APPLICATION OF BENCHMARKING METHOD IN THE CONSTRUCTION PROJECT TO IMPROVE PRODUCTIVITY

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Abstract— **Productivity due to labor, capital, materials, information, environmental conditions, technology and equipment, and other intangible assets, such as the interaction of entrepreneurial construction projects a complex issue. In addition, productivity is difficult because of the heterogeneity of industrial products and measuring its input. Typically, the productivity is said inputs, such as working time is divided into a constant value in place. Some experts believe that it is difficult to improve production efficiency, faster, or longer. In real practice, not only the speed and difficulty of the productivity of work, rather than adopt better working practices to achieve. The real productivity comes from identifying and implementing the most effective work processes to meet regulatory and customer requirements. Therefore, the establishment of mechanisms for continuous improvement that can drive consistent construction efficiency measurement and can promote the development and adoption of best practices in terms of management and process technology to enhance the economic output of construction activity is very important. Benchmarking is the process of a person's best practice business processes and performance indicators compare with other sectors of industry. Destination matrix is composed of a single measurement method in which the direct and indirect measures of productivity for a group. An early application of the matrix method is carried out by Rodríguez (1986).**

Index terms- **Benchmarking Objective matrix,,Productivity, implementing,**

I. INTRODUCTION

Productivity due to labor, capital, materials, information, environmental conditions, technology and equipment, and other intangible assets, such as the interaction of entrepreneurial construction projects a complex issue. In addition, productivity is difficult because of the heterogeneity of industrial products and measuring its input. Typically, the productivity is said inputs, such as working time is divided into a constant value in place. Some experts believe that it is difficult to improve production efficiency, faster, or longer. In real practice, not only the speed and difficulty of the productivity of work, rather than adopt better working practices to achieve. The real productivity comes from identifying and implementing the most effective work processes to meet regulatory and customer requirements. Therefore, the establishment of mechanisms for continuous improvement that can drive consistent construction efficiency measurement and can promote the development and adoption of best practices in terms of management and process technology to enhance the economic output of construction activity is very important. Benchmarking is the process of a person's best practice business processes and performance indicators compare with other sectors of industry. In the benchmarking process, management determined the best performance and best practices in their industry, these targets are compared to their performance and processes. In this way, they learn how to project goals and corporate performance, and more importantly, explain the business process, why these companies are successful. "Construction Productivity continued to improve" the general mechanism of the reference system can provide. Destination matrix is composed of a single measurement method in which the direct and indirect measures of productivity for a group. An early application of the matrix method is carried out by Rodríguez (1986). Tactical deployment of a clean break from the traditional inspection productivity. It includes the impact of productivity does not necessarily measure the relationship between output and input of many different factors. Thus, the term is also good reason performance matrix

II. RELEVANCE / MOTIVATION

Objective measurement frame matrix method has been successfully applied in the manufacturing, services and public institutions. This method can be in the construction sector, because a variety of factors to consider are the framework to measure the performance requirements of the construction project to match to achieve.

III. LITERATURE REVIEW

Zhang [1] Di internal benchmarks and indicators (BM & M) industry enterprise model building understanding of the impact of the implementation level of construction practices papers. In this study, an internal benchmarks and indicators (BM & M) model has been developed for industrial construction companies, to help them understand and implement mechanisms to continuously improve the efficiency of construction. I explained from various angles, including the

effects of factors, increased productivity corresponds to productivity measured at different levels of management changes kind of behavior, and strategic adjustment factors may be manipulated construction productivity improvement mechanism. Functional process model has been developed to guide the internal construction enterprises to achieve such a mechanism for continuous improvement. Jatinder Kumar et al [2] published in document benchmark project: how to use it for non-industrial projects. This case study is the potential power demonstration and benchmarking of the project and examples of non-industrial applications. This article provides a review of the benchmark system, benchmark process, the benchmark interest reference type and benchmarking obstacles. This also explains the benchmarking of different fields of knowledge to use. Studies show examples from Alberta stage CII / COAA database 1 & 2 contingency plans and progress of the implementation of oil and gas projects of the fruits of growth. In CII / COAA reference method it is used to improve the performance of the project in Alberta performed. Use benchmarking system helps in non-industrial projects and better project performance. It can be concluded that the method can be used in non-industrial projects reference other types of projects. Odysseus Manoliadis [3] Greece plans to publish a paper on labor productivity benchmarks. This article aims to show the construction of the concept of labor productivity benchmarking principles to achieve some of these projects in Greece, through the use of indicators and benchmarking labor productivity measures. Index such as interrupt index (DI), performance ratio (PR), waste index (PWI) Project Management Index (PMI), and project calculations. From the above benchmark index it concluded that labor productivity is considered a major extractor of good and poor performance of the project application.

