Design Partnering Framework to Reduce Financial Risk in Construction Projects

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Abstract. The Research aims to design a partnering framework that can be used by construction project, from previous research it is stated that partnering is believed to be a tool that can encourage the achievement of lean construction indicators so that it is better to achieve project performance include cost, quality and time, including change orders, unpredictable due to design changes. However, no research has been found that makes a detailed partnering framework based on the systems and subsystems involved in project implementation. Through literature studies from various journals and previous research, this research uses a mixed method there are qualitative and quantitative analysis to design a partnering framework that can be used as a reference in achieving lean construction indicators and project indicators in the form of cost, quality and time. In the end results, this research will provide benefits for stakeholders involved in project delivery systems, both integrated and non-integrated, consisting of contractors, subcontractors, owners and design consultants.

Keywords: Framework Partnering, Project delivery system, Last Planner System, Integrated Delivery Project, Financial Risks construction.

1 Introduction

The Indonesian Government annually allocates at least 10% of the APBN in the infrastructure sector (BPS, 2019, 2020). The high allocation of the APBN will of course have two consequences, namely first, the need for better handling because the resulting impact will be large on the Indonesian economy, second, problems that arise faced will be increasingly complex in solving various challenges in infrastructure projects [3].

Previous research has shown that there are still many problems in the project that make the project hampered and all indicators (Cost, Quality and Time) are not achieved. Design changes, specifications change, labor cost overruns, variation orders reflect the project has not been delivered properly. The main problems in implementing lean construction are: (1) concept understanding, (2) design and construction integration, and (3) efficient communication between the various participants involved. Various improvement methods

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in construction projects are applied in various delivery system projects that are used [13,15,16].

In the construction industry, owners, contractors and subcontractors need to improve their performance in quality, service and cost, the importance of developing a strategy that leads to increased productivity in construction projects with an approach to inter-company relationship management (partnerships) that can lead to increased collaboration between companies and performance [2,3,4]. The partnership concept encapsulates a wide range of practices intended to facilitate greater collaboration among partners. In the construction industry, partnerships may be short-term and project-oriented or long-term and strategic. Partnership development should be related to optimizing partnership resources through closer collaboration by maximizing long-term benefits. Building partnering with subcontractors in construction projects, after a period of 2 years later the company experienced positive things including: (1). reduction of service problems: order fulfillment increased by 10-20% ;(2). a decrease in the supply of products that do not match the quality problem is reduced by 30-50% and (3). decrease in inventory costs: supplier prices reduced by 3–5% [3,4].

Partnering is one of the tools to achieve indicators in lean construction, this method can be applied because it is believed to provide better results in project objectives. Partnering is believed to be a tool to overcome conflict resolution, make the organization interface and overcome various personal conflicts that occur in the project. Partnering is recommended to be implemented in construction projects because (1). can improve the stability of the relationship between top management and the various stakeholders involved, (2). Can identify problems that arise during the project and (3). Build a project team that has a fast response to deal with critical problems in the project [2,3].

From previous research, many discussed about partnering but did not reveal the systems and subsystems in their implementation, the differences in the indicators in each system and subsystem will make it easier for implementers to implement partnering. In a more technical subsystem, various methods can be developed, such as the Last Planner System (LPS) to ensure engagement occurs, at a broader subsystem level the project life cycle can be developed through indicators of cost, quality, time, safety and the environment where these are the main indicators. a successful project. Furthermore, other qualitative aspects that are desired by the owner in the project delivery system can be developed to make the project successful in a larger system (integrated project delivery).

2 Theory

2.1 Project life cycle

Every program, project, or product has definite stages in its development which are often referred to as the life cycle. Likewise, construction projects also have stages in their implementation. The stages of implementing a construction project start from initiating, planning, executing, and closing [1,2,6,7].

Each stage in the construction project cycle will use budget and time. Most of the use of budgetary and time resources is carried out during the construction project implementation phase. The cost to carry out the design of a project is generally between 7% to 12%. By

using an average of 10%, 90% of the cost of a project will be incurred during the implementation/construction period. If there is a 15% cost variation at the design stage, it will affect the overall project cost only 1.5%. Meanwhile, if there is a cost variation of 15% at the implementation stage or during the construction period, it will affect the project cost by 13.5%.

2.2 Project delivery system

A project delivery system is the organization or development of a framework related to the organization needed to complete or deliver a project and define the formal and informal relationships of the organization [1]. The project delivery system is a comprehensive process where designers, contractors, and other consultants provide their services to carry out design activities and construction activities to be able to complete a complete project for the owner. The project delivery system is an approach used to complete construction project work or services [1,6,7,8]

From the description above, the definition of a project delivery system is a system that regulates organizational relationships or parties involved in the implementation of construction projects in providing services for both design activities and construction activities in order to complete the project according to the needs of the project owner.[1].

