

Article

Project Managers' Competencies in Collaborative Construction Projects

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Abstract: Collaborative delivery methods in construction projects provide a new operational environment, which can foster effective interaction and cooperation between different project stakeholders. Project managers are one of the most important players in this environment, who therefore need to possess appropriate competencies. Collaborative construction projects and their managerial solutions are still a relatively new field and, thus, special aspects such as competencies of project managers in such projects have been limitedly studied. The present research aimed to evaluate project managers' competencies in collaborative construction projects in Finland through a human behavioral approach, where project managers' everyday work was the main source for understanding the competencies of relevance. Accordingly, a web-based questionnaire and semi-structured interviews were used for data collection from the case projects. Based on the gained data, project managers' behaviors were analyzed, and consequently, their specific competencies were identified. Findings of this study propose 10 core competencies for project managers in collaborative construction projects, e.g., group capabilities, language proficiency, and leveraging diversity. Additionally, a set of supportive competencies were identified which, together with the core competencies, form the profile of project managers' competencies for collaborative construction projects. Finally, the differences between competencies needed in traditional and in collaborative construction projects are discussed.

Keywords: project manager; competency; collaborative construction projects; project delivery method

1. Introduction

The selected delivery method for any construction project has a significant role in its success or failure. Changing business conditions, new requirements, and development of technologies are challenging traditional delivery methods and have resulted in several changes and the emergence of new ones, where collaboration between project stakeholders is of prime importance (such as project partnering, integrated project delivery, and project alliance) [1,2]. These new collaborative delivery methods in construction projects provide a different operational project environment, which can foster collaboration (working together) and cooperation (information exchange) among different project stakeholders for the good of the project.

In such an operational environment, appropriate stakeholder management is crucial to facilitate collaborative behaviors and project managers, as project leaders, are responsible for managing the project stakeholders and its atmosphere. Thus, project managers' competencies are one of the main predictors of their performance, and they need to have certain kinds of competencies to have superior performance in their job [3]. Accordingly, the role of competent project managers in successful delivery

of projects, in general, and for construction projects, in particular, has been one of the most investigated topics among the research community.

In this regard, several studies have pursued to identify project managers' competencies in general [4–8] and for specific types of project [9–13]. Those context-oriented studies have focused on different types of projects, such as construction and IT. Construction projects as one of the focused contexts, have received considerable attention for addressing project managers' competencies. Consequently, several conducted studies, mainly focused on traditional construction projects, have resulted in identification of a few competencies [14–19]. Meanwhile, as stated earlier, there have been significant changes in delivery methods of construction projects over the recent years. Particularly, the use of collaborative project delivery methods has spread gradually to facilitate new management approaches, especially for complex infrastructure projects.

Due to the changes in construction project delivery methods and the focus of construction-oriented competency studies on traditional delivery methods, collaborative construction projects and their managerial solutions are still a relatively new field, and thus, special aspects such as competencies of project managers in such projects have been studied in a very limited manner. This study aimed to identify project managers' appropriate competencies for collaborative construction projects. To that end, first, the theoretical background is presented followed by the description of the research methodology and relating research process. After that, the research results are presented together with relating discussion and their positioning with the prior research. The final chapter highlights the gained novel contributions.

2. Theoretical Background

2.1. Definition of Competency

Competency is an underlying characteristic of an individual that is causally related to criterion-referenced effective and/or superior performance in a job or situation [3]. There are also other definitions of competency in prior research. Project managers' competencies are the capabilities to use skills, knowledge, and personal characteristics that enhance the efficiency and effectiveness of project managers in their job performance and subsequently increase the likelihood of project success [20]. Abraham et al. [4] also defined competency as a range of different characteristics, behaviors, and traits that are required for effective job performance. ICB.4 (Individual Competence Baseline for project, program, and portfolio management (ICB) by IPMA) [21] states that individual competency is the application of knowledge, skills, and abilities in order to achieve the desired results. In addition to ICB, there are also other standards of practice (APM Body of Knowledge [22], PMBOK [23], and the Project Manager Competency Development framework (PMCD) [24]) that have provided definitions and categorizations of project managers' competencies.

2.2. Project Managers' Competencies in the View of Standards of Practice

ICB.4, APM Body of Knowledge, PMBOK, and Project Manager Competency Development framework (PMCD) are those standards of practice that have addressed project managers' competencies. ICB.4 [21] introduces 28 competencies of project managers in the three groups of people, practice, and perspective. In another categorization by the Project Management Competency Development framework (PMCD) [24], 16 mentioned competencies of project managers are divided into two groups, performance and personal competencies. The APM standard [22] is another reference that considers 11 competencies in two groups, interpersonal and professional. PMBOK Guide [23] also introduced a framework titled PMI Talent Triangle which considers three types of project managers' skills.

2.3. Project Managers' Competencies in the View of Research Community

The research community has been active in studying project managers' competencies in terms of both competencies of general significance (for various types of projects) and competencies of specific

significance for certain types of projects. Here, the focus is more on the studies addressing project managers' competencies in construction projects. Crawford [25], and Edum-Fotwe and McCaffer [26] conducted studies to explore details of project managers' competencies in construction projects and the correlation of project managers' competency with project success. This was followed by a study carried out by Shenhar [27] "One Size Does Not Fit All Projects: Exploring Classical Contingency Domains" in 2001; he stated that a specific project type should affect the selection of project managers, project team members, and skill development needs.

