REVIEW OF INTERNATIONAL GEOGRAPHICAL EDUCATION

ISSN: 2146-0353 • © RIGEO • 11(1), MARCH, 2021

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Research Article

Role of Technical Education in Partnering Construction Project: A Geographical Study on Indonesia

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Abstract

Construction projects are developing very rapidly, the budget allocation from the Government of Indonesia is increasing every year, at least 10.79% is allocated for infrastructure development each year (BPS and the Indonesian Ministry of Industry). The high development of infrastructure must be balanced with various good management approaches, so that the project does not suffer losses. Construction projects are getting increasingly complex, problems such as schedule delays, material scarcity, and incompabilty in specifications cannot be avoided (Hamza, Shahid, Bin Hainin, & Nashwan, 2019). Various approaches to improve the process are continuously evaluated and implemented, including techincal education in partnering construction projects. The level of partnering in construction projects is very different depending on the project delivery system used, because each project delivery system carries consequences and the level of partnering Techincal education for the implementer. This study aims to reveal the Techincal education in partnering in construction projects for both project delivery systems in the form of Design Bid Build (DBB), Design and Build (DB) and Engineering Procurement Construction (EPC). Through Techincal education in partnering, a project can be assessed on its Techincal education level, so that weaknesses can be improved in partnering. The methodology used is a literature study and a comparison from previous research, the results of this study can be used to confirm the tools to be used in field data collection and Focus Discussion Group (FGD) to formulate partnering strategies in construction projects. (Bajjou, Chafi, & En-Nadi, 2017; Kereri; Koskela, 1992; Sarhan, Xia, Fawzia, & Karim, 2017).

Keywords

Techincal education partnering, tools partnering, partnering delivery method

To cite this article: Sari E, M, Irawan A, P, and Wibowo M, A. (2021). Role of Technical Education in Partnering Construction Project: A Geographical Study on Indonesia. Review of International Geographical Education (RIGEO), 11(1), 636-644. doi: *10.48047/rigeo.11.1.49*

Submitted: 10-01-2021 • **Revised:** 05-02-2021 • **Accepted:** 21-03-2021

Lean Construction & Techincal education Partnering

Lean Construction

The term "lean construction" was coined by the International Group for Lean Construction at its first meeting in 1993 (Howell, 1999). The term "lean" comes from the Toyota Production System (TPS) which was developed in the 1990s. This illustrates the strategy adopted by the company to increase efficiency in production and consumption automatically. His historical lean concept stems from Henry Ford's invention of the conveyor belt which led to the mass production being observed in the 19th century (Udawatta, Zuo, Chiveralls, & Zillante, 2015). There are at least five main principles of "lean construction" that result in production effectiveness in construction (sarha, 2017). These principles consist of (1). The value of the construction is identified based on the views of the customer; (2). The planned value is implemented in the delivery of the material, (3). Reduction/elimination of "waste" in various processes that affect the flow in the work process; (4). Making a system to ensure the accuracy of delivery of materials until needed; (5). organizing accuracy and perfection work that aims to improve the systems and processes needed consistently. The five principles aim to create the necessary system optimization and can increase morale in work (Muhammad, 2017).

The Benefits of implementing lean construction in general in the construction industry includes:

1. increase in customer satisfaction):
2. Quality Improvement;
3. Increase Productivity
4. Reduced Construction Time
5. Improve the construction process;
6. Better Health and safety record;
7. Improve relationships with suppliers;
8. Better inventory control / reduced;
9. Increase market share;
10. Employee satisfaction.

To achieve all lean construction indicators, tools are needed to achieve. Sari, Irawan, Wibowo, and Sinaga (2020), stated that partnering is one of the tools in achieving lean construction indicators, because 95% of partnering indicators are in order to achieve lean construction. Partnering is a tool lean construction indicators, by collaborating from the start in the initiation phase, ensuring more precise specifications, preventing material shortages and unexpected design changes. Partnering is a recommendation for a project delivery system by including from the start which parties are invited to cooperate with formal contracts issued by the joint owner of each stakeholder who will be involved. The project document can add the initials of each party that will be invited to collaborate from the start, so that engagement is very strong in completing the project. Several important factors that must be considered by the owner are the things that influence the occurrence of attractive partnerships in choosing the involved stakeholders (Sari et al., 2020).(Sari, Irawan, Wibowo, & Praja, 2021) The factors of communication, trust, adaptability, share value must be the basis for this collaboration because the principles of trust that are developed to achieve project objectives are better. High commitment is required in partnering, so that material accuracy, material transportation problems and material arrival will be on time and according to the schedule developed in the project. Financial certainty between each stakeholder is predictable with a minimum of design changes, material specification changes and onsite material delays which often cause variation orders and extreme delays exceeding tolerances.(Adi Papa, M Agung, & Hatmoko, 2015; Gadde & Dubois, 2010; Koskela, 1992)

