nurisra (2002), Study of Relationship Cooperation of Subcontractors and Contractors in Indonesia, Magister Theses, Bandung Institute of Technology.
[7]. Packham, G., Thomas, B., Miller, C., (2001), Partnering in The House Building Sector: a Subcontractor's view, International Journal of Project Management, Vol. 21
[8]. S. Thomas Ng, Ziwei Tang, EkambaramPalaneeswaran, (2009), Factors Contributing to The Success of Equipment-intensive Subcontractors in Construction, International Journal of Project Management, Vol. 21
[9]. Sediyanto, Hidayat, A. (2017), Cost Performanceand Time Analysis on Implementation of Construction Project with Earned Value Method, Case Study of Mall and Hotel Construction Project in Pekanbaru, Journal of Engineering and Computer Science, Mercubuana University.
[10]. Siswoyo, (2013), Evaluation of ISO 9001 Quality Management System Implementation in Construction Project Management in Indonesia, Case Study of PT Ciputra Surya, Tbk, ExtrapolasiJurnalTeknikSipilUntag Surabaya Vol 06 No. 02, 17 August University Surabaya.
[11]. Triyanto, D., (2004), Employment Relationship at Construction Services Company, 1st Edition, MandarMaju