Then, other studies were conducted by Abraham et al. [4], El-Sabaa [28], Ruuska and Vartiainen [29], and Kasvi et al. [30], addressing project managers' important competencies, and competencies such as leadership, communication, and goal-orientation were identified in the results of those studies. These efforts concerning the contribution of project managers' competencies on their success and efficiency were followed by other researchers such as Dainty et al. [9], Cheng et al. [31], Gillard and Price [5], Brill et al. [32], and Suikki et al. [33], and new competencies such as analytical thinking, flexibility, and adaptability were also identified in addition to the previous ones.

Some studies focused on the required competencies of project managers in engineering projects particularly, construction ones [14,15,34–40]. The appropriateness of project managers' competencies with the project type was taken into account by Muller and Turner [37,40], and they also identified important leadership competencies in the areas of engineering and construction, IT, and organization and business. These studies were in line with Shenhar's [27] finding on the necessity of matching the project type and project managers' competencies.

Specifically, the project managers' competencies needed in construction projects have been studied in different countries. In the results of these studies, some new competencies, such as contract management and conflict management, were identified [17,41–50]. The more recent studies conducted between 2015 and 2019 suggest that the focus on investigating and identifying project managers' competencies in construction projects has been continued [13,18,51–57]. A recent study [20] concerning project managers' competencies has also shown that construction projects have been considerably focused on by the research community among the other specific project types for addressing project managers' competencies. Reviewing relevant studies resulted in a synthesis of 184 competencies of project managers for construction projects. The following Table 1 presents the top 10 competencies based on that synthesis. Ranking (R) of the listed competencies have been calculated based on their frequency of appearance.

Table 1. Project managers' key competencies in construction projects.

Competency	R	Competency	R	Competency	R
Teamwork and cooperation	1	Resource management	4	Team management	4
Cost management		Knowledge of construction		Project management	5
Communication	2	HSE (Health, Safety, and Environment)		Conflict management	
Leadership	3	Experience		Achievement orientation	
Time management		Ethics		Innovation	5
Quality management		Problem solving		Decision-making	
Flexibility and adaptability	4	Impact and influence		Analytical thinking	

R: Rank based on the frequency of appearance in literature.

2.4. What Is Missing in Project Managers' Competency Research?

Literature analysis revealed that project managers' competencies in construction projects have formed a rather popular research topic. However, the focus of conducted studies has been mainly on

traditional construction projects, and there is no clear evidence whether identified competencies of project managers in traditional construction projects are relevant in collaborative construction projects as well. This study aimed at filling this knowledge gap by identifying project managers' appropriate competencies for collaborative construction projects. The result of comparing identified competencies in this study and the found ones from literature is presented in the discussion section.

3. Methodology

The study employed two different data collection techniques, including a web-based questionnaire and semi-structured interviews. The web-based questionnaire was utilized to identify project managers' competencies by evaluating the frequency and type of their behaviors related to their everyday work. Then, semi-structured interviews were used to validate the obtained findings from completed questionnaires. The process of collecting data through the mentioned techniques is described in the following.

3.1. Web-Based Questionnaire

Self-evaluation of behavioral events is the most effective way for identifying project managers' competencies in a certain context, as competency is a concept based on behavior, and a project manager is the best evaluator of his/her own everyday behavior related to his/her job [3,58,59]. Accordingly, a web-based questionnaire, in a self-evaluation manner, was employed to identify the most appropriate competencies of project managers in collaborative construction projects. This questionnaire was sent to 24 project managers in construction projects of interest. These project managers were selected among the ongoing or recently completed alliance construction projects in Finland. In terms of the role, 10 (42%) out of the 24 approached project managers in this study are/were working as the client's project manager and 14 (58%) of them as the contractor's project manager. The categories of the studied construction projects in this study comprised residential building (housing construction), institutional construction (hospital and school), and infrastructure (road and railway construction). In total, five questionnaires were completed (June–September 2019) with a response rate of 21%. Among respondents, 20% of them are/were working as the client's project manager and 80% of them as the contractor's project manager. The following Figure 1 presents the demographic information of the survey respondents.

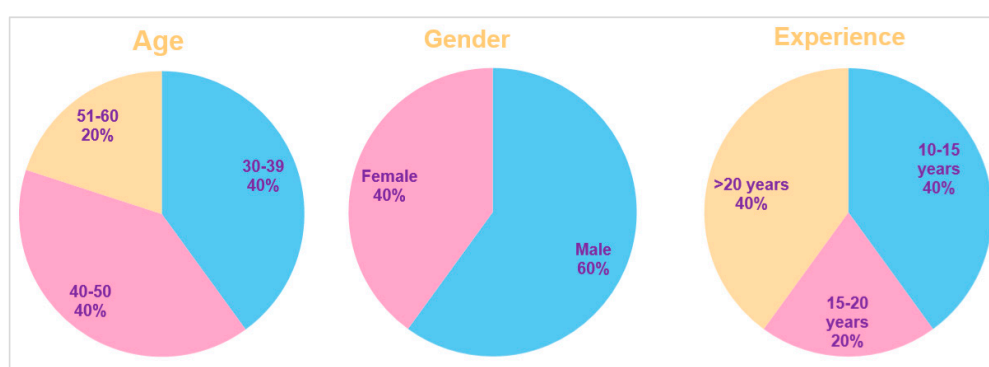


Figure 1. Demographic information of the survey respondents.