Project Delivery System consists of integrated and non-integrated. An unintegrated project delivery system is when the owner wishes to separate the planning and implementation functions of construction carried out by different entities. In project delivery systems that are not integrated, there are usually many design changes because they are carried out by different entities [1,6,7,8]. In addition to design changes, another problem that often occurs is variation orders at the end of high construction work, between contractors, designer consultants and owners developing a competition system in completing projects.

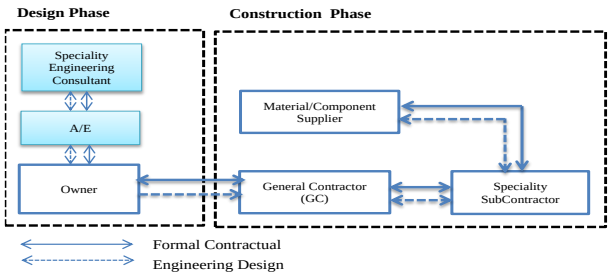

Fig. 1. non-Integrated Project Delivery System (*design bid build*) [1].

In an integrated project delivery system, the owner wishes to unify the planning and construction implementation functions in one entity, the contractor is given the opportunity to design and submit a budget according to the owner's ability, so that if there is a design change, it can be anticipated quickly. Another advantage with an integrated project delivery system is that the possibility of variation orders is very small [1,6, 7,8, 9,10,11].

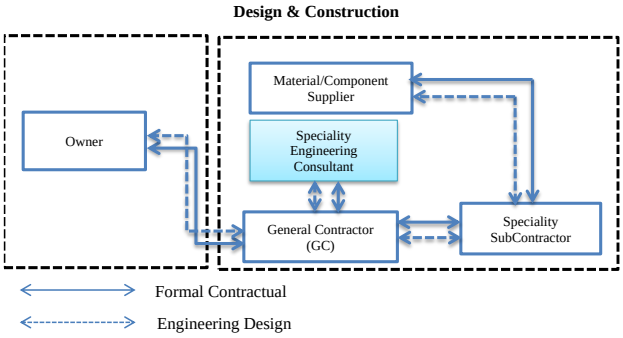

Fig. 2. Integrated Project Delivery System

2.3 Partnering in construction project

In general, the use of partnerships has a hierarchy as a result of the maturity level of the partnership starting from the lowest level to maturity, namely competition, cooperation, collaboration, coalescence [2,3,4]. The more maturity of a partnering is carried out, there will be a strong engagement between stakeholders [3,4]. Each of them formulates what factors must be strengthened so that they can optimize each influential factor to produce higher partnering. The relationship between partnering and productivity is of course very close, productivity in essence is making projects on time, quality and costs are well controlled, so that aspects that cause low productivity are overcome with better engagement between owners, contractors, suppliers, planning consultants and the community around the project.

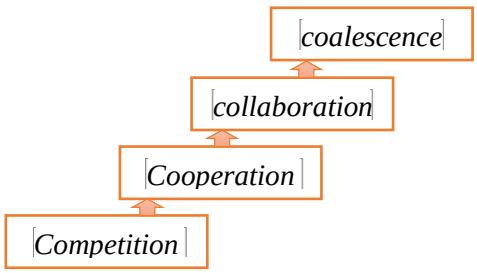

Fig. 3. Level of Partnership Maturity [3,4].

The concept of the partnering triangle that partnering consists of relationships, processes and results. This means that partnering can be successful by going through these 3 processes, namely the establishment of a "trust" relationship and communication between the stakeholders involved, then controlling the process in more complex and detailed systems and subsystems, so that it can produce the desired "result".

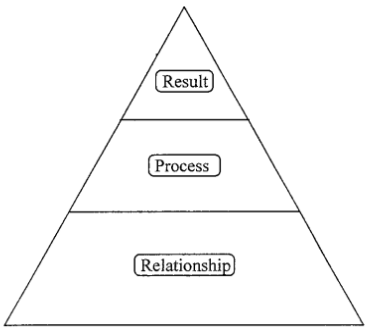

Fig. 4. Partnering triangle [2,3].

2.4 Last planner system

The Last Planner System details the planning with whom to implement and reviews the closest plan to implementation, for collaborative planning, overcoming obstacles together and verifying that the commitments that have been made can be carried out correctly, completely, on time and without ambiguity [5].

