MASTER THESIS

Assessing the capacity of contractors to collaborate and perform in a client-contractor team

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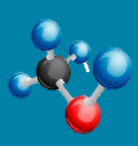

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Assessing the capacity of contractors to collaborate and perform in a client-contractor team

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Abstract:
In construction projects, the client-contractor team performance has been crucial for the success of a project. A project team is efficient and high performing when relational and collaborative traits are present. Therefore, an essential mission of the client, at the beginning of a project (in the partner-selection stage), is to assess the capacity of the bidders to relate and collaborate, towards selecting the most suitable partner with whom the client could have a good relationship, and work effectively together. The relevance of these collaborative traits for team performance has been proven in literature. However, how the *assessment of the capacity of contractors to collaborate and perform in a client-contractor team* has not been properly addressed. Therefore, the objective of this study is to: 1) Identify which categories could be used to assess the contractor's capacity to collaborate and perform with the aims to increase team performance, 2) Investigate instruments that could be used for the assessment, and 3) Propose a general procedure for the assessment of contractors during the partner-selection process. Qualitative research methods such as interviews and an expert panel session were used to contextualize what is found in the literature to the construction industry. Results revealed that *team dynamics* is the main category for the assessment of contractors through competencies trust, communication, mutual respect, team learning, and ability to deal with different interests. *Individual matching* and *organizational cultural congruence* are considered as supportive categories to sustain and validate the results of the *team dynamics* assessment. Out of this research, it is recommended to: 1) use the TDA instrument to assess the team dynamics competencies, 2) use the EII instrument (that can assess *individual matching*) to strengthen further the argumentation of results in the competencies trust, communication, mutual respect, and team learning, and 3) use the OCAI instrument (that can assess *organizational cultural congruence*) to strengthen further the argumentation of results in the competencies trust, communication, and team learning. Additionally, a procedure for contractors' assessment in the partner selection process, as well as the challenges and conditions for a proper assessment, are addressed.

Keywords:
Contractor assessment; collaboration; team dynamics; individual matching; organizational cultural congruence; team performance; partner-selection process.

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1. Introduction

In construction projects, where people from the client and contractor organizations work together over a long period, the performance of the said organization has been reported to be crucial for the success of the project [1]. A project team (i.e., client-contractor team) is efficient, and they perform highly when relational and collaborative traits are present [1]–[4].

In literature, it has been recognized that in highly collaborative and performing partnerships, the client and contractor dynamics are similar to a team working as a unit towards the execution of the project (*team dynamics*) [5]. Additionally, the composition of individuals working in the project team (*individual matching*) and the matching of the organizations' culture (*organizational cultural congruence*) are factors that could give insights into their capacity to collaborate and perform.

To potentially ensure high performance, an essential mission of the client, at the beginning of a project (in the partner-selection stage) [6]–[8] is to assess the capacity of the bidders to collaborate [9], towards selecting the most suitable partner with whom the client could have a good relationship, and work effectively together.

Some studies state the importance of client-contractor collaboration in team performance in construction projects [1]–[3]. Other studies highlight the relevance of assessing and selecting project partners at the beginning of a project [6]–[8]. However, in the construction-related literature, what should be assessed and how the "assessment of potential contractors' capacity to collaborate and perform" should be done in the context of the partner-selection processes is not properly addressed.

Therefore, the objective of this study is to contribute to research in this field by: 1) identifying which categories could be used to assess the contractor's capacity to collaborate and perform in a client-contractor team, with the aim to increase team performance, 2) Investigating instruments that could be used for this assessment, and 3) Proposing a general procedure for the assessment during the partner-selection process. Clients could apply the findings of this study to assess bidders based on the behavioral and collaborative traits towards forming high performing client-contractor teams.

This document is structured as follows: Chapter 2 "Literature review," provides an overview of team assessment in general settings, showing what is measured and how it is done. In chapter 3, there is an explanation of the qualitative methods used to obtain empirical information to understand the context of contractor assessment for partner-selection purposes in the construction industry. Then, the results are presented in chapter 4. The information of the literature review and empirical results are discussed in chapter 5. Finally, chapter 6 shows, among other things, conclusions, practical implications, and recommendations to practitioners.

2. Literature review

2.1 Assessment categories

Literature review in the construction industry and team assessment, have shed light on the importance of a good relationship and collaboration between team members to increase team performance [1].

Research in fields such as team assessment, team staffing, and relational partnership, have revealed that *team dynamics* (the behavioral relationships in a team) [5], *individual matching* (the composition of the team) [10] and *organizational cultural congruence* (cultural alignment between two partner organizations) [11] can explain the capacity of a team to collaborate and perform.

A direct approach to analyze the collaborative behavior of a team is by using the category *team dynamics*, which deals with attitudes and behavioral patterns of the team [12]. *Team dynamics* is influenced, among other factors, by individuals, culture, and environment [5]. However, the category *team dynamics* does not include the analysis of individual-level characteristics, which are considered the primary input for the performance of the team [13]. The assessment of *individual matching* could provide an opportunity to support the *team dynamics* assessment by giving insights into the composition of individuals in the team and how this composition influences its performance. In the case of collided teams, as in the case of the construction industry teams, where the client and supplier (usually referred to as contractor in the construction industry) come together to work on a project, cultural factors become even more relevant. This is because the project managers joining the collided organization come with a pre-set culture adopted from their "mother" organizations (either client or supplier), and their fit in the collided team is essential for its performance [14]. Hence, the categories *individual matching* and *organizational cultural congruence* are indirect approaches to analyze the collaborative behavior of a team by focusing on relevant factors (individuals and organizational culture) that influence the category *team dynamics*.

In the partner-selection process, these three categories could be used to assess the capacity of the contractor (i.e., supplier) to collaborate and perform in a client-contractor team, being *team dynamics* the main category, and *individual matching* and *organizational cultural congruence* supportive categories. The three categories, as well as their indicators, are further elaborated next.

2.1.1 Team dynamics

The category *team dynamics* implies that teams are entities that have qualities that are not appreciated by just analyzing the members of the team, since, as suggested by the philosopher Aristotle, "the whole is greater than the sum of its parts" [15]. *Team dynamics* states that there are unconscious, psychological forces that impact the behavior and performance of the team [5]. By assessing the contractor organization while interacting in the client-contractor team, it might be possible to capture the unconscious forces that are only visible when the collided team is together. *Team dynamics* is assessed by analyzing a group of competencies required in a team to collaborate, coordinate, and perform efficiently.

Team dynamics competencies

Table 1 shows a list of elements found in literature, that can be used as team dynamics competencies. This list comes from six studies, where the focus is on partner selection, high performing teams, and collaborative relationships. The field of two of the studies is the construction industry, while the areas of the remaining four are varied.

Table 1: *Team Dynamics* competencies found in the literature.

Competence	Ref.	Competence	Ref.	Competence	Ref.
Communication*	[16], [1]	Impact	[17]	Propensity to adapt	[18]
Trust*	[16], [1]	Team enthusiasm	[19]	Coordination*	[1]
Dependability	[17]	Self-management	[19]	Balanced contribution*	[1]
Psychological safety	[17]	Goal orientation	[19]	Mutual support*	[1]
Joint risk management*	[16]	Task orientation	[19]	Aligned effort*	[1]
Long term orientation	[18]	Stakeholder orientation	[19]	Cohesion*	[1]
Structure and clarity	[17]	Leadership	[19]		
Meaning	[17]	Team learning	[20]		

*Competencies from the construction industry literature.

In Table 1, there are twenty-two competences that showed a connection with collaboration and team performance. As observed, the large number of competencies indicate that the studies yielded different results. This might be because behavioral science, as part of the psychology branch, is a complex and non-exact science [21], and the definition of the "essential competencies" is still an ongoing task. Differences could also be related to the different contexts where the competencies where suggested. For instance, Leeuwendaal [19] which focus on public organizations, indicates that among the essential competencies are goal orientation, team enthusiasm, stakeholder orientation, among other; while Emden et al. [18] consider that long-term orientation and propensity to adapt are essential in selecting the partner for new product development.

Nevertheless, two commonalities are observed. Doloi [16] and Suprapto [1] talked about the importance of communication and trust in relational and collaborative partnership in the construction industry. Doloi [16], in a survey study done to contractors, architects, consultants, and owners of construction firms, found that communication highly influences success in relational partnering. Trust is also important, and it is mutually inclusive for effective communication. Additionally, it was found that trust directly influences joint risk management. Similarly, Suprapto [1] conducted qualitative and quantitative empirical studies through surveys focusing on Dutch-process industry competence work to understand how collaborative relationships could be designed and developed to enhance project performance. He found that when both teams openly communicate and trust each other, team performance is enhanced in collaborative partnerships.

Communication and trust, together with mutual respect, were also mentioned in the form of psychological safety in another study regarding team effectiveness within a large software development company, where 180+ internal teams were studied. Psychological safety is promoted when team members feel safe to opine, take risks, and be vulnerable in front of each other [17]. These conditions are similar to the ones described by Doloi [16] and Suprapto [1] when they discuss communication and trust in partnerships.

As observed, many competencies are related to collaboration and team performance, communication and trust being crucial, in the construction industry as well as in other industries. However, it is not clear which competencies should be used in the specific context of contractor assessment for partner selection purposes in the construction industry.

2.1.2 Individual Matching

Some researchers suggest that among all the factors involved in the successful execution of a project, the most influencing factor is the individuals forming the team [13]. Hence, efficient teams should be composed of people who can collaborate and work well together [10].

In contrast with the category *team dynamics*, where the team is assessed by analyzing team-level indicators (i.e., competencies such as mutual respect and team learning); the category *individual matching* (also known as team composition), analyzes the characteristics or attributes of each individual [22] and how the mix of these influences team performance [23].

In order to obtain team-level results, first, the individual-level attributes from team members are obtained through tests or interviews [24]. Then, these individual results are brought together and further analyzed. Finally, the results of the team are presented.

Some attributes that appear in literature and can bring insights about the kind of individuals forming a team are personality traits, emotional intelligence, roles, talents, among others.

Emotional Intelligence

Emotional intelligence is the capability of people to understand their own emotions and others' emotions, differentiate and distinguish between different feelings, and use emotions properly to orientate thinking and behavior. An emotionally intelligent individual can adjust emotions to manage relationships with others, adapt to circumstances, and accomplish individual or team goals. Some researchers suggest that 80% of a person's success is attributed to emotional intelligence [25].

Emotional intelligence is assessed through four abilities 1) the ability to perceive emotions in oneself and others, 2) the capability to use emotions to facilitate thinking, 3) the ability to understand emotions, and 4) the ability to manage emotions [26]. These abilities are scored using ten-point scales, which are averaged to obtain an overall *Emotional Intelligence* score for each individual. The score of the team is obtained as the average of the scores of all team members.

In literature, it is suggested that high emotionally intelligent teams efficiently collaborate and perform [27]. Specifically, these teams have high levels of trust [28], [29], communication [29], mutual respect [30], [31], and team learning [32], [33]. Hence, for partner selection purposes, partners with a high average score of *Emotional Intelligence* are preferred.

Personality traits

Personality traits are qualities or characteristics of a person [34]. They are relatively stable over time and define behavior patterns that are hardly modifiable [35]. Hogan [36] states that the tendency of a person to behave and interact with others successfully is related to his/her personality. Many researchers report that the personality of members may be a suitable predictor of future performance, and they may be a useful assessment tool in selection decisions [37].

Many concepts address the personality traits of individuals. The two most relevant are proposed by Robert McCrae & Paul Costa in 1940 [38], and Carl Jung in 1921 [39].