The utilized web-based questionnaire “Cycloid”, by Evolute Technology, focuses on the evaluation of key behavioral competencies of project managers based on their current state (reality), target state (vision), and creative tension (the probable gap between the current and target state: improvement-needed competencies). For this purpose, 30 behavioral competencies of project managers were evaluated through 120 linguistic statements. Respondents were asked to choose and determine the frequency of their behaviors in the situations presented by each linguistic statement on the following scale: never/seldom/often/always in their current and target state. How often these behaviors occurred

in the statements were evaluated both in current and target states through analyzing the numeric values of the current and target states of the self-evaluation results.

These 30 competencies and 120 linguistic statements were developed by Kirsi Liikamaa [6]. Liikamaa [59] has also categorized these 30 competencies into two main groups and five subgroups, including personal competencies and social competencies (see Table 2). Liikamaa's [59] categorization is based on the Goleman's [60] ontology of the five components of emotional intelligence at work, which include personal competencies (including self-awareness, self-management, and motivation) and social competencies (including social awareness and relationship management). Since its first development, Cycloid has been utilized in several studies for evaluating project managers' competencies in different contexts [6,61–65].

Table 2. Categorization of 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 management
	Cognitive ability	Analytical thinking, Conceptual thinking, Language proficiency
	Motivation	Achievement drive, Commitment, initiative, Optimism
Social Competencies	Empathy	Understanding others, Developing other people, Leveraging diversity, Organizational savvy
	Social skills	Communication, Conflict management, Management, Leadership, Relationship building, Collaboration, Teamwork

3.2. Semi-Structured Interviews

In addition, transcripts of 17 interviews were analyzed to evaluate and strengthen the reliability of the obtained results. The mentioned interviews were undertaken with practitioners of two alliance construction projects (Liekki and Rantatunneli) in Finland in 2014 and 2015. These semi-structured interviews addressed management of collaborative construction projects, overall, and the perceived required competencies of project managers in alliance construction projects, in particular. Transcripts of these interviews were analyzed to identify competencies of project managers in the context of interest and compare them with the identified competencies from the Cycloid survey. These results yielded in similar findings (Group 4), and this outcome is seen as evidence that has strengthened the reliability of the research results. Tables 3 and 4 present background information on the interviewees, survey respondents, and projects where they were/are working.

Table 3. Case projects of interviewees and survey respondents.

Data Collection Technique	Project	Owner	Contract Type	Construction Category	Budget	Duration
Questionnaire	Kanta-Häme	KHSHP	Alliance	Institutional (hospital)	-	2018–2024
	Rajatorpan koulu	City of Vantaa	Alliance	Institutional (school)	-	2018–2020
	Botnia High5	VHSHP	Alliance	Institutional (hospital)	-	2018–2022
	Asemataso	Finavia	Alliance	Infrastructure (airport terminal)	100 M€	2014–2017
	T2	Finavia	Alliance	Infrastructure (airport terminal)	200 M€	2015–2017
Interviews	Liekki	Finnish Transport Agency	Alliance	Infrastructure (railway)	100 M€	2011–2015
	Rantatunneli	Finnish Transport Agency	Alliance	Infrastructure (road tunnel)	180 M€	2011–2017

Note: Duration of projects include both their development and construction phases.

Table 4. The job profiles of interviewees and survey respondents.

Data Collection Method	Studied Projects	Participants' Job Title and Parent Organization
Questionnaire	Kanta-Häme	Project manager (contractor)
	Rajatorpan koulu	Project manager (contractor)
	Botnia High5	Project manager (contractor)
	Asemataso	Project manager (contractor)
	T2	Project manager (client)
Interviews	Liekki	Assistant Project Manager (National Transport Agency)
		Manager (National Transport Agency)
		Alliance Project Manager (Track Contractor)
		Project Engineer (Track Contractor)
		Design Manager (Track Contractor)
	Rantatunneli	External consultant, expert and evaluator (Track Consultant)
		Project Manager (Infra Contractor)
		Health, Safety and Environment Coordinator (Infra Contractor)
		Assistant Project Manager (National Transport Agency)
		Procurement Manager (Tunnel City)
		Chairman of the Alliance Executive Team (National Transport Agency)
		Planning Manager (Infra Contractor)
		Public Relations Manager (Infra Designer)
		Technical Project Director (Tunnel Subcontractor)
		Chief Structural Designer (Tunnel Subcontractor)
		Project Cost Engineer (Infra Contractor)
		Procurement Manager (Infra Contractor)

4. Results

The results are presented in four groups (1–4) based on the significance of different competencies in the current and target state of project managers as well as their creative tension and the gap between their current and target state. Finally, as a synthesis of the results the profile of project managers' competencies in collaborative construction projects is presented.

