PROFILE OF PROJECT MANAGERS' COMPETENCIES FOR COLLABORATIVE CONSTRUCTION PROJECTS

Sina Moradi[1], Kalle Kähkönen[2], Ole Jonny Klakegg[3] and Kirsi Aaltonen[4]

[1&2] *Faculty of Built Environment, Tampere University, 33720 Tampere, Finland*

[3] *Department of Civil and Environmental Engineering, Norwegian University of Science and Technology, 7491 Trondheim, Norway*

[4] *Faculty of Industrial Engineering and Management, University of Oulu, 90014 Oulu, Finland*

Several studies have indicated that project managers' competencies contribute to construction project success in a considerable manner. However, these studies have mainly addressed subject of the interest in the context of traditional construction projects. The choice of construction project delivery models is increasingly turning from traditional ones towards the integrated ones (also called collaborative delivery models). Thus, it is imperative to understand how the competency profile for the project managers needs to be developed to support their successful performance in construction projects with collaborative delivery models. To that end, the survey strategy was employed. Then, a self-evaluation questionnaire comprising 60 linguistic statements, representing 30 behavioural competencies, was utilized for analysing the type and frequency of project managers' different behaviours in their everyday work in their current and target states (as is, and as the informant wants it to be in the future). This questionnaire was sent to 33 project managers of relevance in Norway and Finland with a response rate of 73%. The findings present the competency profile of project managers for collaborative construction projects. This competency profile comprises two groups of (i) competencies contributing to the individual performance of the project managers, e.g., trustworthiness, stress tolerance, initiative, optimism, and (ii) competencies contributing to the team performance and dynamics, e.g., conflict management, group capabilities, understanding others. The findings of this study can be insightful for project managers in collaborative construction projects to benchmark their competencies and improve their performance, and for their employers to hire the right project manager.

Keywords: competency; collaborative project; integrated project delivery

INTRODUCTION

The differentiators between successful performers and average ones have come to be called competencies (Zwell 2000). Moradi *et al.,* (2021: 3) stated that "competencies are underlying characteristics (motives, traits, self-concept, skills and knowledge) which cause different kinds of actions while being combined with an intent, which is situation-oriented. The resultant action in a given situation is called competency." In terms of improvability, competencies related to skill and knowledge are relatively easy to develop, competencies related to motive and trait are hard to develop, and

[1] sina.moradi@tuni.fi

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finally the competencies related to self-concept lie somewhere between and are somewhat hard to develop (Spencer and Spencer 1993; Zwell 2000). Competency, due to its behavioural nature, can predict and contribute to successful performance in a consistent manner. Consequently, project managers need to possess certain competencies because competency is an important predictor and facilitator of their successful performance, which in turn, has considerable effect on project success (Müller and Tuner 2007; Spencer and Spencer 1993; Zhang *et al.,* 2013; Moradi *et al.,* 2020a).

In the field of construction projects, the importance of project managers' competencies is considerably high as they are greatly responsible for the successful completion of the projects. Consequently, there exists substantial interest from the research community towards project managers' competencies in construction projects (for instance, Ahadzie *et al.,* 2008 and 2009; Dogbegah *et al.,* 2011; de los Ríos-Carmenado *et al.,* 2014; Klendauer *et al.,* 2012; Tabassi *et al.,* 2016). These efforts, in a holistic view, can be divided into two parts: studies addressing project managers' competencies in construction projects with traditional delivery models, and in construction projects with collaborative delivery models and/or working practices.

Traditional delivery models of construction projects (e.g., design-bid-build, design-build) usually separate design and construction phases, which in turn hinders early involvement of the contractor and other key parties in the project and its design phase. Moreover, the lowest construction price is usually the main criteria for selecting the contractor (Forbes and Ahmed 2011). On the other hand, collaborative delivery models (e.g., alliancing, partnering, integrated project delivery) have some elements and characteristics such as early involvement of the key participants of the project, shared risk-reward based on project outcome, joint project control and trust-based relationships. These elements enable the key parties, with aligned interests, to work together (collaboration) and exchange information (cooperation) for the good of the project (Engebø *et al.,* 2020; Lloyd-Walker and Walker 2015; Fischer *et al.,* 2017, Oakland and Marosszeky 2017). In this study, "traditional construction projects" and "collaborative construction projects," represent the terms "construction projects with traditional delivery models," and "construction projects with collaborative delivery models and/or working practices" respectively.