Robert McCrae and Paul Costa summarized all personality traits into five traits [10]: 1) Conscientiousness (tendency to show self-discipline. It is related to how people control and direct their impulses [38]), 2) Extraversion (extroverts tend to engage with the external world, as opposed to introverts that prefer to be reserved and independent [40]), 3) Agreeableness (Agreeable individuals value getting along with others. They are generally generous, trustworthy, and helpful [41]), 4) Neuroticism (is the tendency to experience negative emotions such as anger, anxiety, or depression [42]), and 5) Openness to Experience (They are intellectually curious, sensitive to beauty, open to emotions, and willing to try new things [43]). These are referred to as the Five-Factor Model (FFM), which is the most accepted personality trait concept [44]. A sixth personality trait, honesty-humility (tendency to avoid manipulating others for personal gain, feel little temptation to break the rules, and uninterested in: lavish wealth, luxuries, and elevated social status [45]) was later added by Ashton and Lee [46]–[48].

On the other hand, Carl Jung presents three personality types in pairs 1. Introversion/Extraversion, 2. Sensing/Intuition, and 3. Thinking/Feeling. Furthermore, a fourth type, Judging/Perception, was added by Myers and Briggs. A person is characterized by one element from each category, forming in this way, 16 personality types [49].

The Costa and McCrae personality traits of extraversion, openness to experience, agreeableness, and conscientiousness are correlated with the Myers and Briggs' Introversion/Extraversion, Sensing/Intuition, Thinking/Feeling, and Judging/Perception, respectively [44].

For the assessment of the personality traits that come from the first concept, a numerical scale is used. For instance, the instrument Big Five uses a 100-point scale, and HEXACO uses a five-point scale. Individuals are tested, and the results for each personality trait are presented. Then, the score of the team is obtained per each category. In team performance literature, the high average of conscientiousness and agreeableness of the team [50]–[53], and low variance of the results of honesty-humility of the team [27] explain high team performance. Hence these three statistic indicators could be used for the assessment of contractors.

For the assessment of the personality types that come from the second concept, the participants take the test, and the results come in the form of the combination of one element per category. For instance, an INTP type means that the participant has a preference of Introversion over Extroversion, Intuition over Sensing, Thinking over Feeling, and Perceiving over Judging. According to Jensen *et al.* [54], when applying the MBTI instrument (which is based on Jung's concept), high performing teams should include these 5 types of individuals 1. An Extroverted Intuitor (E N ? ?), 2. A Judger (? ? ? J), 3. A Perceiver (? ? ? P), 4. A Thinker (? ? T ?), and 5. A Feeler (? ? F ?). Although Jensen recommends some types of personalities needed in an efficient team, the generalization of this finding becomes unclear when the number of members is different from five.

Role

It is a combination of an individual's behavior, attitudes, and values assigned to a person in a social environment. It refers to the "character" people are best suited to take on or adopt in the workplace [55]. However, it is not entirely fixed in a person, meaning that a person could assume a different role if circumstances warrant [13].

According to Belbin [56], there are nine roles that a person can adopt in a team. They can be classified into three groups action-oriented, people-oriented, and thinking roles. Within the action-oriented roles, implementer (the effective organizer of the team), shaper (the slave driver), and completer finisher (the one who guarantees delivery) types can be found. On the other hand, coordinator (the team controller), team worker (the internal facilitator), and resource investigator (the creative negotiator) belong to the group people-oriented roles. Finally, the roles for the group thinking are plant (the source of original solutions), monitor evaluator (the analyzer of problems), and specialist (the one who provides in-depth experience).

The assessment is focused on determining the role of each team member. This would help to analyze how balanced the team is in terms of roles. Belbin [56] suggests that all nine roles should be present in a team to perform highly. A similar idea is presented by Senior [57], who adds that the higher the roles present in a team, the better the probability of performing highly. However, Batenburg [58] argues that creating a balanced team does not always lead to efficient performance.

Talent

It is an innate ability or aptitude of a person that has not being taught [34]. Based on the theory of Henry Murray, TMA specialists (providers of the TMA instrument) suggest that there are forty-four talents. Eight of them are related to emotional balance, ten of them are social talents, eight are influential talents, six are related to general motives of a team, 6 are leadership talents, and finally, the last 6 are organizational talents [59].

The assessment of the teams is done in three steps. First, the customer's expectations in terms of the behavior of the team (i.e., the customer selects the characteristics of a high performing team according to their needs) are obtained. Second, the talent of the team members is unveiled with an interview or filling a test. Finally, the results of the teams are compared with the customer's expectations. No further information about the assessment using talents or the characteristics of a high performing team was found.

As observed, many attributes could be used as indicators of high performance for the category of *individual matching*. It is still unclear, though, which attribute should be used in the construction industry for bidders' assessment.

2.1.3 Organizational Cultural Congruence

According to literature, culture is the composition of cognitions, expectations, mindsets, values, and norms within an organization [60]. Culture influences the decision-making of organizations, the way the team organizes their task, and it shapes the behaviors of team members [18].

Cadden et al. [61], highlight the importance of assessing organizational cultural distance early in a project. The necessity for assessing *organizational cultural congruence* emerges because the collided organization is the product of joining two independent organizations (i.e., the client and contractor) to work together in a construction project. The fit of their cultures has been reported to be an element that explains their performance [11].

It is necessary to highlight that the focus is on the organizational culture and not on the national culture. In a survey of executives from international joint ventures between Indian companies and companies from other countries, the perceived issues on performance due to the cultural distance between partners happened more because of the organizational culture rather than national culture [62].

When partners have matching cultures or at least a certain level of congruence, they overcome issues more quickly; communication is more effective; team members are more likely to trust and understand each other [63], work toward common goals, and facilitate team learning [64]. Parkhe [65] stated that when in a partnership, there is cultural diversity and procedural differences, said diversity could cause adverse effects on collaboration.

Some researchers argue that more important than culture fit is the capacity of the partners to understand and accept cultural differences [66], however other researchers suggest that dealing with cultural differences is laborious and, in some cases, unfeasible [67]. According to many negotiators, when talking about outsourcing partnerships, they stated that they felt more comfortable when the cultural fit existed [14].

2.2 Instruments for assessment

There are many instruments available that could be used for the evaluation of contractor organizations in terms of the three categories. An overview of the instruments that come from the literature can be found in Annex 1, where information such as definition, attribute/indicator considered, connection with team performance, and a process to apply the instrument, among others, can be found. Below, is a summary of the findings.

No instrument can assess the three categories *Team Dynamics*, *Individual Matching*, and *Organizational Cultural Congruence*. Only the instrument Supply Chain Dyadic Relationship predictor (SCDR) can give insights into the two categories *Team Dynamics* and *Organizational Cultural Congruence*. The remaining instruments assess just one category.

Team Dynamics

In order to assess the dynamics of the contractor in a client-contractor team, three instruments were found. These are Team Dynamics Assessment (TDA) [68], [69], Compatibility and Trust Assessment (CaT) [70] and SCDR [66]. To use these instruments for selection purposes, a workshop in which the participants (members of the client and contractor organization) get acquainted and work on cases similar to real project-related situations, is used. These project-related situations trigger stress to the participants, and the contractor's real behavior is revealed. For TDA, the assessment is done by experts who analyze the behavior based on a set of competencies required in a team to collaborate and perform. The set of competencies vary depending on the kind of project and the consulting firm doing the assessment. For instance, one consulting firm uses 1) The ability to set clear goals, 2) The ability to take mutual responsibility. 3) Open communication, 4) Mutual respect, 5) Flexibility in cooperation, and 6) The ability to take initiative as competencies to be used for every assessment [71]. Additionally, consulting firms add extra competencies in the assessment depending on the specific demands of the project. To score each competence, the observers use an ordinal scale. One option is to use a five-point ordinal scale and give a score depending on the performance of the bidders in terms of each competence (1 point: Poor, 2 points: Insufficient, 3 points: Sufficient, 4 points: Good, and 5 points: Excellent).

For the SCDR and the CaT, the participants fill out a questionnaire regarding the relationship between the two parties involved in the assessment. The competencies assessed by both instruments are fixed. In the case of CaT, the competencies assessed are trust, innovation, communication, team orientation, and focus [70]. On the other hand, SCDR assesses the competencies of creativity, stability, communication, reliability, and value.

It can be noticed that TDA allows analyzing a wide range of competencies, while the SCDR and the CaT focus on specific competencies. For more information about these instruments, refer to Annex 1.

These three instruments are meant to assess the dynamics of the team (i.e., client-contractor team). In order to use these instruments to assess the behavior of contractors alone in a client-contractor team, only the performance of the contractor could be assessed.

Individual Matching

The instruments that assess individual's attributes are divided in 4 groups. 1) Personality traits: Big Five [37], HEXACO [47], Insights Discovery [72], DiSC [73], MBTI [49], Rorschach [74], MMPI (Minnesota Multiphasic) [75], and PAI [76]. 2) Emotional Intelligence: Emotional Intelligence Instrument (EII) [77]. 3) Roles: Belbin team role inventory [78]. 4) Talents: TMA [79].

However, as observed in section 2.1.2, to assess individual matching in a team, the individual-level instrument must show evidence of a connection between the results of all individuals in a team and team performance. From the above-

listed instruments, it was not found in the literature that Insights Discovery, Rorschach, MMPI, and PAI comply with this criterion. Furthermore, for Belbin team role theory (for roles) and TMA (for talents), the connection with team performance was found; however, the applicability of roles and talents for assessment of teams for selection purposes remains unclear (see section 2.1.2).

The instruments that assess personality types that comes from the concept of Jung are MBTI and DiSC. MBTI is able to analyze all the four types (Introversion/Extroversion, Intuition/Sensing, Thinking/Feeling, and Perceiving/Judging) [80], meanwhile DiSC assesses types of behavior that are correlated with two of the personality types Introversion/Extroversion and Thinking/Feeling [81]. As observed in section 2.1.2, it is recommended to have five essential personality types within a team. However, it remains unclear how to find efficient teams when the number of members is different from five.

On the other hand, the instruments applying the concept of Costa and McCrae are the Big Five (Five personality traits: openness, conscientiousness, extraversion, agreeableness, and neuroticism) [45] and the HEXACO (Five personality traits + honesty-humility) [10]. As seen in section 2.1.2, the personality traits that explain team performance are conscientiousness (high average), agreeableness (high average) [50]–[53] and honesty-humility (low variance) [27]. HEXACO assesses the three personality traits; meanwhile, the Big Five assesses just agreeableness and conscientiousness.

EII is the instrument that assesses *Emotional Intelligence*. Four abilities are measured 1) the ability to perceive emotions in oneself and others, 2) the ability to use emotions to facilitate thinking, 3) the ability to understand emotions, and 4) the ability to manage emotions [26]. These four abilities are used to obtain the overall emotional intelligence of the individuals. The average of the team member's emotional intelligence explains team performance [27]. Hence, for partner selection purposes, teams with a high average score of *Emotional Intelligence* are preferred.

Organizational Cultural Congruence

Finally, for the assessment of *organizational cultural congruence*, the instruments Organizational Cultural Assessment Instrument (OCAI) [82] and SCDR [66] could be used. OCAI focuses on characterizing and defining the culture of the client and the potential contractors. SCDR analyzes the degree of understanding and acceptance of one party about the other party's culture. For the use of SCDR, an acquaintance between client and supplier is necessary, while for OCAI this is not the case. Another identified difference is the fact that for SCDR, culture is only one dimension with only five questions to identify cultural congruence [66]. OCAI, on the other hand, focuses entirely on the definition of the organizational culture [82].

All the instruments presented in the three categories above, should meet the criteria settled in "The guiding principles of public procurement" [83], so they can be used in public procurement in the European Union. These criteria are Proportionality (does the instrument uses appropriate criterion to achieve the objective and not go beyond the necessary?), Transparency (do the bidders clearly understand the process and selection criteria?) and Non-discriminatory (does the instrument assures equality among the EU citizens?). The instruments Rorschach [74], MMPI [75], and PAI [76] do not meet the requirements of proportionality and non-discrimination. This is because they assess clinical and psychopathological aspects that are not relevant for the position (hence, not proportional) and because their results might be used for not selecting an individual/team despite their actual performance (hence, discriminatory).