4.1. Group 1: The Significance of Different Competencies in the Current State

Group 1 presents the competencies, which the respondents have identified as the most significant in their current state based on the statements. Group capabilities competency was identified as the most significant, with the statements concerning the competency concentrating on working with others toward common goals. The second highest identified competency was trustworthiness, which is the quality of one behaving honestly and ethically. The third highest identified competency was leveraging diversity, which points to the ability of the project manager in creating opportunities for cooperation with different kinds of people. The fourth highest identified competency was leadership, the competency concentrating on the capability to engage group members as well as the project managers' ability to motivate others and to act fair toward them. The fifth highest competency was responsibility, which is being conscientious and responsible for one's own personal performance. The following Table 5 presents the complete list of the competencies identified as the highest in the current state of project managers.

Group 1 also presents the competencies that the respondents have identified as the least significant in their current state, based on the statements. The least significant identified competency was innovativeness, of which statements concentrated on the natural and open attitude towards new ideas, attitudes, and information. The second least identified competency was conceptual thinking, in which the use of concepts and abstractions to find similarities are examined. The third one was emotional awareness, which rates the ability to recognize, realize, and specify one's feelings. The fourth least identified one in the current state was initiative, of which statements evaluate the ability to assess and initiate things independently and voluntarily before obligation. The fifth least identified competency

in the current state was management, in which the ability to concentrate on management activities that are centered upon matters and things are evaluated. The following Table 6 presents the identified 10 least significant competencies of project managers in collaborative construction projects.

Table 5. The 10 highest significant competencies based on the project managers' behaviors in their current state.

Rank	Competency	Rank	Competency
1	Group capabilities	6	Relationship building
2	Trustworthiness	7	Stress tolerance (management)
3	Leveraging diversity	8	Language proficiency
4	Leadership	9	Achievement orientation
5	Responsibility	10	Flexibility

Table 6. The ten least significant competencies based on the project managers' behavior in their current state.

Rank	Competency	Rank	Competency
1	Innovativeness	6	Management
2	Conceptual thinking	7	Developing others
3	Emotional awareness	8	Decision quality
4	Analytical thinking	9	Optimism
5	Initiative	10	Production efficiency

In terms of subgroup competencies (see Table 2 for categorization), as can be seen in the following Figure 2, the competencies of social skills and self-control subgroups have been identified as the highest in the current state of project managers in collaborative construction projects.

4.2. Group 2: The Significance of Different Competencies in the Target State

Group 2 presents the 10 most significant competencies according to the project managers' behavior in their target state (Table 7). These 10 competencies are the core competencies that every project manager in collaborative construction projects is expected to possess. These competencies are those ones that, in the respondent group, were identified as the most important and desirable competencies of project managers in collaborative construction projects. The most significant competency in the target state was identified for the group capabilities, which also was the highest in the current state (group 1). The second highest identified competency was language proficiency, which also rose from its current state (group 1) as the eighth highest identified competency. Language proficiency competency points out to the ability and courage of the project manager to use foreign languages. The third highest significant competency was leveraging diversity, which in fact, is the ability of a collaborative construction project manager in creating opportunities for cooperation with different kinds of people. This competency was identified as the third highest in its current state (group 1) as well. The fourth most significant competency was stress tolerance (stress management), which evaluates project managers' ability to handle adverse, tiring, and stressful issues and situations. The fifth highest identified competency was flexibility, which is the ability of project manager to adapt to changes.

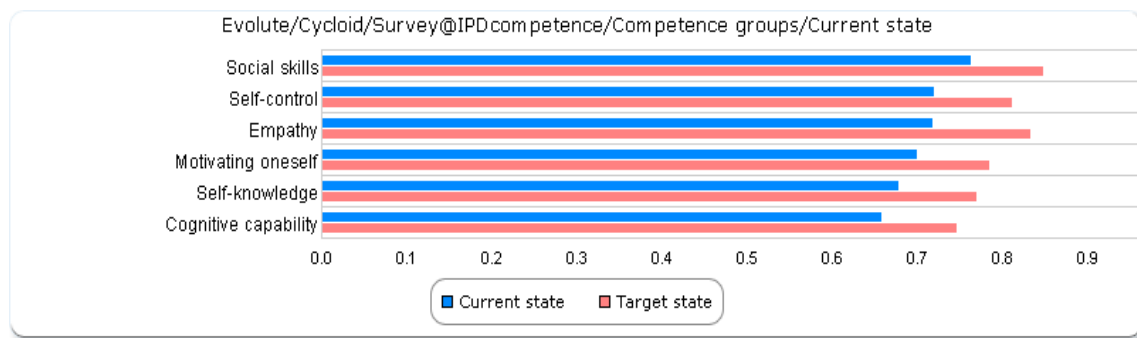


Figure 2. Project managers' subgroup competencies sorted according to their importance (current state).

Table 7. The ranking of core competencies of project managers in collaborative construction projects in the target state.

Rank	Competency	Rank	Competency
1	Group capabilities	6	Relationship building
2	Language proficiency	7	Leadership
3	Leveraging diversity	8	Maintaining order
4	Stress tolerance (management)	9	Achievement orientation
5	Flexibility	10	Understanding others

In terms of subgroup competencies, the competencies of social skills and empathy groups have been identified as the most significant in the target state (Figure 3). In terms of group competencies, it is worthy to point out that the social skills competence group has been identified as the most significant in the both current and target state (Figure 4).