According to (Moradi *et al.,* 2021), the undertaken studies addressing project managers' competencies in construction projects have mainly focused on traditional construction projects (for instance, Ahadzie *et al.,* 2014; Abdullah *et al.,* 2018; Dziekoński 2017; Mutijwaa and Rwelamila 2007; Shah and Prakash 2018). Fig 1 shows those competencies for project managers of traditional construction projects which have been mentioned in the literature more than five times. Project managers' competencies in collaborative construction projects have been studied in a limited manner by the research community (e.g., Walker and Lloyd Walker 2011; Moradi *et al.,* 2020b). This study aims to find out how the competency profile for the project managers needs to be developed to support their successful performance in collaborative construction projects.

METHODOLOGY

The survey strategy was employed for conducting this study where a web-based questionnaire, in a self-evaluation manner, was utilized to identify the most appropriate competencies of project managers in collaborative construction projects. Self-evaluation of behavioural competencies is an efficient and effective way for

studying project managers' competencies in a certain context (Liikamaa 2015; Chang *et al.,* 2009).

Competency/Reference	Edum-Fotwe and McCaffer, 2000	Dainty et al., 2004	Cheng et al., 2005	Mutijvaa and Rwelamila, 2007	Ahadzie et al., 2008	Chen et al., 2008	Ahadzie et al., 2009	Lee et al., 2011	Dogbegah et al., 2011	Hwang and Ng, 2013	Zhang et al., 2013	Iaili Jabar et al., 2013	Liyana Othman and Jaafar, 2013	Panas et al., 2014	Omar and Fayek, 2016	Tabassi et al., 2016	Dziekoiski, 2017	Abdullah et al., 2018	Shah and Prakash, 2018	Moradi et al., 2018	Frequency of appearance
Teamwork and cooperation		✓	✓		✓		✓	✓			✓				✓		✓		✓		9
Cost management			✓	✓				✓	✓	✓					✓		✓	✓		✓	
Communication			✓			✓			✓	✓					✓		✓		✓		7
Leadership		✓	✓								✓				✓	✓				✓	
Time management					✓		✓			✓					✓		✓		✓		6
Quality management			✓					✓	✓						✓			✓	✓		
Flexibility and adaptability		✓	✓												✓		✓		✓		
Resource management				✓					✓	✓					✓			✓			
Knowledge of construction					✓	✓	✓					✓							✓		
HSE (Health, Safety, Environment)			✓					✓							✓			✓	✓		
Experience	✓							✓					✓			✓	✓				5
Ethics									✓				✓		✓		✓		✓		
Problem solving												✓		✓	✓		✓		✓		
Impact and influence		✓	✓					✓			✓				✓						
Team management			✓			✓		✓							✓			✓			

Fig 1: Appearances of different project managers' competencies in the literature for traditional construction projects

The questionnaire was sent to 33 project managers of collaborative construction projects. Data collection was undertaken through non-probability volunteer sampling. These project managers were selected among the ongoing or recently completed alliance and/or partnering construction projects in Finland and Norway. These two countries were selected for data collection because of their representativeness in terms of collaborative construction projects (Hosseini *et al.,* 2016; Moradi *et al.,* 2020b). The categories of the studied construction projects in this study comprise housing construction (residential building), institutional construction (hospital and school), and infrastructure (road and railway construction). In total, 24 questionnaires were completed by 12 Norwegian project managers and 12 Finnish project managers (February-April 2020), and a response rate of 73% was achieved. Among respondents, 35% of them are/were working as the client's project manager and 65% of them as the contractor's project manager. Fig 2 presents the demographic information of the survey respondents.

The utilized web-based questionnaire "Cycloid", by Evolute Technology, focuses on the evaluation of key behavioural competencies of project managers based on their current state (reality), target state (vision), and creative tension. Creative tension is the gap between personal vision (target state) and current reality (current state) (Chang *et al.,* 2009; Liikamaa, 2015). In other words, creative tension is the willingness of an individual (here the project manager) to improve his/her competencies further.

Accordingly, 30 behavioural competencies of project managers were evaluated through 60 linguistic statements, two statements per competency. In this study, respondents were asked to choose and determine the frequency of their behaviours in the situations presented by each linguistic statement on a scale: never/seldom/often/always in their current and target state.