Lewis, F Alarcon and the like. [4] published Modeling Performance Measurement benchmarks paper and construction projects. The study included the design and implementation of construction enterprise project performance measurement system to support the dual purpose of the company's operations continued to improve, and to generate a database of information on the project experience. This database is the development of third party benchmark tests in order to promote the improvement of the industry as a whole is useful. The study suggested that combining empirical data has the expertise to perform a benchmark based on the development of a computer model of the model. Dursun Balkans [5] on enterprise productivity measurement services by the OMAX (target matrix) method, and the application of the Turkish emergency services published papers. This study was designed to determine the public health service and management efficiency measurement suitable method. To this end, the enterprise level productivity measurement methods were studied. For productive projects and measuring services barriers; OMAX, which can be combined by weighting several different measures, and to assess some of the productivity standards to obtain the total productivity index performance index model has been described in detail. For measurement at the enterprise level, Turkish emergency services, which is productivity in the health

sector, and is determined using OMAX method. Global sanitary ware companies, for example: Wilson Kosasih [6] on the performance assessment system based on engineering design and maintenance scorecard framework OMAX type papers. This article describes how to design (OMAX) model of performance measurement system based on the maintenance scorecard (MSC) framework and destination matrix. The study was conducted at PT XXX Tbk company's engineering department. PT XXX Tbk is a global manufacturing company, production of sanitary ware and plumbing hardware. The purpose of this study were: to design appropriate key performance indicators; measure current performance and create corrective action plan. The results of this study, identified 21 of the KPI, which includes four KPI productivity angle of view, three KPI cost-effectiveness perspective, two KPI security perspective, the perspective of three KPI quality point of view, the three environmental point of view of the KPI, KPI, and six for the learning perspective. Performance measurement is the average current and 5.307 rating scale 1-10. Ultimately, there are 32 action plans proposed in this sector to improve performance. The Christopher J. et al. [7] measure Guyana in the construction industry with a set of project performance benchmarks performance indicators published papers. In this study, about 270 projects have been analyzed to obtain the performance of construction index Guyana. The results showed that the worst of the sea defense project, and sanitation projects best performance. The main implication of this is that, at sea defense project may be the most effective, in view of their nature, there are urgent reasons for performance improvement intervention.

Joao Pedro Cunha Pinheiro [8] applicable to the construction of key performance indicators published papers. According to the study, performance measurement and benchmarking of achievements by key performance indicators (KPI), it can be expressed as the construction industry (CI) professionals substantive help to provide them with products and services with the best quality relationship capacity / income, which was recognized by customers, while allowing them to construction projects, performance contracts management and related entities more effective monitoring. Abednego Oswald Gwaya, and so on. [9] in the development of construction projects in Kenya benchmark model papers. This study set out to develop the most appropriate project management variables enable Kenya to achieve an efficient and effective construction industry. In this study, the project has developed a model to monitor construction projects to achieve two main objectives: to provide a successful exponent of the project for each completed project, in order to compare them to each other, and the success of the project to establish a benchmark for future improved implementation. Craig Langston [10] compare the performance of articles published in international construction. In this paper, a new method is proposed international comparison of building performance and in doing so integrated time and quality, can be arranged to determine the project, construction contractors, cities and even entire industry cost ratio - not only today, but also with retroactive the passage of time. Purpose of this article, therefore, is to outline the new model, the use of what is

understood to be a test sample of the largest data sample of countries have assembled in two construction projects: Australia and the United States. Ljubo Markovic, and the like. [11] In building enterprise applications Benchmarking papers. This paper presents the business performance benchmark method to identify a type of measure to make the "best in class" comparison process. Applications, the use of some classification and benchmarking stages of the process are outlined. This article describes the system architecture used in different countries (Chile (CDT), United States (CII), Brazil (Sisin) and the UK (KPI)), which indicates that in the construction industry-related performance measures and benchmarks to determine the requirements for effective the design and implementation of performance evaluation system of key factors. Shahrzad Hawes Ravi, and the like. [12] The construction project success measurement model papers published. This paper presents a model of success measurement projects developed to achieve two main objectives: the success index of every completed project a project, in order to compare them to each other and establish a benchmark in the construction project successful future improvements. The output of the model is to calculate the project's success criteria based on five project success index. The method used in this paper is the first region to undertake a literature review. Then two Delphi questionnaire and standard questionnaire used to successfully collect data and complete the project.

IV. METHODOLOGY

In order to provide quality and productivity to provide customers with the best service, private enterprises should be supported by all standard procedures and facilities construction. So instead of saying, it needs a structured performance measurement system in this study, private companies will discuss how to design framework and performance measurement system based on the model OMAX maintenance scorecard. The purpose of this study were: to design appropriate key performance indicators; measure current performance; and establish a corrective action plan.

