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Empirical Research Paper

Linking partnering success factors to project performance - Findings from two nation-wide surveys

Kristina Nevstad [a,*], Tage Koed Madsen [b], Pernille Eskerod [c], Wenche Kristin Aarseth [a], Anniken Susanne T. Karlsen [a], Bjørn Andersen [a]

[a] NTNU Norwegian University of Science and Technology, Trondheim, Norway
[b] University of Southern, Denmark
[c] Webster Vienna Private University, Austria

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ABSTRACT

In this article we present findings from an investigation into the influence of partnering success factors on multi-partner projects' abilities to meet time schedule, budget, and technical specifications. Our findings are based on the analysis of nation-wide surveys within the engineering consultancy industry in Denmark and Norway, and the research includes empirical data from 124 engineering consultancies. A main conclusion is that in order to meet all three criteria in the project performance measure, i.e. time schedule, budget, and technical specifications, *mutual project objectives* and *commitment are* important. To fulfil the two criteria time schedule and technical specifications, *trust* and *collaborative problem-solving* are important. To meet the criterion technical specifications, *communication* is the important partnering success factor. We also find that to positively influence project performance in a project comprising partners from independent firms, the project manager must aim to ensure the presence of the five identified partnering success factors throughout the project.

1. Introduction

In several industries it is common for companies to create value through projects (Turner et al., 2012; Söderlund, 2008; Crawford, 2006; Brady and Davies, 2004). In some domains, attracting and accomplishing projects requires that several partners work together. For example, this is typically the case in shipbuilding (Ahola, 2009), in oil and gas (Olsen et al., 2005), in construction (Bresnen, 2007), and in sports event projects (Larson and Wikström, 2007). When it comes to infrastructure projects and other large engineering projects, the long-term, integrated construction process requiring multiple services in an increasingly global world has led to widespread recognition of engineering consultancies and construction companies entering into various kinds of cooperation arrangements in order to create value together (Dyer and Nobeoka, 2000; Eskerod and Damgaard, 1998).

In many countries there is an increasing interest in collaborative relationships, also referred to as partnering (Bresnen and Marshall, 2000; Chan et al., 2003; Ng et al., 2002). Partnering is the most frequently discussed institutional form of cooperative relationship in the building and construction industry (Eriksson, 2010; Wood et al., 2002). Each partnering project is formed by a set of hard and soft elements (Fotopoulos and Psomas, 2009; Yeung et al., 2007). Elements that are directly regulated by the project contract or have their basis in the procurement process are considered hard elements (such as a formal contract and gain-share/pain-share), whereas soft elements contribute to the relationship between the project participants (such as trust, communication, and commitment) (Yeung et al., 2007). A study (Nevstad et al., 2018) focusing on the management and collaboration aspects of partnering has identified *trust*, *communication*, *commitment*, *collaborative problem-solving*, and *mutual project objectives* to be the most frequently stated partnering success factors.

Despite the mentioning of multi-partner projects (MPP) in literature (Dietrich et al., 2010), there is no generally accepted definition of the concept. In line with the definition of multi-partner alliances provided by Lavie, Lechner et al. (Lavie et al., 2007) as well as the definition in (Aagaard et al., 2012), we define a multi-partner project as *a project in which employees from two or more independent firms work together to attract, plan and execute a common time-bounded and resource-constrained task of a*

* Corresponding author.
E-mail addresses: kristina.nevstad@ntnu.no (K. Nevstad), tkm@sam.sdu.dk (T.K. Madsen), pernille.eskerod@webster.ac.at (P. Eskerod), wenche.k.aarseth@nord.no (W.K. Aarseth), anniken.t.karlsen@ntnu.no (A.S.T. Karlsen), bjorn.andersen@ntnu.no (B. Andersen).