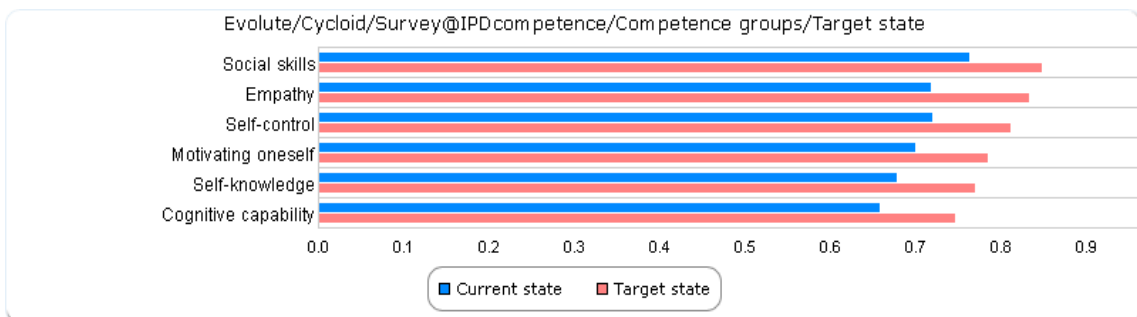


Figure 3. Project managers' subgroup competencies sorted according to their significance (target state).

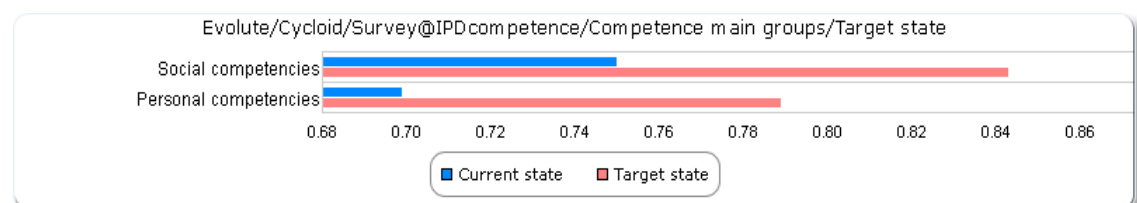


Figure 4. Project managers' group competencies sorted according to their significance (current and target state).

In a holistic view, the following Figure 5 shows the complete list of the competencies sorted based on their significance in the target state.