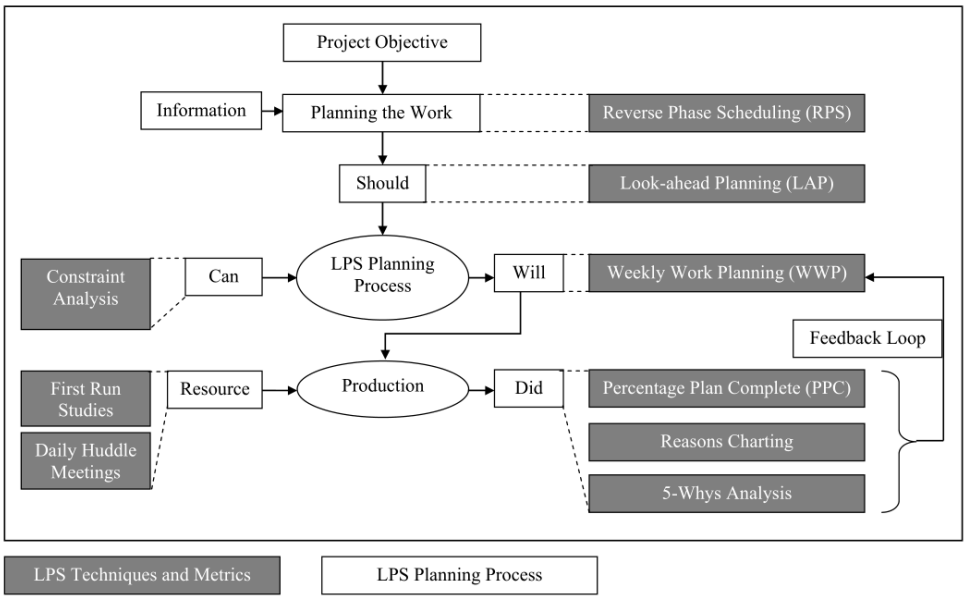

Fig. 5. Last Planner System concepts [5].

The master schedule has input and output, the input master schedule is an update of the previous week's schedule, with a 100% accurate start date, and weekly updates that run accurately so that accurate output is obtained. Phase scheduling is the description of work

in a more detailed form at the initial level of the master schedule. Look ahead planning is the result of mid-term planning covered in a few weeks, usually plans are carried out within the next 6 weeks. After the work to be carried out has been identified, there is a need for a constraint analysis, because this will become an obstacle to the work that is planned to be carried out. Each job has different constraints from one another. For example, there are problems related to contracts, delivery, design, equipment, labor. Weekly work planning is a weekly schedule that will be done after the work being done is completed. Percent Plan Complete (PPC) is a measure of workflow reliability [7,8,9] and is calculated by dividing the number of completed tasks by the total number of planned tasks in a certain period [5].

PPC is the percentage of target achievement (weekly) which is calculated by dividing the progress of the work carried out by the work plan for a certain period of time, the formula for the PPC is as follows.

$$PPC\ (\%) = \frac{number\ of\ completed\ tasks}{number\ of\ assigned\ tasks}\ x\ 100\ .$$

The data needed for PPC calculations are the "number of completed tasks" or the number of jobs that have been completed and the "number of assigned tasks" or the number of planned jobs.

3 Results, discussions and recommendations

3.1 Supporting data and discussion

In this study, a comparison of 5 projects consisting of integrated and non-integrated delivery projects was carried out to see the embryo partnering that occurred in each project. The processed data is a progress report from the project based on official documents signed by the contractor and owner. Below is presented data based on the characteristics of the project as follows:

Table 1. Data characteristics in the project

Proyek	Jenis Bangunan	Nilai kontrak	Lokasi	Durasi	Perusahaan Kontraktor
DBB A	Gedung	106 M	Jakarta	12 bulan	Swasta
DBB B	Gedung	126 M	Jakarta	12 bulan	Swasta
DBB C	Gedung	27 M	Central Java	9 bulan	Swasta
DB A	Gedung	70 M	Central Java	23 bulan	Swasta
DB B	Gedung	68 M	Central Java	12 bulan	Swasta

Information:
DBB: *Design Bid Build*
DB: *Design & Build*

From the various projects above, the data obtained are then compiled monthly progress data that has been approved by the owner, then presented in the graph below:

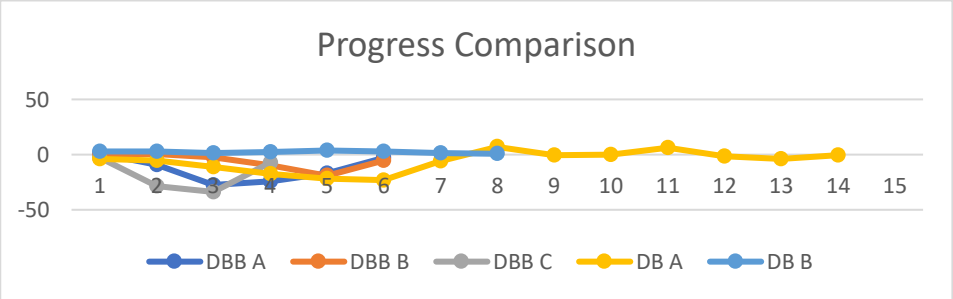

Fig. 6. Comparison of monthly project progress.