Techincal education in Partnering

According to Thomson and Sanders, 1998, in general the use of partnerships has a hierarchy as a result of the Techincal education level of the partnership starting from the lowest level to Geography education, namely competition, cooperation, collaboration, coalescence. The more mature a partnership is carried out, there will be stronger engagement between stakeholders. Each of them formulates what factors must be strengthened so that they can optimize each influential factor to produce a higher level of partnering. The relationship between partnering and productivity is certainly very close, productivity in essence is making projects on time, quality and costs well controlled, so aspects that cause low productivity can be overcomed with better engagement between owners, contractors, suppliers, planning consultants, and the community around the project.(Hallowell & Toole, 2009; Salem, Solomon, Genaidy, & Minkarah, 2006; Wibowo & Alfen, 2014)
To illustrate this, according to Thompson and Sanders, 1998, a continum of partnerships was developed, which describes four general stages: competition, cooperation, collaboration, and coalition. "Competition" represents the traditional owner/contractor relationship, where each party has separate goals, and little effort is extended towards "working together". This competitive pursuit occurs in the absence of partnerships. The other three stages are collaboration, collaboration, and coalition, basically combining, increasing the degree of alignment of goals and commitment by the parties involved, and represented on the continuity to describe the various applications of partnerships.(Alwi, Mohamed, & Hampson, 2002; Babalola, Ibem, & Ezema, 2019; Soekiman, Pribadi, Soemardi, & Wirahadikusumah, 2011)
In considering the partnership, one should assess the business objectives, and analyze the role in order to help, so as to achieve goals within the organization. After identifying this, the company can choose and determine the right style to carry out the partnership. Through this process, a balance can be struck between risk and reward, and resources can be put to good use to develop, implement, and manage partnership relationships (Thompson and Sanders, 1998).

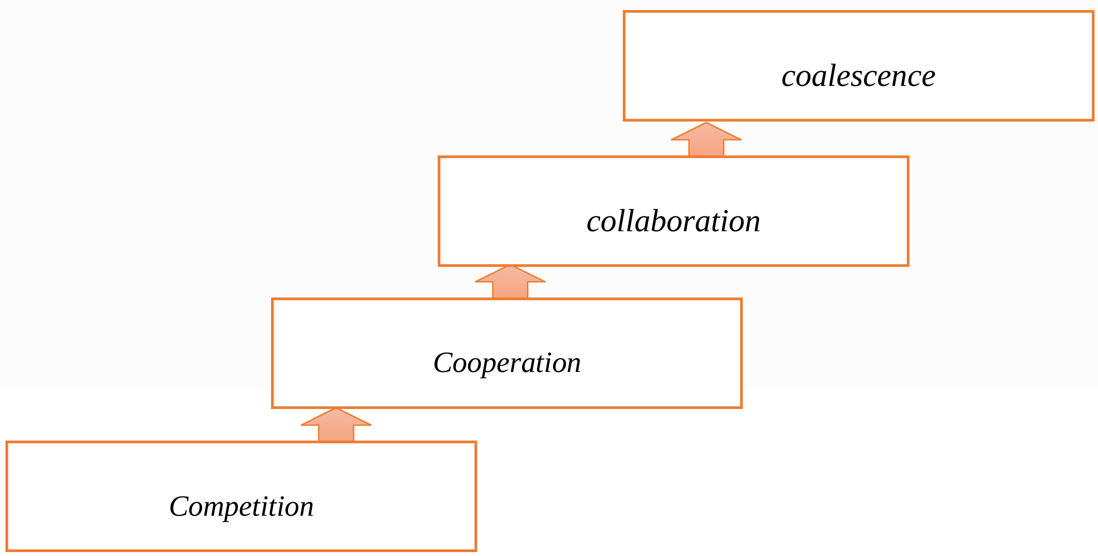

Figure 1. Level of Partnership Techincal education (Thompson dan Sanders, 1998)

The influence of partnerships is initiated through the Supply Chain Management (SCM) which means focusing on completing the design to provide better value and streamline the construction process. Furthermore, it affects: health and safety, environment, quality, accuracy, functionality, flexibility, responsiveness, planning, project administration, technology, cost control, schedule control, teamwork partnership, constructability, amd procurement. All of these result in continuous improvement. Partnerships provides benefits: Reduced ligation, Improved cost control, Improved time control, Improved product quality, Efficient problem solving, Improved closer relationship, Enhanced communication, Continues improvement, Potential for innovation, Improved safety performance, Increased satisfaction, Improved culture, and Lower administrative cost . The form of coalescence is the highest level in the form of partnerships. It can be applied at the design process stage (Collaborative Design) and/or the construction process stage (Construction Partnering). Both of these can be applied for the short term (Project Partnering/Alliancing), and for the long term (Strategic Partnering/Alliancing). According to Feniosky Pena Mora - Gilbert W Winslow - MIT Room 1-253, 2014; Intelligent Engineering System Laboratory, Center for Construction and Research Education, Department of Civil and Environmental Engineering, MIT, the complete Partnering process consists of:(Wandahl, 2014)

Stage 1:

A long-term strategy. Senior management defines a long-term vision with supporting strategies and measurable goals and objectives. Resources are allocated to achieve goals. Leadership, planning, and partnership sessions are conducted to prepare the organization for cultural change. This phase also defines the level of senior management's commitment to the partnership process.