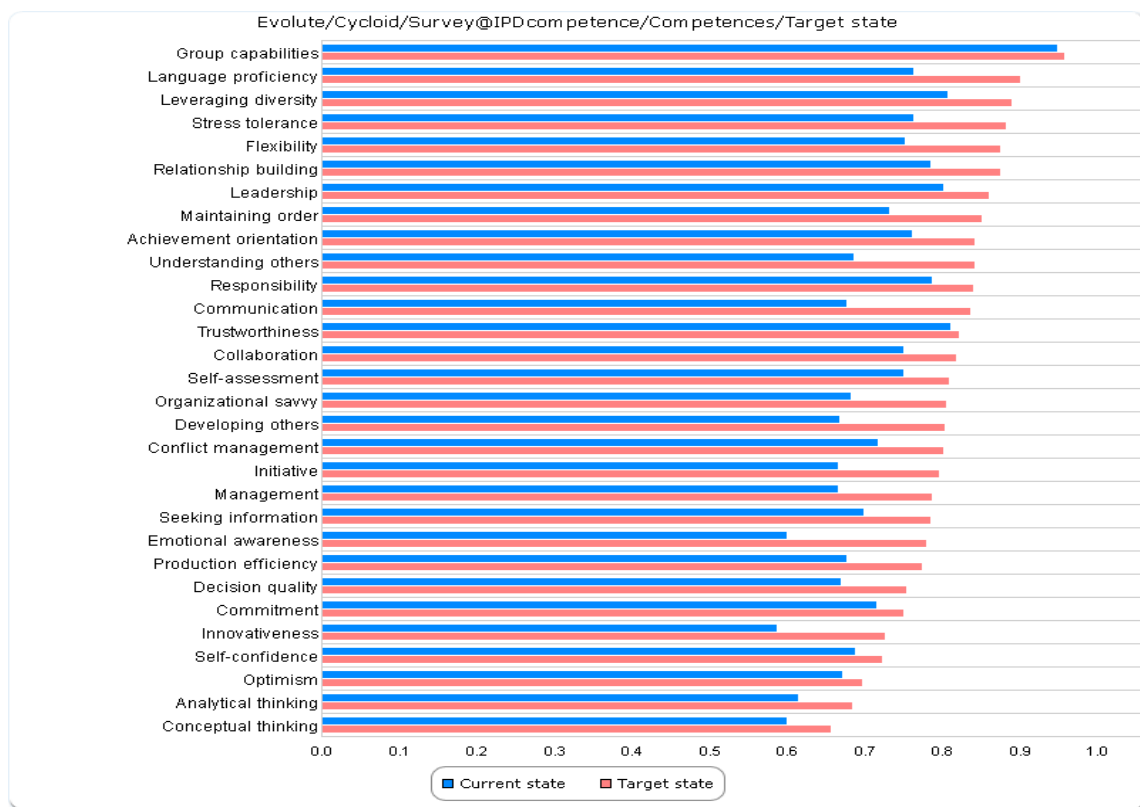


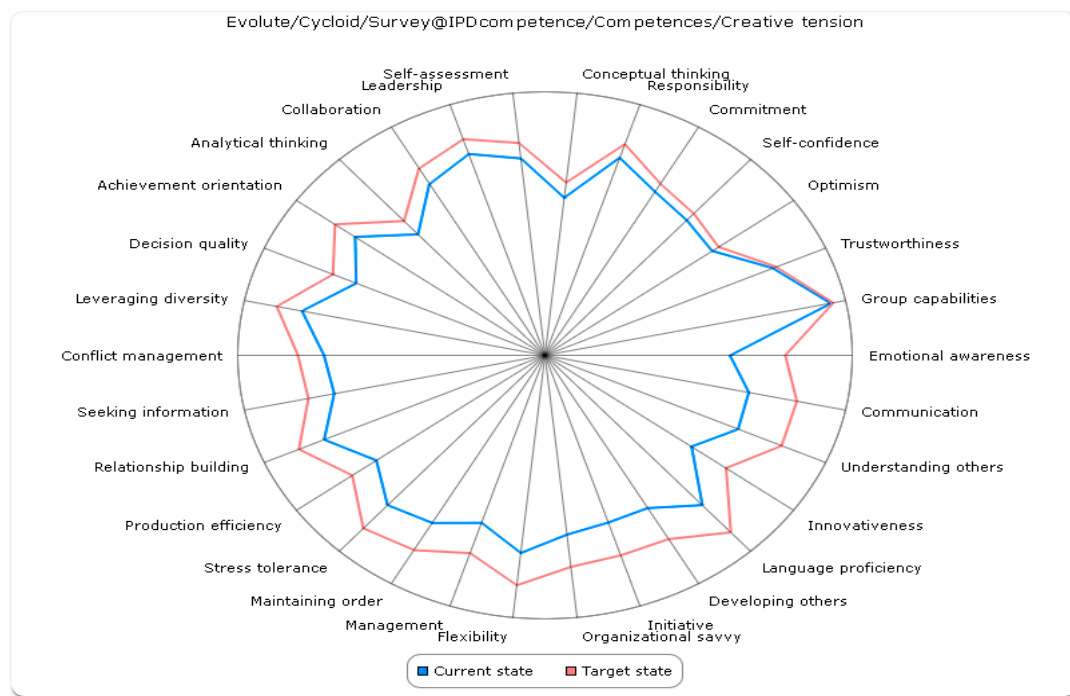
Figure 5. Project managers' competencies sorted according to their significance in the target state.

4.3. Group 3: Competencies That Project Managers Have the Most Willingness to Develop and Improve Them (Creative Tension)

Group 3 presents the competencies for which the greatest creative tension was identified, the gap between the current and target state. Here, the respondents have shown their interest to improve these competencies the most. Accordingly, such competencies are labeled here as creative tension competencies. Participants are most interested in improving their emotional awareness, which also was identified in the current state (group 1) as the third least significant competency. Emotional awareness is related to the ability of a project manager to recognize, realize, and specify others' feelings. The second competency of interest was the communication competency, of which statements concentrated on the ability of listening openly and conveying clearly. The third highest creative tension was identified for the competency of understanding others, in which perceiving, considering, and understanding the feelings and viewpoints of others is evaluated. The fourth highest creative tension was for the innovativeness competency, which also was identified as the least significant competency in group 1. Innovativeness points out to the capability of project managers in being comfortable and open with new ideas, approaches, and data. The following Table 8 and Figure 6 present the highest 10 creative tension competencies of project managers in collaborative construction projects. Figure 6 shows the amount of project managers' willingness for improving different competencies, which emanates from the gap between their current (group 1) and target state (group 2) in each competency. The bigger this gap is, the more creative tension will be formed toward improving a competency.

Table 8. The ranking of 10 creative tension competencies.

Rank	Competency	Rank	Competency
1	Emotional awareness	6	Developing others
2	Communication	7	Initiative
3	Understanding others	8	Organizational savvy
4	Innovativeness	9	Flexibility
5	Language proficiency	10	Management

**Figure 6.** Project managers' willingness to improve their competencies (creative tension).

4.4. Group 4: Profile of Project Managers' Competencies in Collaborative Construction Projects

The profile of project managers' competencies can be reasoned from their core (target state) (Table 7) and supportive (creative tension) competencies (Table 8). Core competencies are those ones that are required and necessary for everybody who is going to manage a collaborative construction project. Creative tension competencies, in fact, are those supportive ones that their presence can be supplementary for the core competencies, as can be understood from the respondents' opinions on the necessity of developing these competencies. Consequently, these supportive competencies (listed in Table 8) are expected to have three effective roles in collaborative construction projects. First, they can positively affect project managers' performance as supplementary competencies. Second, they can be considered as a competitive advantage for those project managers that possess these competencies in addition to the core ones. Third, they can be helpful for decision makers in hiring or selecting project managers for their collaborative construction projects in the sense that those project managers possessing these competencies in addition to the core ones can be outweigh others.