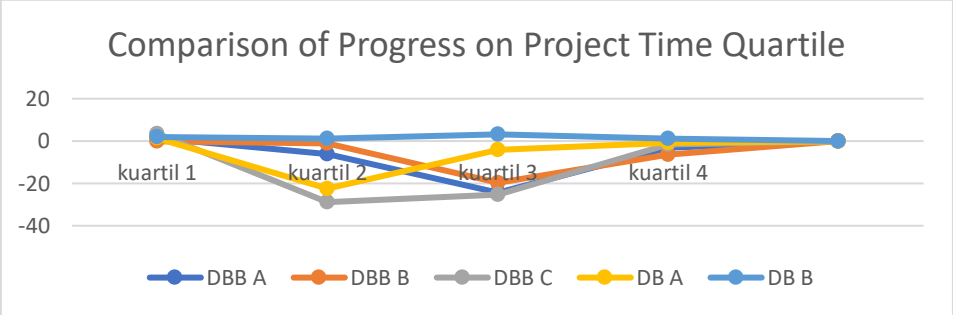

Fig. 7. Comparison of progress on project time execution quartiles

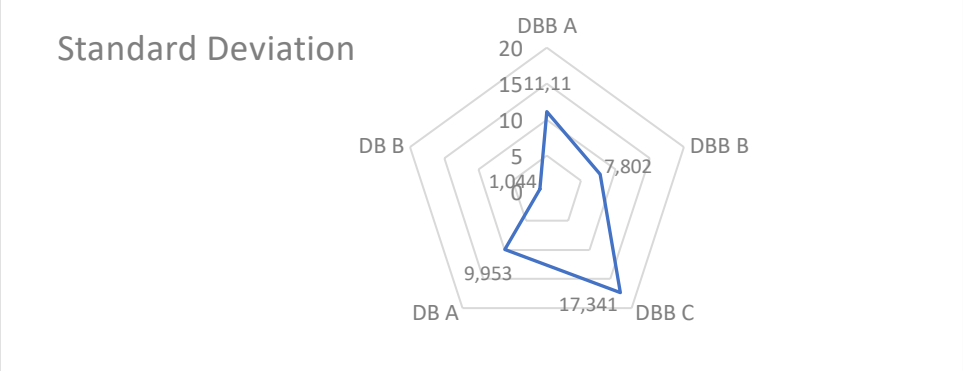

Fig. 8. Standard deviation of project data

From the project comparison data above, it can be seen that each integrated or non-integrated project has the potential to experience delays, but integrated projects have better engagement than non-integrated projects. From quartiles one, two, there is no significant

difference between integrated and non-integrated projects, but entering quartiles 3 and 4 integrated projects will reach progress faster and not be late, because design change decisions are controlled by one entity, so coordination is better and faster. The flow of information can be well controlled on an integrated project. [7,8]. The standard deviation describes a slop to the average progress, in DBB B has a good standard deviation because the project contract is a BOT (Build of transfer), BOT is the embryo of partnering, there is a sense of trust from the start to make the project better.

3.2 Recommendation

From the analysis data above, it can be recommended the need for partnering arrangements in the correct framework so that it can be controlled through more detailed systems and subsystems. Below is a framework for partnering in integrated and non-integrated projects with a stakeholder approach and what is done in each system and subsystem.

The framework partnering needs to be done on each system and subsystem because it requires different handling in each system and subsystem. Partnering will encourage the development of creativity and innovation from each party to jointly minimize the risks that occur. The existence of partnering will lead to effectiveness in the use of the budget because from the beginning there has been collaboration in small sub-systems to larger sub-systems. Below is a partnering framework for non-integrated systems.

