

THE MODEL OF PARTNER RELATIONSHIPS' IMPACT ON TIME, COST, QUALITY AND SAFETY IN CONSTRUCTION PROJECTS

Elżbieta Radziszewska-Zielina^{1*}, Bartłomiej Szewczyk¹

¹Department of Construction Technology and Organisation, Faculty of Civil Engineering of the Cracow University of Technology, ul. Warszawska 24, 31-155 Cracow, Poland

Abstract

Partnering, as an approach to construction project management was adopted and is widely used in such countries as: the United States, the United Kingdom, Australia and China. The world literature, mainly from the counties listed above, indicates the numerous benefits of partnering in construction. In Poland, however, still dominates the competitive attitude among the participants of construction projects. This article develops a model that will be used to determine the impact of partner relationships on time, cost, quality and safety in construction projects in Poland. It will allow to identify the areas of cooperation between the participants of construction projects where partner relationships bring the greatest benefits.

Key words

Construction industry; model; partner relationships; partnering impact

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*Corresponding author: Tel.: +48-12-628-21-26
E-mail address: eradzisz@izwbit.pk.edu.pl

1 INTRODUCTION

The concept of managing the construction projects on the basis of partner relations between the project participants has been developing in the world in the fast few decades. The concept has gained ground particularly in the US, UK, Australia or China where it is now widely used, both as project partnering and strategic partnering. Its popularity is mainly a result of significant benefits the partnering brings as indicated in the publications on the subject, e.g. [1,2,3]. In addition to limiting the number of disputes and improved communication between the project participants, among the main benefits are also these which directly contribute to the project final success, such as reduced project time and costs or improved quality of the works. Despite these advantages, in Poland, however, the partnering approach has not become that popular and fully consciously is used only in single cases [4].

A number of papers dedicated to the partnering in the construction sector have been written. Cheng and Li [5] and Anvuur and Kumaraswamy [6] have developed conceptual models of partnering. Some publications [7,8,9] are dedicated to identification of key success factors of partnering. The most important of them are: mutual trust, effective communication, suitable resources or management support. In addition to the benefits of partnering described in [1,2,3] also important are the barriers to its use. These problems are indicated in [10,11] and include a misunderstanding of the concept of partnering, cultural barriers or uneven involvement of the project participants, among other things. Several models of partnering evaluation have been built in order to keep the partner relations at a high level during the construction projects [12,13,14]. The method presented in [12] is a simple, questionnaire-based evaluation of thirteen measures of partnering by the project participants. The methods presented in [13] and [14] have been expanded to include the computer systems to facilitate data collection and processing for an improved evaluation process. The comparative analysis of partnering evaluation has been presented in [15]. The general characteristics and advantages and disadvantages of these methods are presented in table 1. On the other hand, in [16] Lu and Yan have shown a model which supports the use of partnering in a given situation.

Among Polish publications, one should mention [17] where the author indicates that the partner cooperation among the building contractors in Poland, Slovakia and Ukraine is admittedly noticed but has not reached a high level yet. A method of partnering evaluation using the fuzzy logic has been presented in [18]. A development of this method is the expert control system of partner relations presented in [19]. The author has also developed the method of partner selection to cooperate in construction projects in the context of developing the partner relations [20].

On the basis of primary investigation of the problem, review of available literature, talks with the construction experts and observation of the construction market, it has been determined that the partner relations in Poland are informal and often appear only in selected areas of cooperation between the participants of construction projects. Despite the absence of formal and conscious use of partnering in Poland as an approach in project management, the constant cooperation with a group of proven subcontractors is widely used. Such cooperation manifests itself already at the bid preparation and contract award stage where the general contractor trusting a subcontractor can rely on its reliable pricing or can show that he will have the personnel and equipment necessary for a given project which will be the subcontractor's resources.