As observed, many instruments assess the different categories, use various indicators, and assessment procedures. However, it is not clear which instruments should be used, and how they should be adapted to comply with the requirements in the context of contractors' assessment for partner selection purposes in the construction industry.

3. Method

The two qualitative methods, interview and expert panel, were used to obtain empirical information. This helped to understand better the specific context of contractor assessment in partner-selection processes in the construction industry. These qualitative methods were chosen because they are best for contextualizing and getting a deeper understanding of specific concepts [84].

Unstructured interviews took place to understand the current procedure used for the assessment of bidders. Unstructured interviews are used when there is little information on the topic, and a deeper understanding of the point of view of the interviewee is needed [84]. Face-to-face interviews and e-mail communication were the techniques used to reach out to the interviewees. The use of these two research methods is reported to be viable and valuable to use for conducting qualitative interviews [85]–[87]. Information from six interviewees was obtained. They were selected based on their expertise on the subject. Three of them were consultants that work on procurement and team assessment on the client-side. One of them was a project manager working on the client-side in a client-contractor organization for the

development of an infrastructure project in the north of the Netherlands. One of them was a business unit manager in a contractor company. The final interviewee was a scholar specialized in collaborative contracting in construction projects. This sample aimed to guarantee that the information was collected from different perspectives (i.e., client, contractor, and scholar) [84].

An expert panel session was used to obtain insights into the context of the team assessment in the construction industry in order to understand what should be assessed in practice, and how this should be adapted for the assessment of contractors. The expert panel session allows obtaining empirical information from specialists about a specific topic while obtaining a degree of agreement among them. The advantage of this method is that the decision is made by several specialists after a thorough discussion is carried out [88]. This method helped to realize whether the findings in the literature (1. Assessment categories; 2. Team dynamics competencies; 3. Individual indicators; and 4. General procedure for assessment) can be applied in the construction industry and to find out certain aspects that are important in terms of contractor assessment. The expert panel session was composed of: two client advisors on procurement subjects, two consultants that work on bidders assessment in partner-selection, one project manager in a long-term building project from the client side, and one environment manager who has participated in team assessments from the contractor side. The steps followed in carrying out the expert panel session were standard for the four topics. First, the theory and information from the interviews regarding the topic were presented to the participants. Second, they had 20 minutes to discuss it. Next, the participants use survey platform Qualtrics to record their answers. Finally, the results were discussed together with the reasons for the experts' choices.

After the data was collected, a thematic analysis was performed. Here, the empirical information from interviews and the expert panel session was transcribed, coded, and put together into similar themes. Finally, an organized summary of the findings was obtained [84].

4. Results

This section contains the results of 1. Current methodology to assess contractors for the partner-selection process in the construction industry context and 2. The important aspects that should be assessed and the reasons behind them.

4.1 Current methodology to assess contractors in a client-contractor team

Based on interviews with the experts, it was found that only the category *team dynamics* is currently applied in the partner-selection process (through the use of TDA, as presented in section 2.2) and that the assessment follows a similar methodology across mentioned consulting firms. The assessment methodology involves pre-assessment activities (step 1 and 2), a workshop, where the actual assessment takes place (step 3), and post-assessment activities (steps 4 and 5). This methodology is as follows:

1. The assessment committee and the client define together the extra competencies (i.e., these are added to a list of pre-defined core competencies that each assessment provider has) required to cope with the specific characteristics of the project and the client's expectations. Several meetings are required. Three sets of core competencies for team assessment were found (see Table 2). They have been reported to be used for the assessment of teams from different types of industries, including the construction industry.

Table 2: Competencies currently used by consulting firms for team assessment in general settings (including the construction industry)

Competencies	Firm A	Firm B	Firm C
Ability to set clear goals	x	x	
Ability to take mutual responsibility	x	x	x
Open communication	x	x	
Mutual respect	x	x	
Flexibility in cooperation	x		
Ability to take initiative	x		
Ability to handle conflicts		x	
Ability to deal with uncertainty		x	
Reliable, collaborative behavior			x
Ability to deal with different interests			x
Focus on quality and collaboration			x
Equivalence			x
Ability to be adaptive			x

The consulting firm A obtained this set of competencies from the advisor Martijn Vroemen. Meanwhile, the competencies suggested by firm B were obtained by themselves based on their experience and knowledge on the topic. Firm C worked together with a Dutch university to develop their competencies. Regarding the

research behind the set of competencies, Firm B suggests that more studies are needed to validate their set of competencies. Firm A indicates that there is some research behind their competencies. Finally, similar information could not be collected from Firm C. Because of this, and since the listed competencies are not set explicitly for the construction industry context, it is difficult to say what are the most relevant competencies in the construction industry. The expert panel session helped to answer this question empirically (section 4.2).

2. The assessment committee, together with the client, develop conflicting fictional cases, similar to those that could happen in real work situations and could trigger stress to the participants. These cases will be used to assess the behavior of bidders within the client-contractor team.
3. Contractor assessment. It normally takes one full working day. The project team of the client and the bidders (one day per each bidder) work on the conflicting cases. At the same time, assessor observers perform the assessment based on the predefined as well as the extra competencies. To ensure a good assessment, the assessors should be able to objectively observe and identify the collaborative behaviors of the bidders without projecting themselves in the situation. Just the bidders are assessed, while the client only participates in the activities to provide the context that the contractor would face during the project.
4. The assessment committee conducts the data analysis and obtains the results.
5. The assessment committee presents the results.

4.2 Important aspects of contractor assessment in the construction industry

The expert panel gave insights into the essential aspects considered for the assessment of bidders in the partner-selection in the construction industry. Table 3 shows a summary of these findings. *Team dynamics* and *Individual matching* were entirely accepted among the experts (degree of agreement: 6/6). *Organizational cultural congruence* was also accepted, but not with full support (degree of agreement: 4/6). This is because a few experts had concerns about the need for assessing this category in the construction industry. They believe that the client being a public entity and the contractor being a private entity, implies that they have by default different organizational cultures. However, most of the experts explained that, in fact, the cultures of the organizations influence project performance. For instance, one expert has experienced that when there are client and contractor organizations that have a non-collaborative culture, efficient project performance is negatively affected. Additionally, they highlighted the relevance of *team dynamics* as the main category and the use of *individual matching* and *organizational cultural congruence* as supportive categories to sustain behavior identified with team dynamics.

Of the thirty-two team dynamics competencies presented to the experts, that come from literature (see Table 1) and interviews to assessors (see Table 2), the competencies selected to be the most relevant in the construction industry are open communication, mutual respect, trust, ability to deal with different interests, and team learning (see Table 4). The decision was not unanimous (e.g., *open communication, mutual respect*, and *ability to deal with different interests* with a degree of agreement of 4/6). This could be because, in the case of open communication, one expert brought up that *communication* seems to be the result of trust. For *mutual respect* and *ability to deal with different interests*, there were no issues mentioned about them. The reason could be that there were many competencies presented to the experts that certainly influence collaboration and team performance (i.e., according to literature and practitioners), which led few of the experts to prefer other competencies over *mutual respect* and *ability to deal with different interests*.

Out of the four attributes to be used as indicators of *individual matching* presented to the experts, Emotional Intelligence was 100% accepted among the experts. Only half of the experts voted for personality traits since its applicability for selection purposes in the construction industry might be unethical. This is because, in contrast with Emotional Intelligence (i.e., attribute that can be improved over time), the personality of an individual is hardly modifiable. Therefore, basing the decision on unchangeable characteristics is problematic. The other two attributes, talents and roles, were not relevant to the experts, because they were unaware of the potential use of these attributes for team assessment. They did not recommend the use of other attributes as indicators.

Furthermore, when the experts were asked about the assessment procedure and conditions for assessment, they especially highlighted the importance of making the assessment during the first part of the award phase to level the playing field for all the bidders and adding a final feedback step to explain to bidders the reason behind the results.

Table 3: Expert panel method results

Topics	Degree of agreement	Comments of experts
1. Assessment Categories:		
- Team dynamics	6/6	- The quality of interaction is more important than the quality of individuals. - It is important to assess team dynamics in terms of how skilled the contractor is to collaborate. - Team dynamics is influenced by many aspects (e.g., culture, individuals). - By observation, the behavior of the team during the assessment is similar to the one during the project.
- Individual Matching	6/6	- Group behavior is altered when one member is removed or added. - It is important to assess and understand the individual´s skills and goals to see what the team is capable of.
- Cultural Congruence	4/6	- Cultural alignment between client and contractor affects team performance in the construction industry. - By observation, there are client and contractor organizations that have a non-collaborative culture, which affects the success of the project. - Middle-size contractor companies tend to have a more collaborative culture. - One participant believes that maybe there is no need to assess cultural congruence since it is already known that clients and contractors have different cultures due to their public and private nature, respectively.
2. Team dynamics competences:		
- Open communication	4/6	- Open communication is important to create common goals for the project. - There is a relationship with the competence trust that should be studied. Open communication seems to be the result of trust.
- Mutual respect	4/6	- Respecting and acknowledging the other party´s opinions and interests is crucial.
- Trust	5/6	- An open to trust mindset is desired for collaboration. - Trust needs to grow.
- Ability to deal with different interests	4/6	- Understanding and working for the other party's interest is beneficial for the performance of the team
- Team learning	5/6	- The client-contractor organization starts unexperienced. The faster the team learns, the better the team performs. Team dynamics evolve; therefore, the capacity of the team to learn is fundamental.
3. Individual matching:		
- Emotional intelligence	6/6	- Emotional intelligence is a good predictor of team performance. - An expert used the emotional intelligence indicator to understand the individuals in the contractor companies for training purposes before competing in a procurement process. - Emotional intelligence has not been used for partner-selection purposes yet.
- Personality traits	3/6	- Although this gives good insights into the kind of individuals in a team (because personality traits cannot be developed over time), showing the results of the personality of every individual, which is a private matter, might be problematic in the contractor-selection process.
4. Assessment procedure		
- Challenges and conditions to consider during the assessment	--	- Individual Matching and Organizational Cultural Congruence should be used to sustain what has been observed during the team dynamics assessment. - Specialists that can read the tests should be hired to interpret the results. - For the procurement in the construction industry, current regulations require the assessment committee to present a robust and solid argumentation about the assessment results. - People that are going to work in the project should be the ones to be assessed. - The results of the contractor team should be presented instead of the results of the individuals since we are evaluating the team's capacity. Low individual scores might affect individuals' stability in their companies.
- General steps for assessment	--	- The assessment should take place in the first part of the contractor-selection process when the client and bidders have hardly interacted. This way, the assessment results are more accurate since a biased behavior factor does not intervene. - Post-assessment feedback to bidders is vital to explain the reason behind the results, and therefore this step should be added.

5. Discussion

5.1 About the assessment categories

Literature suggests that *team dynamics* (the behavioral relationships in a team) [5], *individual matching* (the composition of the team) [23] and *organizational cultural congruence* (cultural alignment between client and contractor) [11] are essential aspects that explain team's capacity to collaborate and perform. It also suggests that these categories should be assessed to form efficient teams (although this has been found for every category alone). Experts in the construction industry field considered that these three categories are also relevant to explain a client-contractor team's capacity to collaborate and perform in the construction industry.

Additionally, they think that the three categories can be applied for the assessment of contractors in the partner-selection process. Currently, just the category *team dynamics* is used in practice. Experts think that further assessing the

individuals' collaborative skills and the fit of the contractor's culture with the client's, is meaningful to understand the potential capability of the bidders to collaborate and perform in a client-contractor team.