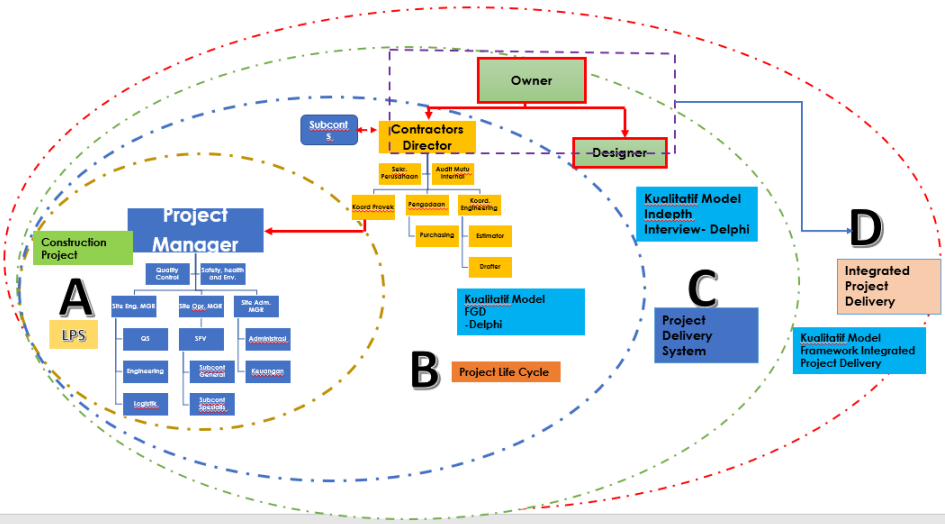

Fig. 9. *Framework partnering* in not integrated project

In a non-integrated project, it is carried out on the project implementation subsystem, project life cycle and project delivery system where there is a separation between the contractor and the designer consultant. In exploring the indicators in the project implementation process, it can be carried out with the Last Planner System (LPS), then in the project life cycle, qualitative models can be explored with indicators of cost, quality, time, safety and the environment. Then to explore partnering indicators in the project

delivery system, it can be developed through in-depth interviews with the Delphi method as part of decision making.

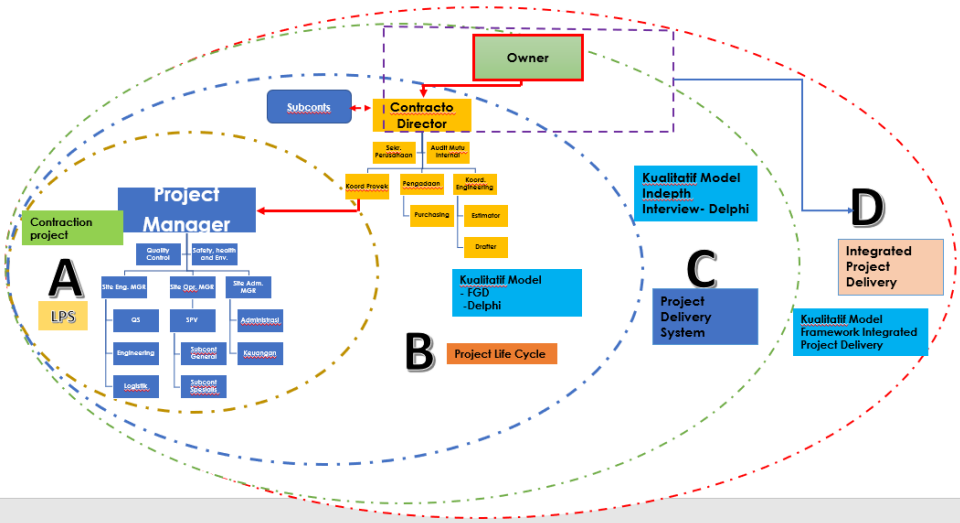

Fig. 10. Framework partnering in integrated projects.

In an integrated project, the same thing is done as in a non-integrated project, but in a project delivery system, the functions of the contractor and the designer consultant are integrated. In an integrated system, supervision is carried out by the owner through Construction Management which is developed by the owner to represent the owner's interests in project implementation.

4 Conclusions

From the explanation above, this research draws the following conclusions:

1. *Project delivery system* both integrated and non-integrated have the potential to be late, but projects with an integrated project delivery system have better engagement which is the embryo of partnering in construction projects.
2. To improve and enhance partnering in construction projects, a partnering framework in systems and subsystems is developed so that relevant stakeholders can be identified based on the scope of work.
3. Partnering causes variation orders not to occur so that the costs incurred will be more efficient because from the start all parties (stakeholders) have been involved.
4. Each system and subsystem have a different treatment partnering.

5. It is necessary to develop a more in-depth analysis method with quantitative and qualitative models to deepen (maturity) partnering so that it becomes a framework of reference that is easy to implement and anticipate factors that influence each system and subsystem in a construction project.

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