Figure 7 present the resultant profile of project managers' competencies in collaborative construction projects. Among the listed competencies in Table 8, three of them—understanding others, language proficiency, and flexibility—were eliminated from the list of supportive competencies since the category of core competencies already includes those. Figure 7 comprises four sections that are competence category, a brief description of each category, the competencies belonging to each category, and their definitions.

The profile of project managers' competencies in collaborative construction projects			
Competence Category	Description	Competency (ranked based on importance)	Competency definition
Core Competencies	Necessary and required for superior performance	Group capabilities	The ability of working with others toward common goals.
		Language proficiency	Ability and courage to use foreign languages.
		Leveraging diversity	Appreciative attitude towards others. Respecting people from different backgrounds.
		Stress tolerance (management)	To maintain performance when facing workload pressures and/or organizational impediments.
		Flexibility	To be open to new experiences and viewpoints.
		Relationship building	Building or maintaining friendly relationships or networks of contacts with people who are or might be useful in achieving work-related goals.
		Leadership	Management activities that are centered upon human beings.
		Maintaining order	Concern for order, quality, and accuracy.
		Achievement orientation	The drive towards a high standard of excellence. Setting challenging goals and working hard to achieve them.
		Understanding others	The ability to sense the feelings and perspectives of other people.
Supportive Competencies	Competitive advantage and supplementary for superior performance	Emotional awareness	The ability to recognize, understand, and analyze one's own feelings.
		Communication	The ability to listen to others. The ability to openly express one's feelings, ideas, and opinions. The ability to read non-verbal cues.
		Innovativeness	Natural and open attitude towards new ideas, attitudes, and information.
		Developing others	Noticing other people's needs for development and promotion of their abilities.
		Initiative	The ability to see new possibilities and to seize opportunities. To do more than what is expected.
		Organizational savvy	Understanding and utilizing organizational dynamics in order to achieve objectives.
		Management	Management activities that are centered upon matters and things.

Figure 7. The profile of project managers' competencies in collaborative construction projects.

4.5. Data Validation

The interview data were used as another research basis. Transcripts of these interviews were analyzed through content analysis to identify competencies of project managers in collaborative construction projects and compare them with the identified competencies from the web-based survey (Cycloid). The following Table 9 shows the detected competencies from interviews.

Table 9. Project managers' competencies in collaborative construction projects, identified from interviews.

Organizational Savvy	Project Knowledge
Collaboration/cooperation/teamwork	Understanding others
Leadership	Analytical thinking
Flexibility and Adaptability	Delegation of authority
Management	Experience
Communication	Alliance construction management knowledge

As can be understood by comparing the identified competencies from a web-based survey (Figure 7) and interviews (Table 9), it becomes clear that more than 70% of identified competencies through interviews were also among the found ones from the survey. This match between two types of results is seen as an indication of conformance between findings. Moreover, results of analyzing interviews transcripts lead to identification of three competencies, which were not among the list of competencies identified through Cycloid. These competencies include alliance construction management knowledge, experience, and delegation of authority.

5. Discussion

The first group of results showed the most and least significant competencies in the current state of project managers in collaborative construction projects. Group capabilities, trustworthiness, leveraging diversity, and leadership were the four highest valued competencies in the current state of collaborative construction project managers. This seems to be in line with the expectations from the project managers

in collaborative construction projects, as part of their responsibility is to manage the projects, and in which one of their principles is cooperation and trust-based relationships among all participants for the good of the project [1,2]. In such a collaborative environment, leadership ability is also crucial in order to take full advantage of the mentioned principal. Concerning the four least significant competencies, including innovativeness, conceptual thinking, emotional awareness, analytical thinking, and initiative, it is quite surprising because these competencies (except emotional awareness), in general, are referred to as the necessary competencies for managerial level jobs [3,58]. Therefore, project managers in collaborative construction projects are expected to possess these competencies, as the areas requiring improvement. Subsequently, findings on the creative tension (supportive) competencies (Group 3) make it clear that among the ten least significant competencies in the current state of collaborative construction project managers, they have willingness for improving five (50%) of them, including innovativeness, emotional awareness, initiative, management, and developing others.

Group 2 included the most significant competencies of project managers in their target state, which later were termed as their core competencies. Here, group capabilities, leveraging diversity, relationship building, and maintaining order are among the ten most significant competencies in the target state (Table 7). This is not surprising as we have already stated that these competencies are highly required for project managers in the collaborative construction projects. In addition, there are six other competencies among the ten most significant ones in the target state, which were not high in the current state. The first one was language proficiency, which surprisingly has been identified as the second core competency of project managers. This can be mainly emanated from the fact that utilizing foreign languages (particularly English) in Finnish construction projects has been considerably increasing during recent two decades. Accordingly, project managers in Finnish collaborative construction projects see language proficiency as a core competency for their success. The importance of language proficiency also emphasizes the need to be able to communicate more in a collaborative environment and this then also makes the language more critical. The second one was flexibility. The nature of collaborative construction projects considerably increases the amount of interactions between project participants. Project manager needs to be open to several various opinions and be able to manage multiple demands, resulted from those interactions, without losing focus, as the leader of the project. Thus, the flexibility competency seems to be completely necessary for project managers in collaborative construction projects.