Tab. 1: Advantages and disadvantages of methods for assessing partnering [15]

Names of authors	Method name	General characteristics	Advantages	Disadvantages and limitations
Roger Bayliss, Sai-On Cheung, Henry C.H. Suen, Shek-Pui Wong	Questionnaire-based, monthly assessment of partner relationships	Assessment of 13 measures using a five-point scale. Assessment of measures as the arithmetic average of ratings of the project participants	<ul style="list-style-type: none"> - The opportunity to develop partner relationships on the occasion of monthly meetings - Involving all project participants in a discussion on improving partner relationships - Adaptability 	<ul style="list-style-type: none"> - The need to organise regular meetings - The method is based on subjective assessments by the project participants - Failure to determine the validity of individual measures analysed - No synthetic indicator for all attributes analysed - Involvement of a large number of project participants
Sai On Cheung, Henry C.H. Suen, Kevin K.W. Cheung	Partnering Temperature Index (PTI)	Measures rated using a five-point scale. Measure PTIs as an arithmetic average of project participants' ratings. Project PTI as a weighted average with the Measure PTIs	<ul style="list-style-type: none"> - The possibility of assessment via the Internet - Automatic calculation of indicators - The ability to adapt the number of measures analysed and their validity to the project 	<ul style="list-style-type: none"> - Selection of measures and their validity requires the manager's knowledge and experience - The method is based on subjective assessments by the project participants - Involvement of a large number of project participants
John F.Y. Yeung, Albert P.C. Chan, Daniel W.M. Chan	Partnering Performance Index (PPI)	7 evaluated KPIs. Each KPI correspond to QI and QR. Project manager gives the value of QIs. Value of QIs are converted to assessment using a five-point scale in accordance with the accepted QRs. PPI is a weighted average of these assessments	<ul style="list-style-type: none"> - The use of QIs and QRs eliminates the problem of subjective assessments by the project participants - The possibility of assessment via the Internet - Automatic calculation of indicators - No need of involvement of a large number of project participants 	<ul style="list-style-type: none"> - The need to adjust the monitored QIs and QRs to the specifics of the project and the environment in which it will be implemented
Tung-Tsan Chen, Tsung-Chiang Wu	Project Partnering Volition (PPV)	The method uses the theory of fuzzy sets and AHP analysis. Rule database	<ul style="list-style-type: none"> - The ability to verbally identify the studied factors - Assessment is carried out by competent persons 	<ul style="list-style-type: none"> - Complicated method - Requires the appointment of a team of experts - No IT system
Elżbieta Radziszewska-Zielina	Fuzzy expert system controlling partner relationships	The method uses the theory of fuzzy sets. It provides assessment and control of partner relationship	<ul style="list-style-type: none"> - In addition to assessment, the system helps control partner relationships - No need of involvement of a large number of project participants 	<ul style="list-style-type: none"> - Need for training in the use of the specially developed Conrel IT system - Used for strategic partnership

This article identifies types of possible partner cooperation in construction projects depending on the cooperating entities. For each type of cooperation measures of partnering have been indicated which influence time, costs, quality and safety of project performance. The measures of partnering are understood as the parameters which describe the partnering and allow to evaluate its current state [21]. The purpose of the paper is to develop the model of impact of partner relations on time, costs, quality and safety in construction projects, on the basis of identified and defined measures of partnering. In the future, the model will be used to examine the measures of partnering the high level of which brings the most benefits.

2 RESEARCH METHODS

On the basis of the analysis of partnering evaluation methods in [15], 15 measures of partnering have been identified which appear in at least two described methods, as shown in table 2.

Tab. 2: Measures of a partnering in various methods [15]