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certain complexity for a client in order to create value for the firms and client involved. A multi-partner project can be seen as a knowledge collective, which is characterized by cross-disciplinary, loosely coupled groups with a minimal common knowledge base (Lindkvist, 2005). Multi-partner projects involve highly complicated knowledge-sharing processes and collaborative arrangements and are therefore highly relevant to study.

Project-based collaboration, often spanning national borders and organizations, is challenging due to a multitude of reasons, including the temporary nature of alliances that are formed to deliver new output together. Several complex projects experience substantial cost overruns and delays in completion as well as failure in delivering what was agreed upon (Chang et al., 2013; Williams and Samset, 2010). However, partnering (in terms of both hard and soft elements) has been documented to contribute positively to construction projects (Suprapto et al., 2016; Tabish and Jha, 2011; Xue et al., 2010; Jacobson and Ok Choi, 2008; Chan et al., 2004; Bayramoglu, 2001; Cheng et al., 2000; Larson, 1997).

In recent years, researchers have increasingly turned their focus from hard elements to social and human aspects, i.e. soft elements related to working in project-based collaboration (Jacobsson and Roth, 2014; Hanisch and Wald, 2011). Several authors state that improved collaboration has a positive effect on performance in construction projects (Caniëls et al., 2019; Sarhan et al., 2017; Walker et al., 2017). Generally, there is a need for more research investigating the link between collaboration and project performance (Silva and Harper, 2018; Bond-Barnard et al., 2018; Meng and Gallagher, 2012). This investigation responds to the call to collect data from a large number of projects to test that there is a positive relationship between collaboration and project performance (Eriksson and Westerberg, 2011).

Several studies have been carried out to identify factors responsible for successful partnering (Chan et al., 2004; Cheng et al., 2000; Ling et al., 2015; Black et al., 2000; Doloi, 2009; Chen and Chen, 2007). Furthermore, studies on human project success factors, in the context of the project team, have been explored to some extent (Eriksson and Westerberg, 2011) in literature, but these have been investigated in relative isolation from the other factors (Bond-Barnard et al., 2018). Even though research has been conducted, several existing studies are based on surveys with limited empirical support (Silva and Harper, 2018; Bond-Barnard et al., 2018; Meng and Gallagher, 2012; Haaskjold et al., 2020) and therefore testify to a gap in the existing literature. In order to explore the relationship between project-based collaboration and project performance further, it is apparent that more empirical research is needed.

In this investigation, we focus on collaboration between multiple partners within the engineering consultancy industry. Based on the argumentation above, our research question is:

> RQ. How do partnering success factors influence multi-partner projects' performance in terms of being on time, within budget, and to technical specifications?

This article is organized as follows: Section 2 describes the theoretical background for partnering success, including subsections on project performance and partnering success factors. This is followed by section 3, in which a description of the chosen research methodology is presented. In section 4, findings are summarized and central aspects of our findings are discussed. Finally, in section 5, conclusions, practical implications and further research are presented.

2. Theoretical background

In this section, we discuss the two core concepts in the research underlying this article.

2.1. Project performance

The literature distinguishes between project success (measured against the purpose and the overall objectives of the project) and project management success (measured against the widespread and classic measures of performance, i.e. cost, time, and quality) (De Wit, 1988; Cooke-Davies, 2002). Traditionally, projects were perceived as successful when they met time, budget, and performance goals (Shenhar et al., 2001). Performance in terms of cost, time and quality is commonly known as "The Iron Triangle" (Rezvani and Khosravi, 2018). This concept is a fundamental aspect of how we understand success in projects. It is a representation of the most basic and classic criteria by which project success is measured, specifically whether the project is delivered by the due date, within budget, and to some agreed level of quality, performance or scope (Julien et al., 2018).