Maintaining order and achievement orientation are the next competencies identified as the highest in the target state. A very important goal of collaborative construction projects is the concern for quality, which is most often is sacrificed in traditional construction projects for meeting time or cost targets [1]. One other important goal in collaborative construction projects is the orientation toward excellent results through setting and meeting the challenging goals [2]. The two mentioned competencies, maintaining order and achievement orientation, precisely account for these goals, and therefore are of prime importance for project managers in collaborative construction projects. The last one is relationship building. As already stated, collaborative and trust-based relationships are principally required to set and meet the common goals for the good of the collaborative construction projects. Conceptually, relationship building is the ability of establishing or maintaining friendly relationships or networks of contacts with people who are or might be useful in achieving work-related goals. Accordingly, the relationship-building competency is completely needed for establishing effective and trust-based relationships in the collaborative construction projects.

Moreover, project managers' core and supportive competencies, together, characterized the profile of their competencies in collaborative construction projects. This finding is originated from project managers' self-evaluations concerning their competencies. Self-evaluation in a behavioral manner is one of the most valid and effective methods in conducting competency studies [3]. This competency profile of project managers contributes to the existing knowledge and brings new insights on project managers' competencies in collaborative construction projects, particularly in the Finnish context.

Finally, based on the obtained results, it looks obvious that there are differences between the required competencies for project managers in traditional and collaborative construction projects. Whereas the managerial competencies for traditional construction projects highlight the significance of systems and methods, the recognized competencies of relevance for collaborative construction projects draw attention to human issues and management. This argument can be supported from two aspects. First, looking at top 10 competencies identified from literature (Table 1) and those competencies from survey and interviews (Figure 7 and Table 9), competencies such as time management, quality management, and human resource management, which have been important in traditional construction projects, are no longer focused in collaborative construction projects. Second, looking at the competencies detected in this study, it seems that the importance of competencies (such as understanding others and stress management) related to human issues and in particular, behavior of project managers in collaborative construction projects, have increased.

Moreover, the body of needed competencies in traditional and in collaborative construction projects may well emanate from the differences between the working culture, management style, and business model of traditional and collaborative construction projects. The working culture in collaborative construction projects is based on trust, cooperation, effective communication, and teamwork whereas traditional construction projects suffer often from mistrust, adversarial relationships, and ineffective communication [1,2]. The type of culture in collaborative construction projects needs a project manager whose management style helps him/her to trust project team members and foster teamwork and effective communication [66]. To that end, competencies such as group capabilities, language proficiency, leveraging diversity, flexibility, relationship building, and understanding others are here characterizing the needed culture as mentioned by this study (Figure 7). Then, a business model comprising elements such as fixed profit and profit based on project outcome (shared risk/reward system) needs a project manager who can lead all project practitioners toward a common goal by aligning their commercial interests toward project efficiency as a whole. Such a project manager needs competencies such as leadership, management, and developing others (see Figure 7). In other words, project managers in collaborative construction projects are managers of people rather than managers of systems and technology. Therefore, in collaborative construction projects the behavioral competencies related to human issues are of prime importance, whereas in traditional construction projects the key competences are around systems and methods.

6. Conclusions

This study aimed at evaluating project managers' competencies in collaborative construction projects, especially in a Finnish context, to identify the most appropriate ones suiting the context of interest. It was carried out through undertaking qualitative research to analyze project managers' behaviors related to their everyday work. The obtained results provide the basis for the following conclusions concerning the collaborative construction projects:

- Project managers' 10 core competencies (necessary for their superior performance) comprise group capabilities, language proficiency, leveraging diversity, stress tolerance (management), flexibility, relationship building, leadership, maintaining order, achievement orientation, and understanding others.
- The seven supportive competencies (supplementary for core competencies) of project managers were found to be emotional awareness, communication, innovativeness, developing others, initiative, organizational savvy, and management.
- There are four competencies that were found to be very important in both current and target state of project managers. These are group capabilities, leveraging diversity, relationship building, and maintaining order.
- Project managers have a strong willingness to improve the emotional awareness, communication, innovativeness, developing others, initiative, organizational savvy, and management competencies that are not high in their current state.

- The profile of project managers' competencies can assist them to cover their competency deficiencies and help decision makers in companies to hire or select the right person as a project manager.
- The recognized competencies of relevance draw attention to human issues and management, whereas the managerial competencies for traditional construction projects are highlighting the significance of systems and methods.

These findings provide new insights for project managers of collaborative construction projects in terms of possessing the competencies necessary for their superior performance, and their managers to be aware of project managers' core and supportive competencies in collaborative construction projects. Since 2011, the total value of launched alliance-type construction projects in Finland is more than EUR 3 billion. This highlights the importance of this study's findings for contributing to the existing knowledge on project managers' competencies in collaborative construction projects. Finally, it should be acknowledged that the generalizability of the findings of this study is rather limited due to its scope, which includes project managers of collaborative construction projects in Finland. Therefore, studies on project managers' competencies in collaborative construction projects in various regions and business conditions is a potential area for further research.

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