	Questionnaire -based, monthly assessment of partner relationships	Partnering Temperature Index	Partnering Performance Index	Project Partnering Volition	Fuzzy expert system controlling partner relationships
Trust	X		X	X	X
Information sharing	X				X
Communication	X	X	X	X	X
Cooperation and mutual relations	X				X
Standards and rules of behaviour	X				X
Quality	X	X	X	X	X
Safety	X	X			
Financial security	X			X	
Job satisfaction	X				
Resources	X			X	
Waste minimization	X				
Third parties' needs	X				
Dispute resolution	X	X			X
Time		X	X		
Cost		X	X	X	
Environment		X			
Contract relations		X			
Top management commitment			X	X	
Innovation and improvement			X	X	
Dedicated team				X	
Flexibility to change				X	X
Long-term perspective				X	
Partnership formation at design stage				X	
Good cultural fit				X	
Company wide acceptance				X	
Questioning attitudes				X	
Clear understanding				X	
Consistent with objectives				X	
Technical expertise				X	
Equal power/empowerment				X	
Basis of order placement					X
Number of suppliers					X
Approach to service quality control					X
Cost division					X
Participation in the enterprise's new offer					X
Contact frequency					X

Among them, the measures which result directly from the partner relations have been detailed: trust, information sharing, communication, cooperation and mutual relations, standards and rules of behaviour, financial security, resources, dispute resolution, top management commitment, innovation and improvement, flexibility to change. High or low evaluation of the remaining ones (time, cost, quality, safety) may be a result of using the partnering, but just as well of a number of other causes. Thus, improving these parameters should be treated not as a measure of partnering, but as a benefit from using it. Due to a wide range of factors affecting time, costs, quality and safety in construction projects, identification of those which at the same time can be perceived as measures of partnering becomes problematic.

Consequently, in order to indicate those measures, it has been decided to use the knowledge of experts (selected specialists, people with many years of experience on managerial positions in construction companies). The list of measures was verified and supplemented during the interviews with four experts, looking for an answer to the question about the measures of partnering which may affect time, costs, quality and safety in construction projects. The deliberations were limited to the site mobilization and project implementation. This was caused by the fact that the cooperation between the general contractor and subcontractors at the bidding and contract award stage does not always result in a contract, and other subcontractors are chosen instead. Moreover, the impact of partner relations on time, costs, quality and safety is best visible at the project implementation stage. Four types of partner cooperation in constructions projects have been identified depending on the project participants with which the general contractor cooperates. Hence, the measures of partnering have been assigned to the four types of cooperation of the general contractor, namely cooperation with subcontractors, with the designer, with material and equipment suppliers, and with the employer.

3 DEVELOPING THE RESEARCH MODEL

3.1 Graphical presentation of the model

The model of impact of partner relations on time, costs, quality and safety in construction projects has been developed, as shown in figure 1. The measures of partnering will be evaluated on scale 1 to 5, similarly to their impact on time, costs, quality and safety in specific construction projects. Then, the correlation and regression model will be used as a method of analysis. The descriptions of individual measures of partnering in the area of four types of partner cooperation are given in sections 3.2 - 3.5.