Nevertheless, when these three categories are combined for assessment purposes, *team dynamics* is considered the main category, meanwhile *individual matching* and *organizational cultural congruence* are supportive categories that enrich the analysis by identifying *the potential of bidders to collaborate and perform together with the client,* from different perspectives. Hence, they should not be considered as independent attributes or arguments by themselves, but instead, be considered to sustain and validate what has been observed during the team dynamics assessment. This has been supported by practitioners who suggest that the category *team dynamics* is influenced, among other things, by culture and individuals. Although a similar definition of team dynamics is also addressed in theory [12], the assessment of *team dynamics* involves only the analysis of behavior in a team level, without considering the analysis of individual-level characteristics, which are considered the primary input for the performance of the team [13]. The assessment of *individual matching* provides an opportunity to validate the team dynamics assessment by giving insights into the composition of individuals in the contractor team and how this composition influences the performance of the client-contractor team. In the same way, *organizational cultural congruence* sustains *team dynamics* assessment by analyzing the culture of the client and contractor organization and how their fit influences the efficient performance of the client-contractor team [11].

The category *team dynamics* could provide insights into how the client-contractor team would collaborate and perform together during the project by assessing their behavior when working together. However, it was found that in the public partner selection process in the construction industry, the client-contractor relationship is not assessed. Instead, just the bidders are assessed. This is because bidders consider unfair to be scored during the assessment based not only on their collaborative skills but also on the client's skills; the client could have a biased behavior, impairing the assessment results. Hence, assessing the contractor alone limits the understanding of the client-contractor team's capacity to collaborate, to just the understanding of how skilled the bidders are to collaborate under the context provided by the participation of the client and the nature of the exercise (see section 4.1).

As observed in the results section, o*rganizational cultural congruence* was accepted but not entirely (degree of agreement: 4/6) because some experts had concerns about the weight of this category. As mentioned by one of the experts, the client and contractor in the construction industry have, by default, different organizational cultures, because they are public and private organizations, respectively. For this reason, the client and contractor would hardly share a similar culture; instead, there is a clear cultural distance. Nevertheless, as mentioned by Caden *et al*. [61], assessing organizational cultural distance (i.e., degree of no *cultural congruence*) very early in a project is relevant because it could prevent causing adverse effects on collaboration [65]. Therefore, based on the literature and the majority of the experts who agreed during the expert panel session, *organizational cultural congruence* remains as a relevant category to be assessed during the selection process.

5.2 About the categories' indicators

Regarding *team dynamics* competencies, this study: 1. validates the relevance in the construction industry of the competencies of *trust,* and *communication* (see Table 1), which are mentioned in the construction-related literature [1], [16]. 2. shows that the competencies *mutual respect* and *team learning* (see Table 1), indicated in research from other industries [17]–[20], are also crucial in the construction industry context, and 3. reveals the importance of the competency *ability to deal with different interests,* although it was not mentioned in literature. This competency is vital because the client and contractor have different interests in the project that need to be clearly understood and accepted by each party.

In the current state of assessing teams in practice (see section 4.1), the assessment firms use their own set of competencies for the assessment of teams from different industries. The same sets of competencies are used for team assessment in the construction industry (see Table 2). Here it is noticed that the competencies *trust* and *team learning* have not been mentioned. In this study, the experts suggested the use of these competencies in the construction context. This is because an "open to trusting mindset" is desired for collaboration (i.e., trust), and the faster the newly created client-contractor organization learns, the better it performs (i.e., team learning).

Consequently, the set of team dynamics competencies selected by the experts in this study (when presented with Table 1 and Table 2) communication, trust, mutual respect, ability to deal with different interests, and team learning (see Table 4) are preferred for partner selection purposes in the construction industry, over the sets of competencies currently used (see Table 2). This is because these five competencies are tailor-made for the specific context of the construction industry. Although the reasons for selecting the 5 competencies were collected (see

Table 3), the reasons why the experts didn't select the other 27 competencies could not be collected due to the long list of competencies and the short time of the expert panel session.

Some individual matching indicators were found in the literature, being the most relevant: Personality traits, emotional intelligence, roles and talents [25], [35], [55], [89]. In this study, it was found that emotional intelligence is the most suitable for the assessment of contractors in the construction industry. It outperforms the other indicators, including personality traits, which, according to Kichuk & Wiesner [10] and Hogan [36], maybe a suitable predictor of future behavior and performance and an excellent assessment tool in selection decisions. However, based on the experts' opinion, the decision to choose emotional intelligence over personality traits is because although they are both good predictors of team collaboration and performance, using personality traits for selection purposes in the construction industry might be considered unethical. Showing the results of an individual's personality might be problematic. Using *Emotional Intelligence* for assessing the capacity to collaborate and perform goes in alignment with the study of Jordan *et al.* [25], on which he suggests that emotional intelligence can predict the success of a person's management of relationships.

As indicated before, *individual matching* and *organizational cultural congruence* can be used as supportive categories of *team dynamics*. This is possible because, in the literature, it is observed that emotional intelligence and organizational cultural congruence can explain particular *team dynamics'* competencies. High emotional intelligence in team members (i.e., a high average of the team), have a positive effect on the *team dynamics* competencies trust [28], [29], communication [29], mutual respect [30], [31], and team learning [32], [33]. Furthermore, high organizational cultural congruence in a collided organization (i.e., high organizational cultural congruence value), positively influences the competencies trust [63], [90], communication [91]–[93], and team learning [64], [94]. Finally, in literature, a connection between *emotional intelligence* or *organizational cultural congruence* and the competence *ability to deal with different interests* could not be found.

5.3 About the assessment instruments

In literature, it is observed that no instrument can assess the three categories *Team Dynamics, Individual Matching*, and *Organizational Cultural Congruence*. Nevertheless, for each category, there is a potential instrument that could be used among the instruments covered in this study.

Within the category *team dynamics*, three instruments were found. These are SCDR [66], CaT [70] and TDA [68], [69]. However, TDA (i.e., the current instrument/methodology used for partner selection purposes) is the only instrument able to analyze all the specific core competencies proposed in this study (communication, trust, mutual respect, ability to deal with different interests, and team learning, see Table 4). This is because TDA is flexible in analyzing different types of competencies depending on the project requirements, due to the participation of trained experts (i.e., observer assessors usually with background in psychology, sociology or with expertise in behavioral assessment) who can assess any kind of competencies through a workshop where the client and contractor interact (see Table 16). On the other hand, SCDR and CaT assess a fixed set of competencies (through questionnaires) that do not entirely match what is required in the context of the construction industry. Out of the required competencies, SCDR only assesses communication, while CaT assesses communication and trust. To see more similarities and differences among the instruments, refer to section 2.2.

Interviewees suggested that when using TDA, the assessors should be able to objectively observe, describe, and identify behaviors that match with the competencies assessed. They should not project themselves or react in the situation. Therefore, having trained experts, that are able to separate themselves from what they observe would increase the probability of having proper results.

According to the collected empirical information, the individual matching indicator suitable for the assessment of the contractor is emotional intelligence. From the list of instruments presented in this study, EII is the only instrument that analyzes emotional intelligence [77]. For assessment purposes, the results of EII are brought together to obtain the average of the contractor team. This result is used to validate the results in competencies trust [28], [29], communication [29], mutual respect [30], [31], and team learning [32], [33] that are assessed with TDA.

To assess *organizational cultural congruence*, an instrument that characterizes the organizational culture of the client and contractor organization is required. The instrument OCAI [82] allows defining the culture of every organization to determine the fit between them. Conversely, SCDR [66], instead of defining the organizational cultures, focuses on identifying the degree of understanding of each other's culture. Additionally, the instrument OCAI concentrates entirely on the assessment of the organizational culture. At the same time, on SCDR (which also assesses team dynamics), culture is only one dimension, among the seven dimensions that the instrument assesses (i.e., six-team dynamics dimensions and one culture dimension). Hence, OCAI is preferred over SCDR. For assessment purposes, the results of OCAI from the client and contractor are computed together to obtain the organizational cultural congruence value. High

organizational cultural congruence value could explain results in competencies trust [63], [90], communication [91]–[93], and team learning [64], [94] that are assessed with TDA.

As observed, the discussed instruments use expert observers (for TDA) and the team members themselves (for EII and OCAI, in the form of self-reports) as data gathering methods to find information about the assessed competencies (directly through TDA, and indirectly through EII and OCAI). The advantages of using expert observer reports lie in the ability to have "clearer lenses" [24] that help to mitigate self-enhancing bias in self-reports [95]. However, a disadvantage might be the difficulty of generalizing the behavior observed in only one workshop [96]. On the other hand, the advantage of using self-reports lies in their capacity to measure some individual characteristics that cannot be detected by observers outside one-self. A disadvantage, though, is the propensity to have self-enhanced results [97]. Based on the above discussed, where the two data gathering methods present advantages and disadvantages, McDonald [96] suggests that combining these methods lead to a more accurate assessment. Hence, the use of TDA (as expert observer method) and EII and OCAI (as self-report method) might result in a better assessment.

By using the TDA, EII, and OCAI (which assess *Team dynamics*, *Individual matching*, and *Organizational cultural congruence*, respectively) together in the assessment of contractors in the partner selection process, all the indicators of collaboration and performance as defined in this study are measured. Their applicability in the partner-selection process (i.e., public procurement in the European Union) is feasible because, as seen in section 2.2, they meet the criteria set forth in "The guiding principles of public procurement" [83]. Additionally, it is also applicable in terms of time. This is because, in the current state of team evaluation (using TDA alone), the assessment takes one full day. Meanwhile, when adding the assessment of individual matching and organizational cultural congruence (using EII and OCAI) to the current state adds only one additional day to the time required for the assessment.

5.4 About the procedure

As observed in section 1, no information about the contractor assessment in the specific context of the partner-selection process in the construction industry has been found. However, based on empirical information obtained in this study from interviews, the current state of team assessment (using TDA) is composed of five steps (see section 4.1). The addition of the assessment of *individual matching* and *organizational cultural congruence* does not require changes in the overall procedure. It can be done in step number three and takes place after the workshop on a different day, where the client and all the bidders fill in the questionnaires under the supervision of the assessment committee. Both client and bidders fill in the OCAI [82] questionnaire necessary to analyze the organizational cultural congruence between client and bidders. Only the bidders fill in the EII [98] questionnaire. Then, in step four, this information is analyzed together with the results of the assessment of *team dynamics*. The TDA results (in terms of the competencies, trust, communication, mutual respect, team learning, and ability to deal with different interests, together with the additional competencies) are the principal argumentation in the report.

In contrast, the results of EII and OCAI are used to validate and better explain the reasons and scores behind the behavior observed with TDA. High average emotional intelligence could explain good performance in competencies trust, communication, mutual respect, and team learning. Similarly, high organizational cultural congruence value could explain good performance in trust, communication, and team learning. Additionally, the empirical results suggest that a sixth step is needed to give feedback and to present the assessment results to the bidders.

6. Conclusions

Since the information in the field of partner-selection in the construction industry related to the assessment of bidders' capacity to collaborate and perform is limited, I aimed to fill this gap by 1. Identifying which categories could be used to assess bidders' ability to collaborate and perform in a client-contractor team, 2. Investigating instruments that could be used for the assessment and 3. Proposing a general procedure to perform the assessment during the partner-selection process. It is relevant to address this issue because clients could apply the proposed methodology to assess the bidders based on behavioral and collaborative traits towards forming high performing client-contractor teams.

Interviews and an expert panel session were used to gather empirical information about the categories and important aspects that should be assessed, as well as the current state of contractors' assessment for partner-selection purposes. This information helped understand the context of the assessment in the construction industry, to afterward, recommend instruments and a procedure for the assessment.