How often these behaviours occur in the statements representing each competency were evaluated both in the current and target states through analysing the numeric values of the current and target states of the self-evaluation results. Liikamaa (2015) has categorized these 30 competencies into two main groups and five subgroups (see Table 1).

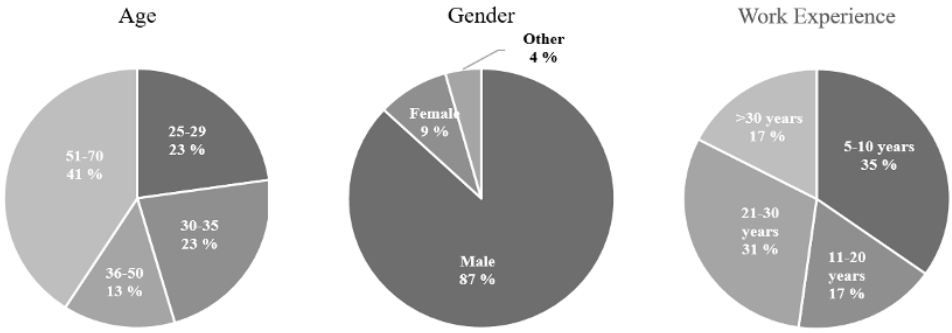

Fig 2: Demographic information of the survey respondents

After its first development, Cycloid has been utilized in several studies for evaluating project manager's competencies in different contexts (for instance Liikamaa 2015; Chang *et al.,* 2009; Moradi *et al.,* 2020).

Table 1: Project managers' competencies in Cycloid

Group	Subgroup	Competency
Personal competencies	Self-awareness	Emotional awareness, Self-assessment, Self-confidence
	Self-control	Trustworthiness, Maintaining order, Flexibility, Innovation, Responsibility, Seeking information, Production efficiency, Decision quality, Stress tolerance
	Cognitive ability	Analytical thinking, Conceptual thinking, Language proficiency
	Motivation	Achievement orientation, Commitment, Initiative, Optimism
Social competencies	Empathy	Understanding others, Developing others, Leveraging diversity, Organizational savvy
	Social skills	Communication, Conflict management, Management, Leadership, Relationship building, Collaboration, Group capabilities

Analysing the obtained research data from the field surveys revealed the significance of project managers' different competencies in the current state, target state and creative tension. Top 10 competencies of each respondent group in their current state, target state and creative tension were chosen and compared with each other for identifying the similarities and differences. Those top 10 competencies are seen as the most important ones contributing to the successful performance of the project managers. The ranking of the competencies listed in Fig 3 and 4 have been developed based on the median of the ranking in the current state, target state and creative tension of the two respondent groups. Those competencies with the same rank in both respondent groups, have been listed alphabetically.

RESULTS

Significance of Competencies in the Current and Target State

The following Fig 3 presents the results of comparing the 10 most significant competencies of the respondent groups in the current state and in the target state. Concerning the current state, it became clear that 7 out of 10 most significant competencies of both respondent groups were the same. These identified common competencies have been listed in Fig 3 and labelled as "common" under the category of "Current state." Conversely, 3 out of 10 most significant competencies in the current state of each respondent group were different, and therefore, those six competencies, in total, have been labelled as "specific" under the category of "Current state," as can be seen in Fig 3. Regarding the target state, similar results were obtained in terms of the number of commonalities and specificities (see Fig 3).

Among the identified common competencies in the current state, trustworthiness was the most significant one, with the statements concerning acting honestly and in an ethical manner and admitting mistakes. Among the specific competencies in the current state (Fig 3), responsibility was the most significant one. This competency is related to the quality of being responsible for the progress of one's own work and the feeling of responsibility over common goals. Fig 3 presents the complete list of the specific competencies in the current state. Regarding the target state, as listed in Fig 3, trustworthiness and responsibility, again, were the most significant competencies in the categories of "common" and "specific", respectively.