Maintenance Scorecard

According to Daryl Mather (2005) in his book "The Maintenance Scorecard: Creating Strategic Advantage" maintenance scorecard (MSC) is defined as a method for short-term and long-term development and implementation of regional strategies in asset management. Or at the level of the target application in three basic levels of structured approaches MSC is the enterprise level, strategic level and functional level. MSC mode provides companies with the implementation and communication throughout the company's corporate strategy tool. It is also a means of promoting innovative thinking within the organization, especially in the creation of economic growth or risk management of new, more effective means in terms of

Methodological   Perspective
One.   Productivity   Perspective:
Bay   of   cost-effectiveness   perspective:
C.   Safety   angle:
ð.   Quality   Perspective:
That   is   an   environmental   perspective:
F.   Learning   perspective:

It requires three steps to achieve the MSC, namely
One.   development   of
Bay   Create
C. Embed

V. OMAX MODEL

Destination matrix (OMAX) model was developed by Dr. James Riggs (Department of Industrial Engineering at Oregon State University). This model was first introduced in the 1980s in the United States. OMAX is a productivity measurement system. This measurement model combines productivity and integration into the conditions associated with one another. This model relates directly to all work units to measure its performance.
The model consists of three parts

Table Assessment Scheme of Model OMAX
1.Define   the   block
2.Quantitative   seat
3.The   weight   and   value   seat
Traffic light system is closely linked to the scoring system. Traffic light system is a system that can indicate whether there KPI needs to be improved or not. Traffic Light System Index and follows several colors

VI. RESEARCH METHODOLOGY

Weighting of Each Perspective, Strategy Objective, and KPI by AHP

In this study, weighting was conducted by using AHP. AHP is a multi-criteria decision-making method developed by Saaty, which is designed to capture the perception of a person or group of people who are closely related to certain issues through a procedure that is made to acquire a preference scale. This method makes it possible to draw up a problem into a hierarchy process, then given a numeric value in term of preference scale that indicates the relative importance of one element to another element in term of each criterion. The values of the pairwise comparisons in the AHP are determined according to the scale introduced by Saaty (1980). Finally, the assessment is then processed to determine which elements should have the highest priority

VII. RESULTS

. In the introduction, we mentioned that the main purpose of this study is based on the maintenance scorecard framework for measuring and assessing whether the division's performance has reached its target or not a performance measurement system. Maintenance Scorecard initial design stage depth understanding of the company's vision and mission, and then translate it into six scorecard maintenance point of view. Meanwhile, discussions are also conducted interviews with management to find the critical success factors (KSFs) of the company as a competitive advantage. After the decision in accordance with the company's strategic objectives KSFs. Key performance indicators (KPI) Further, according to the strategic objectives for each perspective of engineering design. Weighting for each KPI is carried out by the Analytic Hierarchy Process Method (AHP) method. The questionnaire was distributed to 10 respondents, which can be seen as an expert. All respondents position as a manager or assistant manager, and has been working for 2 years minimum. Then prepare a pairwise comparison matrix analysis, we can also calculate the consistency ratio (CR) to determine whether the results of the questionnaire are consistent. Then, the actual performance of each KPI achievements will be measured.

Measurement of Current Performance

In the current study to measure performance is by using OMAX methods and MSC from this to give some weight to make a decision and then action plans Development Plan of Action
• improve the accuracy of scheduling
• prioritize work
• increase its estimate of the accuracy before starting the activity.
• Based on work by increasing the expertise of each person's speed.
• Make site layout to facilitate workers'
• Make budget estimates based on previous activities.
• Do measures on workers' safety awareness
• Training for staff
• ensure and regularly check the quality of work
• Avoid waste material as possible can
• arrangements for the program, so that the same understanding about
• Increase the number of 5S workshops to raise awareness of workers to achieve
• increase followed by engineering and technical personnel, the annual number of trainees
• increase internal training implementation and training institutions,

• Make development plans and objectives of engineering and technical personnel
• to provide training to improve their skills, workers
• engineers, supervisors and workers who make innovative recommendations to provide additional incentives or rewards.
• Employee Satisfaction Survey conducted engineers, supervisors and workers, by measuring their satisfaction.

VIII. CONCLUSIONS

MSC is designed to be in private companies, eight key performance indicators can be used to measure performance, and to improve the action plan. Determine the indicators using AHP priority discover occupy the top position, that three indicators: increase customer satisfaction reduce accidents reduce construction waste, OMAX model for implementation of the current performance measurement

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