In this study, it was empirically found that the essential categories for the assessment of the contractors' capacity to collaborate and perform are *team dynamics* (which is the only category currently used for the assessment), *individual matching*, and *organizational cultural congruence*. The behavior of contractors should be mainly assessed with *team dynamics*, while the implementation of the other two categories is meant to explain and underpin the behavior observed

during the assessment. The *team dynamics* competencies that the experts considered relevant in a client-contractor organization and are recommended for the assessment of the contractor are open communication, mutual respect, trust, ability to deal with different interests, and team learning (see Table 4). Emotional intelligence resulted in being the most suitable indicator for *individual matching*. Finally, organizational culture is suggested to be the indicator of *organizational cultural congruence* in terms of team performance.

6.1 Selected instruments

The empirical results of this study showed that the categories *team dynamics* (analyzed through competencies), *individual matching* (analyzed through emotional intelligence), and *organizational cultural congruence* (analyzed through organizational culture) could be used in the construction industry context. As seen in the discussion section, the instruments TDA, EII, and OCAI outperformed the other instruments in each category. For that reason, I recommend using these three instruments for the assessment of bidders in the partner-selection process. TDA as the main instrument to assess the behavior of the bidders through the competencies in Table 4 and the additional ones, as suggested in step 1 of section 6.2. On the other hand, it is advised to use the results of EII and OCAI to validate and strengthen the argumentation of the results of TDA. EII validates the results of the competences trust, communication, mutual respect, and team learning, while OCAI validates the results of trust, communication, and team learning.

6.2 Assessment procedure

The following recommendation is a general procedure to assess the capacity of contractors to collaborate and perform in the partner selection-stage in terms of the category *team dynamics*, and supported by *individual matching* and *cultural congruence*. Steps number 1 and 2 correspond to pre-assessment activities and take several months. Step number 3 is the assessment, per se. Here, one day (per bidder) is needed for the assessment of the bidders when interacting with the client through a workshop (i.e., *team dynamics*), and one day is necessary for the assessment of *individual matching* and *organizational cultural congruence* through questionnaires. Finally, steps 4, 5, and 6 belong to the post-assessment activities, which take some months.

1. The assessment committee and the client define together the extra competencies (i.e., additional to the core competencies, proposed in this thesis, see Table 4) for the assessment of *team dynamics* required to cope with the specific characteristics of the project and the client's expectations. Several meetings are required.
2. The assessment committee, together with the client, develops the conflicting cases, which are fictional activities, like those that could happen in real work situations and could trigger stress to the participants. These cases will be used to assess the contractors' dynamic when interacting with the client.
3. Assessment: For *team dynamics*, the assessment is done through a one-day workshop (per bidder) where the client and the bidders work on the conflicting cases while expert observers perform the assessment based on the predefined set of competencies. To score each competence, the observers use a five-point ordinal scale and give a score depending on the performance of the bidders in terms of each competence (1 point: Poor, 2 points: Insufficient, 3 points: Sufficient, 4 points: Good, and 5 points: Excellent). They can use the behavioral indicators per competence recommended in Table 4 as a guide to see whether the bidders have the expected behavior. Just the bidders are assessed, while the client only participates in the activities to provide the context that the contractor would face during the project.

   The *individual matching* and *cultural congruence* assessment take place after the workshop on a different day, where the client and all the bidders fill in the questionnaires under the supervision of the assessment committee. It takes around 30 minutes per questionnaire to complete. Both client and bidders fill in the OCAI questionnaire which is necessary to analyze the client-contractor organizational cultural congruence. Only the bidders fill in the EII questionnaire.
4. Once the data is collected, the assessment committee conducts the data analysis, obtains the results, and writes the report. For *team dynamics*, the final score of each bidder is the sum of the scores obtained from every competence in TDA. For *individual matching*, the EII results of each individual are brought together to obtain the average of the team (see Table 5), while for *organizational cultural congruence*, the results of OCAI from the client and bidders are computed together to obtain the organizational congruence value (see Table 19).

   The TDA results come with a report with detailed information about the observed bidders' behavior and the argumentation of these results. Then, in order to make a more robust argumentation, the EII team average and the OCAI congruence value are used to validate and better explain the reasons and scores behind the behavior observed. High average emotional intelligence could explain good performance in competencies trust,

communication, mutual respect, and team learning. Similarly, high organizational cultural congruence value could explain good performance in trust, communication, and team learning.

5. The assessment committee presents the results and the final decision to the client.
6. Finally, the bidders receive the assessment results and feedback from the assessment committee. This helps to make the process transparent and contributes to bidders' self-improvement.

Table 4. Team dynamics competencies and their behavioral indicators[1].

Trust
Contractor team members are comfortable being dependent on each other and on the members of the client team
Contractor team members keep their promises
Contractor team members work with high levels of integrity
Contractor team members are fair to each other and to the members of the client team
Communication
Contractor team members sufficiently inform about what is going on
Client-contractor team members feel entirely free to say what they think (the contractor team members provide a safe environment to do so)
Contractor team members honestly tell each other and the client team members what they think
Contractor team members are open to discuss and deal with conflicts
If necessary, contractor team members call each other and the client team members to order
Mutual respect
Contractor team members take seriously each other as well as the members of the client team
Contractor team members know how each other, and the members of the client team can be of help
The contractor team is all right when their members or the members of the client team have a different opinion
Contractor team members accept their differences as well as the differences of the members of the client team
Contractor team members use the different qualities in their members and the members of the client team
Ability to deal with different interests
Contractor team members look out for the interests of both companies
Contractor team members can distinguish between motivations and interests of others
Contractor team members constructively deal with distinct pursuits
If necessary, the contractor team members adjust their goal to the interest of the client-contractor team
Team learning
Contractor team members share knowledge, opinions or creative thoughts to others who were unaware of it
Contractor team members co-construct. They learn through an iterative process of recognizing, rephrasing, articulating, querying, concretizing the knowledge, opinions, or creative thoughts.
Constructive conflict. Contractor team leverage different points of view by assimilating them into a solution for the well-being of the client-contractor team
Contractor team members recognize their mistakes and reflect on them to gain knowledge and experience
Contractor team members can assimilate information to put it into practice

[1] Behavioral indicators of trust were based on [1], communication and mutual respect on [69], ability to deal with different interests on [1], [69], and team learning on [99], [100].

6.3 Recommendations to practitioners

Recommendations to practitioners to be considered during the assessment, resulted from this project, are:

- Within the assessment committee, there must be EII and OCAI specialists present to help interpret the results that come from these two instruments.
- For the procurement in the construction industry, current regulations require the assessment committee to present a robust and solid argumentation about the assessment results. Therefore, it is recommended to use the results of EII and OCAI to sustain further the results obtained in TDA (see step 4 in section 6.2).
- The assessment committee should make sure that people who will work in the project (from the client and the bidders' side) are the people participating in the workshop. This aims to guarantee good results of the assessment, since, according to practitioners, when changing team members in a team, the psychological forces influencing the dynamics change, as well as the matching of individuals. As a result of these changes, the team performance will be different from the one seen during the assessment.
- The results of the contractor team should be presented instead of the results of the individuals since we are assessing team capability and because showing low individual scores might affect the individual's stability in their companies.
- It is recommended to perform the workshop in the first stages of the partner-selection process when there is little or no acquaintance yet between the client and the different bidders. This no-interaction is essential to avoid the biased behavior of the client during the assessment that might favor one bidder over the other.

6.4 Limitations and future work

One encountered limitation during working on this project is time constraints. The understanding of every element in this project (e.g., team dynamics competences, individual matching indicator, assessment instruments, procedure) is a full topic of itself that requires a considerable amount of time as well as more elaborated research methods. Secondly, some information regarding instruments is not freely available. There were potentially useful instruments, but since I was not able to determine their validity or reliability, they could not be used in this study. Finally, the small sample of the experts for the interviews prevented from obtaining a holistic view of the full spectrum of experts' knowledge.

Future research is recommended to test whether the proposed team dynamics core competencies are required in a client-contractor team in the construction industry to collaborate and perform effectively. Furthermore, research should be carried out to see in practice the potential of the proposed assessment procedure to select the most suitable contractor in terms of collaboration and performance.

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9. Annexes

Annex 1: Tables of assessment instruments

Table 5. Emotional Intelligence Instrument (EII)

Definition	*Theory behind the instrument*	Instrument that analyzes E.I. which is the capacity of people to understand their own emotions and others' emotions. An emotionally intelligent individual can adjust emotions to manage relationships with others.
Indicator measured	*Indicators that are considered for each instrument to be measured (e.g. competence, personality traits, roles, talents, etc.)*	Emotional intelligence that is reflected in 1) The ability to perceive emotions in oneself and others 2) the ability to use emotions to enable thinking, 3) the ability to understand emotions, 4) the ability to manage emotions
Individual/Team/Cultural assessment instrument	*Does the instrument assess individual, team level or cultural characteristics?*	Individual assessment instrument with potential to assess teams
Industry where applied	*Indicates the industries where the instrument has been used.*	AEC, service industry, knowledge-based work and others
Characteristics of a high performing team	*Describes the characteristics of a high-performing team in terms of the indicators assessed by the instrument*	The higher the average E.I test score of a team, the higher levels of team performance.
Description of the data collection instrument	*A description of the data collection instrument (e.g. questionnaires, tests, etc.) that is used to collect the information from the people assessed*	The WEIP-3 is a self-report which measures individuals' emotional intelligence in teams. It employs a seven-point scale, being 1 (strong disagree) and 7 (strongly agree), with statements regarding personal behavior, for example: I am conscious of my feelings when performing in a team.
Self/colleague observer/expert observer report	*Is the data collection instrument filled by the individual him/herself, by a colleague or by a third-party expert? (If the report is filled by a third-party expert, then an interview or a workshop where the expert can observe the subject's behavior will be needed).*	Self-report
Some versions	*Some versions of the instrument that are available*	MSCEIT, MSCEIT V2.0, WPQ-EI, WLEIS, WEIP-3, etc.
Time required to do the assessment	*Time required to collect the data from the subjects*	30 minutes approximately
Need to purchase the right to use it	*Does the instrument need to be purchased?*	yes
Is the instrument proportional?	*Requirements of the instrument to be used in a public procurement in the European Union*	yes
Is the application of the instrument transparent		yes
Is the instrument non-discriminatory?		yes
How can the assessment (in the contractor-selection process) be performed?	*Adaptation of the assessment instrument into the contractor selection process*	The potential contractors fill the questionnaire, it is not required for the client to fill the questionnaire. The score of the team is obtained as the average of the scores of all team members
Additional remarks	*Extra relevant information about the instruments*	Commonly used to analyze leaders, managers, etc. EII should be used in combination with other instruments. It is a complementary resource.
References	*Source of information*	[25]–[27], [77], [89], [98], [101]–[104]

Table 6. Big Five

Definition	*Theory behind the instrument*	It recaps all personality traits into five. It is used in companies to select individuals capable to work in a team environment.
Indicator measured	*Indicators that are considered for each instrument to be measured (e.g. competence, personality traits, roles, talents, etc.)*	Personality traits: 1. Openness, 2. Conscientiousness, 3. Extraversion 4. Agreeableness 5. Neuroticism
Individual/Team/Cultural assessment instrument	*Does the instrument assess individual, team level or cultural characteristics?*	Individual assessment instrument with potential to assess teams
Industry where applied	*Indicates the industries where the instrument has been used.*	Management and human resources, among others
Characteristics of a high performing team	*Describes the characteristics of a high-performing team in terms of the indicators assessed by the instrument*	High performing teams have high average scores in conscientiousness and agreeableness
Description of the data collection instrument	*A description of the data collection instrument (e.g. questionnaires, tests, etc) that is used to collect the information from the people assessed*	The NEO PI-R consists of 240 items and evaluates six subcategories (called facets) of each Big Five personality trait
Self/colleague observer/expert observer report	*Is the data collection instrument filled by the individual him/herself, by a colleague or by a third-party expert? (If the report is filled by a third-party expert, then an interview or a workshop where the expert can observe the subject's behavior will be needed).*	Self and colleague observer report
Some versions	*Some versions of the instrument that are available*	NEO PI, NEO PI-R (or Revised NEO PI), and NEO PI-3, NEO-FFI, etc.
Time required to do the assessment	*Time required to collect the data from the subjects*	30 to 40 minutes
Need to purchase the right to use it	*Does the instrument need to be purchased?*	yes
Is the instrument proportional?	*Requirements of the instrument to be used in a public procurement in the European Union*	yes
Is the application of the instrument transparent		yes
Is the instrument non-discriminatory?		yes
How can the assessment (in the contractor-selection process) be performed?	*Adaptation of the assessment instrument into the contractor selection process*	The potential contractors fill the questionnaire, it is not required for the client to fill the questionnaire
Additional remarks	*Extra relevant information about the instruments*	Used by human resources professionals to place employees. Bias can be overcome by combining self and observer report
References	*Source of information*	[10], [38], [108]–[113], [40]–[43], [50], [105]–[107]