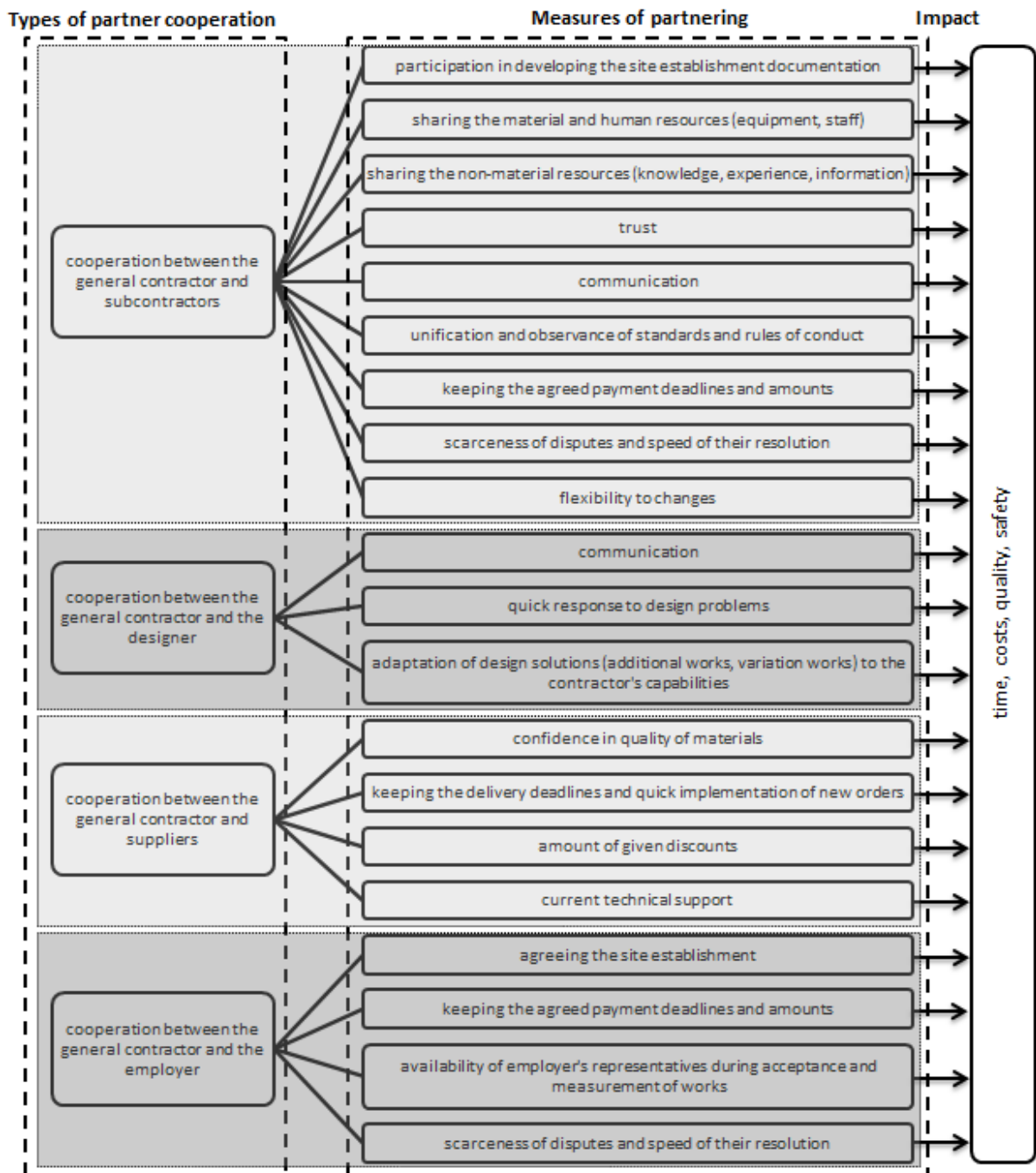


Fig. 1: Research model of impact of partner relations on time, costs, quality and safety in construction projects (source: own work)

3.2 Measures of partnering for cooperation between the general contractor and subcontractors

Nine measures of partnering have been identified and defined for the cooperation between the general contractor and subcontractors:

1. *Participation in developing the site establishment documentation* – the cooperation between the general contractor and subcontractors during the development of the works organization plan, site arrangement plan and health and safety plan. As the subcontractors will use the site themselves, they may contribute some ideas to facilitate the works. They can be consultants

at this stage. Some general contractors however see a problem in reconciling the suggestions of many subcontractors. Therefore, they believe that as they have the overall responsibility for the project, they have the full picture of the situation and do not use the assistance of subcontractors in developing the site establishment documentation.

2. *Sharing the material and human resources (equipment, staff)* – sharing the resources by the general contractor and subcontractors in case of problems in a task (e.g. equipment failure, tight deadlines).
3. *Sharing the non-material resources (knowledge, experience, information)* – sharing the knowledge on possible difficulties, methods of works organization, used technologies in which the other party does not have a sufficient experience to fulfil the task well.
4. *Trust* – willingness to build trust between the general contractor and subcontractors. It expresses the belief that the partners' decisions will be beneficial for both parties which will allow to limit the inspections.
5. *Communication* – both written and oral. An effective communication helps avoid disputes and misunderstandings. The used methods of communication should be considered, as well as the comprehensibility and conciseness of messages
6. *Unification and observance of standards and rules of conduct* – development on the basis of common values and goals of procedures, standards and rules of conducts which both parties will strive to observe.
7. *Keeping the agreed payment deadlines and amounts* – paying the subcontractors the agreed amounts on agreed dates.
8. *Scarceness of disputes and speed of their resolution* – it relates to both the number of disputes during a construction project and an effective resolution of such disputes.
9. *Flexibility to changes* – it relates to the subcontractors' response to the changes made in the design, both in terms of the amount of works and their type or technology.