Stage 2:

Training. Project participants receive specific training about the partnership and learn about the strategies developed and outlined in the previous phase. Each participant must clearly understand the role played in the partnership and how their performance will affect the outcome of the effort.

Stage 3:

Team building. Workshops and meetings are scheduled at a neutral site to begin the team building process to develop trust and open channels of communication. In this phase, the project team develops a common goal: alignment.

Stage 4:

On-site implementation. Regular meetings with the parties involved, evaluation of periodic assessments and feedback, process of resolving issues. A creative and innovative project completion.

Stage 5:

Project close-out. The parties should identify successes and failures, and improvements made during the process to incorporate these experiences into their respective and shared long-term visions.

The partnering process of competition, cooperation, collaboration and coalescence can be applied to every project delivery system, both in design bid build, design and build and EPC. The five stages in partnering can be combined in any project delivery system, each construction project must strive to reach the coalescence level in order to achieve partnering Techincal education so that the highest level can be achieved, especially in complex construction projects.

Methodology

The methodology is carried out by grouping the partnerships (competition, cooperation, collaboration and coalescence) ,accompanied by factors that affect productivity, then the factors that are considered to affect productivity will be assessed for the level of each factor through Focus Discussion Groups (FGD). For example, for competition, how high is the level of trust, how high is the communication level, etc. the same way is done in cooperation, collaboration and coalescence. Furthermore, for each influential factor and its level, excavation is carried out through a questionnaire in the field so that an assessment of each project is obtained with a project delivery system: what is the level of partnering? Have you reached a mature partnership in coalescence? Furthermore, on each data in the field, models will be obtained for projects with various partnering models.
For example in competition, cooperation, collaboration and coalescence models. In each model, X is the same with different levels (%). For example, the level of trust in the competition is only 25%.