Table 7. HEXACO

Definition	*Theory behind the instrument*	Studies the 5 personality traits of big five, with the addition of a sixth personality trait: Honesty– Humility, which is the tendency to avoid manipulating others for personal gain, feel little temptation to break the rules, etc.
Indicator measured	*Indicators that are considered for each instrument to be measured (e.g. competence, personality traits, roles, talents, etc.)*	Personality traits: 1. Honesty-Humility, 2) Emotionally, 3) Extraversion, 4) Agreeableness, 5) Conscientiousness, 6) Openness to experience
Individual/Team/Cultural assessment instrument	*Does the instrument assess individual, team level or cultural characteristics?*	Individual assessment instrument with potential to assess teams
Industry where applied	*Indicates the industries where the instrument has been used.*	Management and human resources, among others
Characteristics of a high performing team	*Describes the characteristics of a high-performing team in terms of the indicators assessed by the instrument*	Maximum homogeneity amongst the members in terms of Honesty/Humility (i.e. low variance), additional to the requirements expressed in big five.
Description of the data collection instrument	*A description of the data collection instrument (e.g. questionnaires, tests, etc) that is used to collect the information from the people assessed*	The HEXACO-PI-R has 100 items asking for agreement or disagreement in terms of certain statements such as: I often watch television.
Self/colleague observer/expert observer report	*Is the data collection instrument filled by the individual him/herself, by a colleague or by a third-party expert? (If the report is filled by a third-party expert, then an interview or a workshop where the expert can observe the subject's behavior will be needed).*	Self and colleague observer report
Some versions	*Some versions of the instrument that are available*	HEXACO-PI-R (Last version)
Time required to do the assessment	*Time required to collect the data from the subjects*	15 minutes
Need to purchase the right to use it	*Does the instrument need to be purchased?*	yes
Is the instrument proportional?	*Requirements of the instrument to be used in a public procurement in the European Union*	yes
Is the application of the instrument transparent		yes
Is the instrument non-discriminatory?		yes
How can the assessment (in the contractor-selection process) be performed?	*Adaptation of the assessment instrument into the contractor selection process*	Client and contractor do the self and observer questionnaire. Results for the client-contractor organization are obtained. For conscientiousness and agreeableness the average of the individuals is required, while for honesty-humility the variance is needed.
Additional remarks	*Extra relevant information about the instruments*	--
References	*Source of information*	[27], [45]–[48], [114]

Table 8. Belbin

Definition	*Theory behind the instrument*	Belbin looks at the role each individual is best suited to take on in a team environment
Indicator measured	*Indicators that are considered for each instrument to be measured (e.g. competence, personality traits, roles, talents, etc.)*	Roles: THINKING: 1. Monitor evaluator, 2. plant, 3. specialist. ACTION:4. Implementer, 5. shaper, 6. completer finisher. PEOPLE: 7. Coordinator, 8. resource investigator, 9. Team-worker
Individual/Team/Cultural assessment instrument	*Does the instrument assess individual, team level or cultural characteristics?*	individual assessment for team composition
Industry where applied	*Indicates the industries where the instrument has been used.*	Value Engineering (inside construction industry), among others
Characteristics of a high performing team	*Describes the characteristics of a high-performing team in terms of the indicators assessed by the instrument*	Effective teams need all 9 roles. All team members need to be acquainted and maximize the strengths of others in terms of behavior, whilst managing weaknesses. Some projects demand prominently certain roles that need to be included in the team.
Description of the data collection instrument	*A description of the data collection instrument (e.g. questionnaires, tests, etc.) that is used to collect the information from the people assessed*	The Belbin SPI (Self-Perception Inventory) consists of eight parts and each part contains 10 statements. For each section, the test taker has 10 points that can allocate to one, or between two or three sentences most applicable to him/herself: one of which he/she feels sums up well while the other only applies some of the time; the sum total of points for the section must be 10. For example, he/she can give 6 points to the first choice and 4 points to the second choice.
Self/colleague observer/expert observer report	*Is the data collection instrument filled by the individual him/herself, by a colleague or by a third-party expert? (If the report is filled by a third-party expert, then an interview or a workshop where the expert can observe the subject's behavior will be needed).*	Self and colleague observer report
Some versions	*Some versions of the instrument that are available*	The Belbin Self-Perception Inventory
Time required to do the assessment	*Time required to collect the data from the subjects*	15 - 20 minutes
Need to purchase the right to use it	*Does the instrument need to be purchased?*	yes
Is the instrument proportional?	*Requirements of the instrument to be used in a public procurement in the European Union*	yes
Is the application of the instrument transparent		yes
Is the instrument non-discriminatory?		yes
How can the assessment (in the contractor-selection process) be performed?	*Adaptation of the assessment instrument into the contractor selection*	Client do the test and the roles are identified. Then, the potential contractors do the test too. The contractor team with roles that best complement the roles of the client gets the best score. The idea is to see which contractor helps to create the best “balance” in terms of team roles.
Additional remarks	*Extra relevant information about the instruments*	If a role is not naturally present in a team, said role can be adapted by a team member
References	*Source of information*	[13], [58], [78], [115], [116]

Table 9. TMA

Definition	*Theory behind the instrument*	Assess and develops talents and teams. TMA suggests that people are more motivated and effective in a work that certainly fits them.
Indicator measured	*Indicators that are considered for each instrument to be measured (e.g. competence, personality traits, roles, talents, etc.)*	22 drivers, 53 competencies and 44 talents. - Emotional balance (8 talents) - Social talents (10) - Influential talents (8) - General motives of a team (6) - Leadership talents of a team (6) - Organizational talents of a team (6)
Individual/Team/Cultural assessment instrument	*Does the instrument assess individual, team level or cultural characteristics?*	Individual assessment instrument with potential to assess teams
Industry where applied	*Indicates the industries where the instrument has been used.*	Management and Human Resources, business settings, among others
Characteristics of a high performing team	*Describes the characteristics of a high-performing team in terms of the indicators assessed by the instrument*	Client selects which competences are required in a team.
Description of the data collection instrument	*A description of the data collection instrument (e.g. questionnaires, tests, etc.) that is used to collect the information from the people assessed*	The TMA talent analysis is formed by three sub-instruments: 1. TMA competency library, where the client selects the assessed competencies. 2. TMA instrument, to perform the assessment. 3. Talent notebook, where the results are shown.
Self/colleague observer/expert observer report	*Is the data collection instrument filled by the individual him/herself, by a colleague or by a third-party expert? (If the report is filled by a third-party expert, then an interview or a workshop where the expert can observe the subject's behavior will be needed).*	Self-report
Some versions	*Some versions of the instrument that are available*	TMA talent analysis
Time required to do the assessment	*Time required to collect the data from the subjects*	45 minutes
Need to purchase the right to use it	*Does the instrument need to be purchased?*	yes
Is the instrument proportional?	*Requirements of the instrument to be used in a public procurement in the European Union*	yes
Is the application of the instrument transparent		yes
Is the instrument non-discriminatory?		yes
How can the assessment (in the contractor-selection process) be performed?	*Adaptation of the assessment instrument into the contractor selection process*	Three steps: 1) Desired competences are obtained from the client, with the use of "TMA competence library" 2) Participants are assessed with the use of "TMA instrument" 3) The most suitable contractor is selected based on their scores, with the help of "Talent notebook"
Additional remarks	*Extra relevant information about the instruments*	--
References	*Source of information*	[59], [79], [117]

Table 10. Insights discovery

Definition	*Theory behind the instrument*	Based on the Insights Discovery color energy model, it is possible to identify the most important aspects for the development of teams.
Indicator measured	*Indicators that are considered for each instrument to be measured (e.g. competence, personality traits, roles, talents, etc.)*	Attitudes: extraversion and introversion. Functions: Split into two rational (Thinking and Feeling) and two irrational functions (Sensation and Intuition). Lifestyle preferences:
Individual/Team/Cultural assessment instrument	*Does the instrument assess individual, team level or cultural characteristics?*	individual assessment for team improvement
Industry where applied	*Indicates the industries where the instrument has been used.*	Management and human resources, business settings, among others
Characteristics of a high performing team	*Describes the characteristics of a high-performing team in terms of the indicators assessed by the instrument*	An empirical study reported that extroverted teams outperform introverted teams and variable (heterogeneous) teams outperform dominant (homogeneous) teams. Insight Discovery practitioners states that it is not a framework to select people.
Description of the data collection instrument	*A description of the data collection instrument (e.g. questionnaires, tests, etc.) that is used to collect the information from the people assessed*	Insights Discovery Evaluator (IDE): It is a forced-choice) and normative evaluator consisting of 25 sections in which the participant selects from a choice of four word pairs a "most", a "least" and then gives points to the remaining two alternatives in between least and most using a 5 point scale. Each of the 4 word pairs in a section assess preference called "cool blue", "sunshine yellow", "fiery red" and "earth green". A completed test will have for each of the four colors, a score between 0 (for least) and 6 (for most).
Self/colleague observer/expert observer report	*Is the data collection instrument filled by the individual him/herself, by a colleague or by a third-party expert? (If the report is filled by a third-party expert, then an interview or a workshop where the expert can observe the subject's behavior will be needed).*	Self-report
Some versions	*Some versions of the instrument that are available*	Insights Discovery Evaluator 3.0
Time required to do the assessment	*Time required to collect the data from the subjects*	10 - 20 minutes
Need to purchase the right to use it	*Does the instrument need to be purchased?*	yes
Is the instrument proportional?	*Requirements of the instrument to be used in a public procurement in the European Union*	yes
Is the application of the instrument transparent		yes
Is the instrument non-discriminatory?		yes
How can the assessment (in the contractor-selection process) be performed?	*Adaptation of the assessment instrument into the contractor selection process*	ID practitioners state that it is not a framework to select people.
Additional remarks	*Extra relevant information about the instruments*	There is not strong evidence about how to form a group based on insights discovery, results from individual report just helps to understand individuals and then ID specialists recommend how to treat them, but a connection with team performance level has been barely found. ID practitioners say it is not a framework to select people.
References	*Source of information*	[118], [119]