Current state			Target state		
R	Competency	Common or specific	R	Competency	Common or specific
1	Trustworthiness	Common	1	Trustworthiness	Common
2	Group capabilities		2	Stress tolerance	
3	Initiative		3	Conflict management	
	Optimism			Group capabilities	
	Stress tolerance			Self-assessment	
4	Flexibility		4	Initiative	
5	Leadership		5	Optimism	
1	Responsibility	Specific	1	Responsibility	Specific
2	Achievement orientation		2	Collaboration	
	Collaboration			Leveraging diversity	
3	Leveraging diversity		3	Decision quality	
4	Self-assessment			Maintaining order	
5	Analytical thinking		4	Leadership	

Fig 3: Project managers' competencies in their current state and target state

Creative Tension

The 10 most significant competencies of both respondent groups in terms of creative tension were compared. As can be seen in the following Fig 4, production efficiency, decision quality and understanding others are three competencies which were common between both the respondent groups. Production efficiency is the capability of project managers in performing tasks quickly and according to high standards. Decision quality is about making decisions based on principles, purposes, and values. Understanding others points out to project managers' ability to sense the feelings and perspectives of other people.

The number of identified common competencies between creative tension of the respondent groups (listed in Fig 4) represents a weak overlap, unlike the current state and the target state. The most significant competency among the identified specific ones in creative tension is relationship building, which is related to the ability of project managers in building or maintaining friendly relationships or networks of contacts with people who are or might be useful in achieving work-related goals. The second one is communication representing the ability to listen to others, to openly express one's feelings, ideas and opinions and to read non-verbal cues. The third one is management for controlling people and things in a systematic way.

Stress tolerance, collaboration, and conflict management are three competencies here, which were also among the 10 most significant ones in the current and the target state. This amount of emphasis on these competencies means that stress and conflict amount can be very high in some collaborative contexts. The competencies (labelled "specific" in Fig 4) are seen, here, as the context-oriented ones which their contribution to the successful performance of project managers can be different based upon the specific characteristics of the collaborative construction projects, e.g., culture, contracting parties.

Rank	Competency	Common or specific
1	Production efficiency	Common
2	Decision quality	
3	Understanding others	
1	Relationship building	Specfic
2	Communication	
3	Management	
	Stress tolerance	
4	Collaboration	
	Conflict management	
5	Emotional awareness	
	Maintaining order	
6	Language proficiency	
7	Analytical thinking	
	Commitment	
8	Organizational savvy	
	Seeking information	
9	Achievement orientation	

Fig 4: Project managers' creative tension competencies

Profile of Project Managers' Competencies for Collaborative Construction Projects

A profile of project managers' competencies was developed for collaborative construction projects (see Fig 5). This was undertaken through analysing the 10 most significant competencies of both respondent groups in their target state and creative tension and identifying the common ones. This profile is comprised of two main parts: (i) competencies contributing to the individual performance of the project managers, and (ii) competencies contributing to their team performance and dynamics.

Competencies contributing to the individual performance
The obtained research results suggest that the identified competencies in this category mainly contribute to the project managers' individual performance (Fig 5). Accordingly, these competencies enable project managers to be successful in the tasks, which they need to handle by themselves. In terms of the improvability, these competencies are mainly hard or somewhat hard to improve (except production efficiency), and therefore it is the most cost-effective way for employers to hire those project managers which already have these competencies. Production efficiency is the only competency in this group, which is easy to improve, and a cost-effective way for improvement is training.

Competencies contributing to the team performance and dynamics
The competencies of this category, as can be understood from their definition, seem to mainly contribute towards team performance (Fig 5). Accordingly, these competencies (group capabilities, conflict management) enable the project managers to succeed in those tasks, which need to be accomplished in cooperation with other team members. It also means that these competencies, (understanding others, decision quality) positively affect the project managers' leadership, as a whole, which subsequently can improve team performance and dynamics.

Training provides a possibility for improving the competencies contributing to the team performance. These competencies that are improvable can be considered by employers for the recruitment of project managers and improving the performance of the present ones.