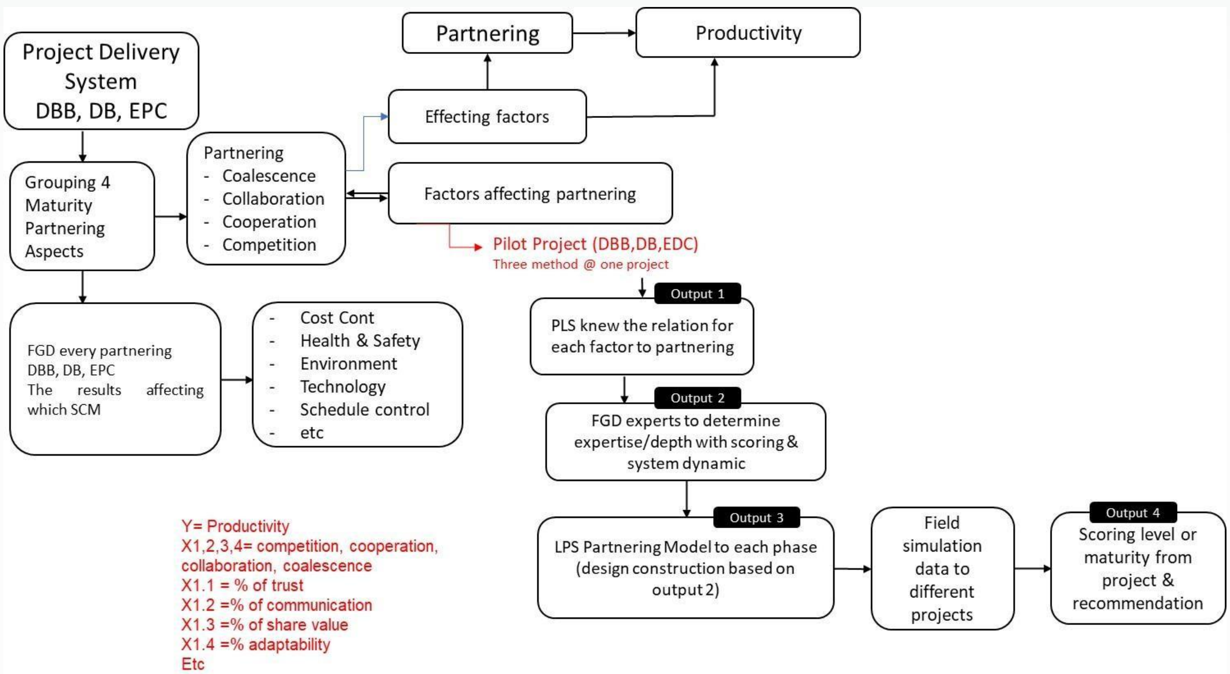

Figure 2. Methodlogy

For the first step, partnering is grouped according to its level and process to identify the next activity in order to achieve outputs 1, 2, 3 and 4. Partnering is classified from the lowest level to Techincal education (DBB, DB and EPC). Some of the factors that influence each partnering are translated into concrete activities for further preparation of a questionnaire for the expert FGD.

Discussion

Analysis of Techincal education & Process in Partnering

The table below describes the Techincal education and process partnering in each partnering depth, from levels 1-5 can be used and implemented with varied descriptions in each level.

Table 1.
Analysis of Technical education & process in partnering

No	Technical education	Partnering Process	Description of Techincal education Level
1	Coalescence	Stage 1 to stage 5 (A Long Term Strategy, Training, Team Building, collaboration design, collaboration to define specification, On-site implementation, have alternative and adaptability for changes, project close out). There was a fusion of consultant-contractor organizations and constructability input took place from the beginning of the design.	The highest level. There is fusion in the organization with the highest Techincal education level, 75%-100%
2	Collaboration	Stage 1 to stage 5 (A Long Term Strategy, Training, Team Building, BOT, On-site implementation, project close out).	Quite high, there is no fusion but the merge in the organization has a Techincal education level of 50% - 75%
3	Cooperation	Stage 1 to stage 5 (A Long Term Strategy, Training, Team Building, On-site implementation, project close out).	Medium, independent organization with ad hoc cooperation, 25% - 50%
4	Competition	Nothing. Arrangements are the full responsibility of the owner	Low, there is free competition. Marturity rate : 0%-25%

The table below is application of project delivery system partnering processs dan Techincal education partnering.

Table 2.
application Techincal education in partnering

Level of partnering / Partnering process (% of Geogrphy education)	Competition	Cooperation	Collaboration	Coalesence
75%-100%			DBB,DB, EPC	DBB,DB, EPC
50%-75%			DBB,DB, EPC	DBB,DB, EPC
25%-50%		DBB, DB	DBB, DB	DBB, DB
0-25%	DBB	DBB	DBB	DBB

The table below is affecting factors of partnering level.

Table 3.
affecting factors of partnering level

	Competition	**Cooperation**	**Collaboration**	**Coalesence**
Trust	25%	50%	75%	100%
Communication	50%	75%	75%	100%
Adaptability	50%	75%	75%	100%
Share value	25%	50%	75%	100%

Comparison % of Techincal education can be used to assess the project, so that the construction project level can be known and can be easily improved to achieve a mature partnership. Below is a comparison of 5 factors that influence partnering according to the % of Geography education, as follows:

Table 4.
implemented % of Techincal education

% of Techincal education	**25%**	**50%**	**75%**	**100%**
Trust	The contractor is not involved in the design and specifications	Contractors and designers prepare specifications in the design	The contractor and designer is one entity	Contractors, designers and procurement formulate designs and specifications
Communication	Formal communication in bidding, weekly meeting, progress evaluation	Intense communication to evaluate projects together, not only limited to formal communication	Project communication and management communication are carried out from design to project close out	Intense communication between contractors, designers and procurement before, during and after the project is implemented
Adaptability	Changes in design and specifications are only 25% adaptable to changes	Changes in design and specifications are only 50% adaptable to changes	Changes in design and specifications are only 75% adaptable to changes	Changes in design and specifications are only 100% adaptable to changes
Share Value	Contractors, designers, suppliers barely understand about share value in construction projects	Contractors, designers, implement share value in the project schedule.	Contractors and designers do share value and implement it in schedule, cost, man power, material, etc.	Contractors and designers do share value and implement them in schedule, cost, procurement, man power, stochastic, etc.

Conclusion

Coalesense as a reference in achieving project success can carry out the 1-5 partnering process. Applications can be implemented on projects based on Design Bid Build (DBB), Design and Build (DB) and Engineering Procurement and Construction (EPC). Implementing a mature partnership to coalitions requires organizational commitment and good individual competency improvement in addition to technical administration in project management.

The higher the level of Techincal education in partnership (coalenscence), the faster and more reliable the achievement of design quality and design performance is, so that it avoids: change orders, reworks, claims, construction failures, so that projects can achieve their goals and deliver better projects.

1. An expert Focus Discussion Group (FGD) is needed to confirm the level of partnering.

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