Table 11. DiSC

Definition	*Theory behind the instrument*	DiSC measures tendencies and preferences, surface traits and how they lead to behavioral differences among individuals.
Indicator measured	*Indicators that are considered for each instrument to be measured (e.g. competence, personality traits, roles, talents, etc.)*	Types of behavior: 1) Drive/Dominance (D), 2) Influence (I) 3) Steadiness (S), 4) Compliance/Conscientiousness (C)
Individual/Team/Cultural assessment instrument	*Does the instrument assess individual, team level or cultural characteristics?*	individual assessment for team composition
Industry where applied	*Indicates the industries where the instrument has been used.*	Business and many other industries
Characteristics of a high performing team	*Describes the characteristics of a high-performing team in terms of the indicators assessed by the instrument*	Client selects which competences are required in a team. From their experience they have identified 5 keys common to all effective teams: - Trust - Communication - Common Goals - Mutual Respect - Tolerance
Description of the data collection instrument	*A description of the data collection instrument (e.g. questionnaires, tests, etc) that is used to collect the information from the people assessed*	For an Everything DiSC assessment, users answer around 80 questions, depending on the version. It uses a rating scale (strongly disagree, disagree, neutral, agree, strongly agree), where people respond to a phrase instead of a single word. This test measures deep personality traits, and it aims to explain their influence over behavioral differences between users.
Self/colleague observer/expert observer report	*Is the data collection instrument filled by the individual him/herself, by a colleague or by a third-party expert? (If the report is filled by a third-party expert, then an interview or a workshop where the expert can observe the subject's behavior will be needed).*	Self-report
Some versions	*Some versions of the instrument that are available*	DiSC for Management, leadership profiles and resources. Everything DiSC, DiSC classic, Computerized DISC. The results of the assessment of the teams are exposed in the Disc Group Dynamics form
Time required to do the assessment	*Time required to collect the data from the subjects*	10 min.
Need to purchase the right to use it	*Does the instrument need to be purchased?*	Yes
Is the instrument proportional?	*Requirements of the instrument to be used in a public procurement in the European Union*	Yes
Is the application of the instrument transparent		Yes
Is the instrument non-discriminatory?		Yes
How can the assessment (in the contractor-selection process) be performed?	*Adaptation of the assessment instrument into the contractor selection process*	Three steps: 1) Desired competences are obtained from the client 2) Participants are assessed with the Everything Disc 3) The team is selected based on their scores presented in the Disc Group Dynamics form
Additional remarks	*Extra relevant information about the instruments*	--
References	*Source of information*	[73], [80], [81], [120]–[122]

Table 12. MBTI

Definition	*Theory behind the instrument*	The Myers-Briggs Type Indicator defines differing psychological preferences in how people perceive the world around them and make decisions. MBTI assumes that individuals have certain preferences in the way they interpret their experiences. These preferences shape individuals' values, motivations, needs, interests, etc.
Indicator measured	*Indicators that are considered for each instrument to be measured (e.g. competence, personality traits, roles, talents, etc.)*	Dichotomies: 1) Extraversion vs introversion, 2) sensing vs intuition, 3) thinking vs feeling, 4) judging vs peption
Individual/Team/Cultural assessment instrument	*Does the instrument assess individual, team level or cultural characteristics?*	Individual
Industry where applied	*Indicates the industries where the instrument has been used.*	Management and human resources, business setting, among others
Characteristics of a high performing team	*Describes the characteristics of a high-performing team in terms of the indicators assessed by the instrument*	Teams should include individuals with the next personalitites: 1. An Extroverted Intuitor (E N ? ?), 2. A Judger (? ? ? J), 3. A Perceiver (? ? ? P), 4. A Thinker (? ? T ?), and 5. A Feeler (? ? F ?)
Description of the data collection instrument	*A description of the data collection instrument (e.g. questionnaires, tests, etc.) that is used to collect the information from the people assessed*	The MBTI Step I include 93 ipsative questions (i.e., the North American version), meaning that participants pick one of two possible answers to each question. The options are a combination of statements and word pairs. Statements are meant to reflect opposite preferences on the same dichotomy.
Self/colleague observer/expert observer report	*Is the data collection instrument filled by the individual him/herself, by a colleague or by a third-party expert? (If the report is filled by a third-party expert, then an interview or a workshop where the expert can observe the subject's behavior will be needed).*	Self-report
Some versions	*Some versions of the instrument that are available*	For the MBTI Step I: Form M (93 items), Form M self-scorable (93 items). For the MBTI Step II and the MBTI Step III, form Q (144 items) and a form containing 222 items are used respectively.
Time required to do the assessment	*Time required to collect the data from the subjects*	25 min.
Need to purchase the right to use it	*Does the instrument need to be purchased?*	yes
Is the instrument proportional?	*Requirements of the instrument to be used in a public procurement in the European Union*	yes
Is the application of the instrument transparent		yes
Is the instrument non-discriminatory?		yes
How can the assessment (in the contractor-selection process) be performed?	*Adaptation of the assessment instrument into the contractor selection process*	It is not clear how to use it for contractor assessment
Additional remarks	*Extra relevant information about the instruments*	Created by Isabel Myers and Katharine Briggs without psychology background. Normally used to characterize a person. Helps to increase team effectiveness. Commonly criticized because it describe people in terms of just two levels of each dichotomy instead of giving a score to each dichotomy.
References	*Source of information*	[49], [54], [123]–[129]

Table 13. Rorschach

Definition	*Theory behind the instrument*	It is a projective psychological test developed in 1921 by Hermann Rorschach to measure thought disorder for the purpose of identifying mental illness. The test consists on 10 cards where the subject states what he/she see.
Indicator measured	*Indicators that are considered for each instrument to be measured (e.g. competence, personality traits, roles, talents, etc.)*	1) The person's emotional world, 2) The person's cognitive world, 3) the person's ability to deal with situational stress, 4) The person's perception of others and relationships, and 5) the person's self-perception.
Individual/Team/Cultural assessment instrument	*Does the instrument assess individual, team level or cultural characteristics?*	Individual
Industry where applied	*Indicates the industries where the instrument has been used.*	Mainly clinical field, some companies use them to hire people, but its use is questionable
Characteristics of a high performing team	*Describes the characteristics of a high-performing team in terms of the indicators assessed by the instrument*	Not found
Description of the data collection instrument	*A description of the data collection instrument (e.g. questionnaires, tests, etc.) that is used to collect the information from the people assessed*	Rorschach test is composed by 10 inkblots, which represent ambiguous images. additionally, the psychologist has a register for writing down the answers and comments
Self/colleague observer/expert observer report	*Is the data collection instrument filled by the individual him/herself, by a colleague or by a third-party expert? (If the report is filled by a third-party expert, then an interview or a workshop where the expert can observe the subject's behavior will be needed).*	Expert observer through an interview
Some versions	*Some versions of the instrument that are available*	Rorschach Test
Time required to do the assessment	*Time required to collect the data from the subjects*	1 h 30 min
Need to purchase the right to use it	*Does the instrument need to be purchased?*	Yes
Is the instrument proportional?	*Requirements of the instrument to be used in a public procurement in the European Union*	No, assess clinics aspects no relevant for the position
Is the application of the instrument transparent		Yes
Is the instrument non-discriminatory?		No (sometimes it is used for not hiring people despite their actual performance)
How can the assessment (in the contractor-selection process) be performed?	*Adaptation of the assessment instrument into the contractor selection process*	According to experts from the University of Chile, Rorschach test should not be used in the selection process (not for individual nor team selection), since it was not developed with that aim, but to detect mental illnesses, such as depression or psychosis.
Additional remarks	*Extra relevant information about the instruments*	Profiles are a bit less specific than in other tests, time-consuming, validity and reliability discussed, answers subjective. It is complementary, does not say much information by its own. Needs more information from other tests to be useful and confirmed. It reveals facts about users' clinical characteristics, which are not relevant for work field. The use in the business sector is questionable, since this test was created for clinical settings
References	*Source of information*	[74], [130]–[134]

Table 14. MMPI (Minnesota Multiplastic)

Definition	*Theory behind the instrument*	Evaluation of general personality attributes. It is used in clinical settings and for screening employees when public safety (airline, pilots or nuclear power employees) is concerned
Indicator measured	*Indicators that are considered for each instrument to be measured (e.g. competence, personality traits, roles, talents, etc.)*	1. L Scale: willingness to acknowledge faults or problems 2. K Scale: tendency to minimize problems 3. F Scale: Tendency to exaggerate problems or to fake the test by overresponding to extreme items 4. TRIN and VRIN Scales: Response inconsistency. 5. Clinical Scales: Hypochondriasis, Depression, Hysteria, Psychopathic Deviate Masculinity/Femininity, Paranoia, Psychasthenia, Schizophrenia, Hypomania, Social Introversion
Individual/Team/Cultural assessment instrument	*Does the instrument assess individual, team level or cultural characteristics?*	Individual
Industry where applied	*Indicates the industries where the instrument has been used.*	Clinics and for hiring employees in public safety
Characteristics of a high performing team	*Describes the characteristics of a high-performing team in terms of the indicators assessed by the instrument*	Not found
Description of the data collection instrument	*A description of the data collection instrument (e.g. questionnaires, tests, etc) that is used to collect the information from the people assessed*	MMPI-II test includes 567 false-true items, distributed in 10 clinical scales (Hypochondriasis, Depression, Hysteria, Psychopathic Deviate, Masculinity/Femininity, Paranoia, Psychasthenia, Schizophrenia, Social Introversion), five validity scales (L, K, F, VRIN, TRIN), fifteen content-based scales (ex.: Antisocial Practices or ASP, Bizarre Mentation or BIZ, and Family Problems or FAM) and many special scales (e.g.: Addiction Potential scale or APS, Addiction Acknowledgment scale or AAS).
Self/colleague observer/expert observer report	*Is the data collection instrument filled by the individual him/herself, by a colleague or by a third-party expert? (If the report is filled by a third-party expert, then an interview or a workshop where the expert can observe the subject's behavior will be needed).*	Self-report
Some versions	*Some versions of the instrument that are available*	MMPI-2 (adults), MMPI-A (adolescents)
Time required to do the assessment	*Time required to collect the data from the subjects*	1h20 to 1h40 per person
Need to purchase the right to use it	*Does the instrument need to be purchased?*	yes
Is the instrument proportional?	*Requirements of the instrument to be used in a public procurement in the European Union*	No, assess clinics aspects no relevant for the position
Is the application of the instrument transparent		Yes
Is the instrument non-discriminatory?		No (since it is a clinical test, certain characteristics found in users may help to reject them from job position)
How can the assessment (in the contractor-selection process) be performed?	*Adaptation of the assessment instrument into the contractor selection process*	Not suggestions for the contractor selection process, however below you can find how is the assessment performed for clinical or public safety settings: Questionnaire is given to individuals. Once they have finished, results should be obtained automatically (if the instrument was computer-based). If the instrument is paper-based, interviewer should transfer the data to a computer programme in order to obtain the results from the users. The psychologist needs to be at the place applying the test, cannot be done from home
Additional remarks	*Extra relevant information about the instruments*	--
References	*Source of information*	[75], [134]–[137]

Table 15. Personality Assessment Inventory PAI

Definition	*Theory behind the instrument*	This instrument assesses psychopathological syndromes, relevant for clinical diagnosis and screening for psychopathology
Indicator measured	*Indicators that are considered for each instrument to be measured (e.g. competence, personality traits, roles, talents, etc.)*	1) Validity scales, 2) Clinical scales, 3) Treatment scales, 4) interpersonal scales
Individual/Team/Cultural assessment instrument	*Does the instrument assess individual, team level or cultural characteristics?*	Individual
Industry where applied	*Indicates the industries where the instrument has been used.*	Clinics and criminal settings
Characteristics of a high performing team	*Describes the characteristics of a high-performing team in terms of the indicators assessed by the instrument*	Not found
Description of the data collection instrument	*A description of the data collection instrument (e.g. questionnaires, tests, etc.) that is used to collect the information from the people assessed*	PAI is composed by 344 items, to obtain information regarding 4 validity scales, 11 clinical scales, 5 treatment scales, and 2 interpersonal scales. Each item is measured by using a 4-point Likert Scale (1 = very true, 2 = mainly true, 3 = slightly true, 4 = false).
Self/colleague observer/expert observer report	*Is the data collection instrument filled by the individual him/herself, by a colleague or by a third-party expert? (If the report is filled by a third-party expert, then an interview or a workshop where the expert can observe the subject's behavior will be needed).*	Self-report
Some versions	*Some versions of the instrument that are available*	Personality Assessment Inventory (PAI), Personality Assessment Inventory-Adolescent (PAI-A)
Time required to do the assessment	*Time required to collect the data from the subjects*	50-60 to administer ad 15-20 min to score
Need to purchase the right to use it	*Does the instrument need to be purchased?*	Yes
Is the instrument proportional?	*Requirements of the instrument to be used in a public procurement in the European Union*	No, assess psychopathological traits not relevant for the position
Is the application of the instrument transparent		Yes
Is the instrument non-discriminatory?		No (it measures psychopathology, clinical indicators that might not be relevant in workplace)
How can the assessment (in the contractor-selection process) be performed?	*Adaptation of the assessment instrument into the contractor selection process*	Not suggestions for the contractor selection process, however below you can find how is the assessment performed for clinical or criminal settings: Interviewees are administered with the test and, once they have finished, they will get results automatically (if the test is computer-based). If test is paper based, the interviewer has to transfer the data to computer. For data to be reliable, the administration should be supervised by a psychologist. The psychologist needs to be at the place applying the test, cannot be done from home
Additional remarks	*Extra relevant information about the instruments*	This test might not be appropriate for work, because it measures clinical indicators that are not relevant for workplace.
References	*Source of information*	[76], [138], [139]