Profile of Project Managers' Competencies for Collaborative Construction Projects				
Category	Competency	Definition	Improvability	Key function(s) for employers
Competencies contributing to the individual performance	Trustworthiness	To deliver on promises, keep schedules, arrive on time on meetings and complete work as agreed and maintain trust between people.	Hard to improve	- Selecting those project managers that already possess these competencies
	Stress tolerance	To maintain performance when facing workload pressures and or organizational impediments.		
	Initiative	The ability to see new possibilities and to seize opportunities. To do more than what is expected.		
	Optimism	Pursuing goals regardless of obstacles and setbacks.		
	Self-assessment	The comprehension of one's own limits and strengths.	Somewhat hard to improve	- Improving performance of the existing project managers by training - Selecting the project managers
	Production efficiency	Performing tasks quickly and according to high standards.	Easy to improve	- Improving performance of the existing project managers by training
Competencies contributing to the team performance and dynamics	Conflict management	The ability to negotiate and resolve disagreements between people. To reach out for win-win situations.	Somewhat hard to improve	- Improving performance of the existing project managers by training - Selecting the project managers
	Group capabilities	The capability of working cooperatively with others, to be part of a team, to work together.	Easy to improve	- Improving performance of the existing project managers by training
	Decision quality	Making decisions based on principles, purposes, and values.	Somewhat hard to improve	- Improving performance of the existing project managers by training - Selecting the project managers
	Understanding others	The ability to sense the feelings and perspectives of other people.		

Fig 5: Project managers' competencies for collaborative construction projects

DISCUSSION

The findings of this study imply that successful project managers of collaborative construction projects need to possess two sets of competencies which are related to individual performance and team dynamics. Competencies related to individual performance are mainly related to the enduring characteristics and traits of the personality and therefore hard to improve. Conversely, the competencies related to team performance and dynamics can be easily improved through training, as they are related to skill and knowledge. Therefore, it can be argued that motive, trait and self-image-oriented competencies of project managers in collaborative construction projects can mainly contribute towards individual efficiency and effectiveness, whereas skill and knowledge competencies can contribute towards better team dynamics and performance. Those competencies of project managers contributing towards team performance can be improved by training. A slight improvement in these competencies (skills and knowledge) will result in considerable development in the performance of the whole project team (Spencer and Spencer 1993; Zwell 2000).

The presented competencies in Fig 5 seem to be in line with the prior research and aligned with the key characteristics and elements of collaborative construction projects. As it has been stated by different scholars (e.g., Oakland and Marosszeky 2017; Fischer *et al.,* 2017), collaborative construction projects represent a working environment in which the project manager, as the leader, collaborates and cooperates with the key participants based on trust-based relationships to form a single integrated team with aligned commercial interests solely for the best of the project. The developed profile in this study (Fig 5) presents those competencies which enable project managers to build reliable relationships with all team members (through trustworthiness, group capabilities, understanding others), and to reach out win-win situations (through conflict management and stress tolerance) when there is conflict within the project team. The project managers also need to be individually productive as the project leaders, where they need initiative, optimism, self-assessment and production efficiency competencies to succeed. The competencies presented in Fig 5 are also in line with the recent relevant studies (Moradi *et al.,* 2021).

The developed profile of project managers' competencies provides a novel research-based contribution. It includes practical insights for the project managers and their employers to be aware of the value-adding competencies in the collaborative

construction projects, which can be used in hiring the project managers and improving the performance of the existing ones. The presented results, for instance, in Finland with over 5 billion EUR launched collaborative construction projects (since 2013) can mean significant savings when selecting project managers with fitting competencies and also improving performance of the currently employed ones.

The presented competency profile and its details can be important and value-adding also for the other project professionals (e.g., project coordinators, site engineers, project controllers). These competencies, in the big picture, represent the individual efficiency and effectiveness, teamwork, mutual understanding and trust, collaborative cooperation, and no-blame related behaviour, which indicate the key elements and characteristics of collaborative construction projects (Moradi 2021).

CONCLUSIONS

This study aimed at understanding the spectrum of required competencies for being a successful project manager in collaborative construction projects. The results provide the basis for the following conclusions concerning project managers' competencies in collaborative construction projects:

- The competencies contributing to the individual performance include trustworthiness, stress tolerance, initiative, optimism, self-assessment, and production efficiency.
- The competencies contributing to the team performance include conflict management, group capabilities, understanding others and decision quality.
- The developed profile of project managers' competencies, in the big picture, represents blame-free behaviours with a focus on individual productivity as well as supporting and developing others, and joint planning, control and management of the project.

These findings provide novel understanding over project managers' competencies in collaborative construction projects. The developed profile of competencies needs validation in other contexts as well. Therefore, complementary studies in various regions and business conditions are a potential area for further research.

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