3.3 Measures of partnering for cooperation between the general contractor and the designer

Three measures of partnering have been identified and defined for the cooperation between the general contractor and the designer:

1. *Communication* – similarly as in case of cooperation with subcontractors, it is both written and oral communication. As the designer is not present on the site all the time, its availability is important to allow for any communication at all. Thus, it is important to use different forms of communication. Similarly as in case of cooperation with subcontractors, comprehensibility and conciseness of messages is important.
2. *Quick response to design problems* – quick response of the designer to the requests to design additional elements or to redesign the previously designed elements as a result of unforeseen circumstances or design errors.
3. *Adaptation of design solutions (additional works, variation works) to the contractor's capabilities* – it refers to a situation when some additional or variation works are necessary. Such being the case, the contractor's resources and experience in a given technology should be taken into account.

3.4 Measures of partnering for cooperation between the general contractor and suppliers

Four measures of partnering have been identified and defined for the cooperation between the general contractor and suppliers:

1. *Confidence in quality of materials* – belief on the the part of the contractor that the delivered material is of good quality This allows to limit the inspections of delivered material. However, it also brings the risk that this confidence may be abused by suppliers and the quality of materials will deteriorate. Usually, as the complexity of materials increases, the confidence decreases.
2. *Keeping the delivery deadlines and quick implementation of new orders* – refers to treating the general contractor by subcontractors as a serious partner. If the subcontractors care about the business with the general contractor, they will make any effort to keep the deadlines.
3. *Amount of given discounts* – similarly to keeping the deadlines, the amount of given discounts is a reflection of the will to do business with the general contractor.
4. *Current technical support* – refers particularly to using the technology unfamiliar to the contractor. The contractor should receive a sufficient technical support in both, the application of the technology and assistance in case of problems.

3.5 Measures of partnering for cooperation between the general contractor and the employer

Four measures of partnering have been identified and defined for the cooperation between the general contractor and the employer:

1. *Agreeing the site establishment* – facilitation of the site establishment by allowing the general contractor to use space in existing buildings, sources of water and energy, parking places, etc.
2. *Keeping the agreed payment deadlines and amounts* – paying the general contractor the agreed amounts on agreed dates.
3. *Availability of employer's representatives during acceptance and measurement of works* – refers to the time after which the employer's representative makes the technical acceptance and approves the measurement of the works, particularly the hidden works.
4. *Scarceness of disputes and speed of their resolution* – similarly to the cooperation between the general contractor and subcontractors, it relates to both the number of disputes during a construction project and an effective resolution of such disputes.

4 CONCLUSIONS

The original list of measures of partnering developed in [15] has been modified in this model to make them specifically relate to individual types of partner cooperation between the general contractor and other participants of a construction project. Thanks to this modification, this model can also be used in other projects, formally not implemented according to the partnering principle. Out of original measures of partnering listed in [15], this final model does not include the top management commitment. It relates to the commitment of the top management in the project management by using the partnering. In Poland it is difficult to speak about such commitment, because only in a few companies such type of project management is fully used. In [22] it has been stated that in the opinion of construction companies, the main obstacle to the full use of partnering is the construction market characterized by high variability and risk.

The article presents the model of impact of partner relations on time, costs, quality and safety in construction projects. Four types of partner cooperation have been distinguished, depending on the cooperating entities, and the measures of partnering have been identified for each type. The model is a starting point to investigate the mentioned impact and to indicate the measures of partnering the high level of which brings the most benefits. These measures will then be used to develop the system of evaluation and control of partner relations in construction projects which will be presented in next publications.

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