Table 16. Team dynamics assessment

Definition	*Theory behind the instrument*	This assessment instrument/method is commonly used by assessment committees in partner-selection process in the construction industry to assess team dynamics competences in client-contractor teams.
Indicator measured	*Indicators that are considered for each instrument to be measured (e.g. competence, personality traits, roles, talents, etc.)*	Team dynamics competences. The set of team dynamics competences vary depending on the kind of project and the consulting firm in charge of the assessment. Some examples of competences are: Open communication, Mutual respect, team learning, etc.
Individual/Team/Cultural assessment instrument	*Does the instrument assess individual, team level or cultural characteristics?*	Team assessment instrument
Industry where applied	*Indicates the industries where the instrument has been used.*	AEC and any other industries
Characteristics of a high performing team	*Describes the characteristics of a high-performing team in terms of the indicators assessed by the instrument*	A high performer team have high levels of the competences required for the project
Description of the data collection instrument	*A description of the data collection instrument (e.g. questionnaires, tests, etc) that is used to collect the information from the people assessed*	There are different ways to form the assessment scales. For instance, one type of scale is as follows: Per every competence there are behavioral indicators that help the (expert) observer to see if the bidders' behavior meet the requirements of the assessed competence. The observer gives a score until 5 points depending on how much of that competence the bidder poses.
Self/colleague observer/expert observer report	*Is the data collection instrument filled by the individual him/herself, by a colleague or by a third-party expert? (If the report is filled by a third-party expert, then an interview or a workshop where the expert can observe the subject's behavior will be needed).*	Expert observer report
Some versions	*Some versions of the instrument that are available*	Team assessment by Motion Consult, Behavioural assessment by Twynstra Gudde
Time required to do the assessment	*Time required to collect the data from the subjects*	half to one full day
Need to purchase the right to use it	*Does the instrument need to be purchased?*	no
Is the instrument proportional?	*Requirements of the instrument to be used in a public procurement in the European Union*	yes
Is the application of the instrument transparent		yes
Is the instrument non-discriminatory?		yes
How can the assessment (in the contractor-selection process) be performed?	*Adaptation of the assessment instrument into the contractor selection process*	With a workshop, where the client-potential contractor team is exposed to critical situations related to the construction project (the critical situations are defined with the client). The activities take a reasonable amount of time and pressure to get a clear sight on the actual behavior of the contractor in a client-contrctor team. Finally, the assessment is performed by experts observing and assessing the behavior of conractors.
Additional remarks	*Extra relevant information about the instruments*	To ensure a good assessment, the assessors should be well trained to objectively observe and identify the collaborative behaviors. Which system you assess is important, hence the workshops activities must be like those activities the team might face during the execution of the project. The participation of the client also helps define the system.
References	*Source of information*	[68], [69]

Table 17. Compatibility and Trust assessment (CaT)

Definition	*Theory behind the instrument*	Evaluate the trust and compatibility between buyer and contractor. Can be used in the beginning of relationships to create a strong foundation of trust and learn how to build compatibility.
Indicator measured	*Indicators that are considered for each instrument to be measured (e.g. competence, personality traits, roles, talents, etc.)*	Five dimensions of compatibility and trust: 1. Trust, 2. Innovation, 3) Communication, 4) Team orientation and 5) Focus
Individual/Team/Cultural assessment instrument	*Does the instrument assess individual, team level or cultural characteristics?*	Team assessment instrument
Industry where applied	*Indicates the industries where the instrument has been used.*	Buyer-contractor type industries
Characteristics of a high performing team	*Describes the characteristics of a high-performing team in terms of the indicators assessed by the instrument*	High compatible buyer-contractor relationship have a high "vested deal index" which is computed based on the test results.
Description of the data collection instrument	*A description of the data collection instrument (e.g. questionnaires, tests, etc.) that is used to collect the information from the people assessed*	The test contains around 36 statements belonging to 5 dimensions. Possible answers to the statements are: never, mostly not, less times than not, sometimes, more times than not, most times and always.
Self/colleague observer/expert observer report	*Is the data collection instrument filled by the individual him/herself, by a colleague or by a third-party expert? (If the report is filled by a third-party expert, then an interview or a workshop where the expert can observe the subject's behavior will be needed).*	Self and Colleague observer report. In this case buyer and contractor fill a test about themselves and other about the other party
Some versions	*Some versions of the instrument that are available*	CaT instrument
Time required to do the assessment	*Time required to collect the data from the subjects*	15 minutes per quetionnaire
Need to purchase the right to use it	*Does the instrument need to be purchased?*	Yes
Is the instrument proportional?	*Requirements of the instrument to be used in a public procurement in the European Union*	Yes
Is the application of the instrument transparent		Yes
Is the instrument non-discriminatory?		Yes
How can the assessment (in the contractor-selection process) be performed?	*Adaptation of the assessment instrument into the contractor selection process*	Client and bidders (contractors) work in a workshop so they get acquainted. Client and contractors complete the test. Gaps in relationship are obtained. Selection should be made based on the willingness of the bidder to close the gaps; hence, client and bidder discuss about the strategy to close the gap. Then, the client selects the contractor based on the discussions.
Additional remarks	*Extra relevant information about the instruments*	--
References	*Source of information*	[70]

Table 18. Supply Chain dyadic relationship SCDR

Definition	*Theory behind the instrument*	Instrument that predicts future relationship success, between client and supplier, at the earliest stages of the relationship formation.
Indicator measured	*Indicators that are considered for each instrument to be measured (e.g. competence, personality traits, roles, talents, etc.)*	1) Creativity- encouraging innovation and high performance, 2) Stability-creating a framework for successful business, 3) communication-transparency for business success, 4) Reliability-creating reliable business processes. 5) Value-creating the incentive to work together. 6)Culture matching
Individual/Team/Cultural assessment instrument	*Does the instrument assess individual, team level or cultural characteristics?*	Team and cultural assessment instrument
Industry where applied	*Indicates the industries where the instrument has been used.*	Supply chain management
Characteristics of a high performing team	*Describes the characteristics of a high-performing team in terms of the indicators assessed by the instrument*	Both, the client and supplier need to have high levels of these characteristics: Creativity, stability, effectiveness at communicating, reliable, value, cultural matching.
Description of the data collection instrument	*A description of the data collection instrument (e.g. questionnaires, tests, etc) that is used to collect the information from the people assessed*	questionnaire divided in 6 sections (every section belongs to every element assessed). Creativity, stability, communication, reliability, value, culture matching contains 8, 6, 7, 10,7 and 5 questions respectively.
Self/colleague observer/expert observer report	*Is the data collection instrument filled by the individual him/herself, by a colleague or by a third-party expert? (If the report is filled by a third-party expert, then an interview or a workshop where the expert can observe the subject's behaviour will be needed).*	observer report
Some versions	*Some versions of the instrument that are available*	SCDR predictor
Time required to do the assessment	*Time required to collect the data from the subjects*	30 minutes to fill the questionnaire, plus an additional time for a workshop between the client and the potential suppliers (normally half day per supplier)
Need to purchase the right to use it	*Does the instrument need to be purchased?*	No
Is the instrument proportional?	*Requirements of the instrument to be used in a public procurement in the European Union*	yes
Is the application of the instrument transparent		Yes
Is the instrument non-discriminatory?		Yes
How can the assessment (in the contractor-selection process) be performed?	*Adaptation of the assessment instrument into the contractor selection process*	Client and potential contractors evaluate themselves, each other and the relationship
Additional remarks	*Extra relevant information about the instruments*	A workshop between the client and contractor is necessary.
References	*Source of information*	[66]

Table 19. Organizational Culture Assessment Instrument (OCAI)

Definition	*Theory behind the instrument*	The OCAI, developed Robert Quinn and Kim Cameron, is an instrument that examines organizational culture. It uses the model of the Competing Values Framework which assess four competing values corresponding to 4 types of organizational culture. They state that every organization has a mix of these 4 types of organizational culture. The categorization is based on six dimensions: 1. Dominant Characteristics, 2. Organizational Leadership, 3. Management of employees, 4. Organizational Glue, 5. Strategic emphases and 6. Criteria of success.
Indicator measured	*Indicators that are considered for each instrument to be measured (e.g. competence, personality traits, roles, talents, etc.)*	Type of culture of the organization: 1. Clan, 2. Adhocracy, 3. Hierarchy, 4. Market
Individual/Team/Cultural assessment instrument	*Does the instrument assess individual, team level or cultural characteristics?*	Organizational Cultural assessment
Industry where applied	*Indicates the industries where the instrument has been used.*	All industries
Characteristics of a high performing team	*Describes the characteristics of a high-performing team in terms of the indicators assessed by the instrument*	Partners with compatible cultures are more likely to understand one another and to work toward common goals
Description of the data collection instrument	*A description of the data collection instrument (e.g. questionnaires, tests, etc) that is used to collect the information from the people assessed*	It is a questionnaire where the participant is asked to give 100 points over four alternatives regarding the type of culture of their organization. Six questions or statements are judged, these statements correspond to the 6 dimensions of their organization: 1. Dominant Characteristics, 2. Organizational Leadership, 3. Management of employees, 4. Organizational Glue, 5. Strategic emphases and 6. Criteria of success.
Self/colleague observer/expert observer report	*Is the data collection instrument filled by the individual him/herself, by a colleague or by a third-party expert? (If the report is filled by a third-party expert, then an interview or a workshop where the expert can observe the subject's behaviour will be needed).*	self (i.e. participants answering about their company)
Some versions	*Some versions of the instrument that are available*	Organizational Culture Assessment Instrument (OCAI)
Time required to do the assessment	*Time required to collect the data from the subjects*	15 minutes
Need to purchase the right to use it	*Does the instrument need to be purchased?*	yes
Is the instrument proportional?	*Requirements of the instrument to be used in a public procurement in the European Union*	yes
Is the application of the instrument transparent		yes
Is the instrument non-discriminatory?		yes
How can the assessment (in the contractor-selection process) be performed?	*Adaptation of the assessment instrument into the contractor selection process*	1 The client and bidders do the questionnaire. 2) Then the values of the 4 types of organizational culture are obtained for the client and bidders. 3) The 4 absolute differences (from the types of organizational culture) between client and bidder is obtained and then summed to obtain a score. 4) Organizational cultural congruence value is obtained by resting the value obtained in step 3 to 200. 5) Bidders with more cultural compatibility with the client have higher scores in organizational cultural congruence value compared to the bidders with less cultural compatibility.
Additional remarks	*Extra relevant information about the instruments*	Besides defining the compatible bidder based on cultural fit, the results can be used to improve the organizational culture of the client-contractor organization
References	*Source of information*	[18], [82], [140]–[142]