Several researchers perceive "The Iron Triangle" concept as a poor definition of project success, as it does not take into account fulfillment of the project's purpose about bringing value (Müller and Jugdev, 2012). However, most project managers in the construction industry have an operational focus, and their mindset and success criteria are focused on "getting the job done". While other success criteria have emerged, such as environmental impact, societal value, etc., industries still put heavy emphasis on finishing projects on time, within budget, and to specifications (Shenhar et al., 2001), implicitly implying that this is the first step towards fulfilling the other success criteria. In addition, it is easier to measure than other performance measures. Thus, we have chosen this classic project performance construct (time schedule, budget, and technical specifications) for our empirical study. The scope of this study is limited to performance measures pertaining to the concept "The Iron Triangle" only.

2.2. Partnering success factors

Project partnering is not easy to define, since researchers have been unable to develop a widely accepted description of project partnering. While (Larson, 1995) formulated a definition of partnering that includes a list of success elements, such as collaboration, trust, openness, and mutual respect, other authors have emphasized that a partnering definition cannot be separated from the presented elements (Chan et al., 2003; Yeung et al., 2007; Naoum, 2003; Nyström, 2005; Lu and Yan, 2007). We use the definition by Børve, Rolstadås et al. (Børve et al., 2017): "Project Partnering is a relationship strategy whereby a project owner integrates contractors and other major contributors into the project. Through commitment to mutual project objectives, collaborative problem solving and a joint governance structure, partners pursue collaborative relationships, trust and improved performance" [57, p. 694].

Partnering elements, such as trust, common understanding, and conflict resolution mechanisms, are in literature identified by a majority of the authors as important elements of partnering (Hosseini et al., 2018). As mentioned in the introduction, Nevstad, Børve et al. (Nevstad et al., 2018) found five groups of partnering success factors. The most important partnering success factor was *trust*, the second most important was *communication*, *commitment* was the third most important, *collaborative problem-solving* was listed as number four, and finally *mutual project objectives.* Inspired by Nevstad, Børve et al. (Nevstad et al., 2018), Table 1 shows groups of factors responsible for successful partnering described in literature and references. Each of the five partnering success factors, mentioned above, will be described in further detail.

Trust is a broad term (Wong et al., 2008; Kadefors, 2004) and varies in literature from "mutual trust" (Cheung et al., 2003) to the more specific "System-based trust" (Wong and Cheung, 2005). The factors of trust refer to involved partners (Cheung et al., 2003; Wong and Cheung, 2005; Lau and Rowlinson, 2009; Meng, 2012). Kaluarachchi and Jones (2007), adopting a broader view, require trust between "all stakeholders". Furthermore, trust is in literature described as an outcome (Eriksson, 2010), as an objective (Cheung et al., 2003; Construction Excellence, 2009), a measure (Mesa et al., 2016; Meng, 2012; Chan et al., 2004) or as a prerequisite (Aarseth et al., 2012; Kaluarachchi and Jones, 2007; Construction Industry Institute (CII) and C, 1991).

Table 1
Groups of factors responsible for successful partnering described in literature and references (adapted from Nevstad, Børve et al. (Nevstad et al., 2018)).

Partnering success factors	Formulations used to describe the factor	References
Trust	"Mutual trust"	Cheung, Ng et al. (Cheung et al., 2003)
	"System-based trust" (satisfactory terms, alignment, adoption of alternative dispute resolution)	Wong and Cheung (Wong and Cheung, 2005)
	"Inter-firm trust"	Lau and Rowlinson (Lau and Rowlinson, 2009)
	Described as a prerequisite	Aarseth, Andersen et al. (Aarseth et al., 2012)
		Kaluarachchi and Jones (Kaluarachchi and Jones, 2007)
		Construction Industry Institute (CII) (Construction Industry Institute (CII) and C, 1991)
	Described as a measure	Mesa, Molenaar et al. (Mesa et al., 2016)
		Meng (Meng, 2012)
		Chan, Chan et al. (Chan et al., 2004)
	Described as an objective	Construction Excellence (Construction Excellence, 2009)
		Cheung, Ng et al. (Cheung et al., 2003)
	Described as an outcome	Eriksson (Eriksson, 2010)
	Implicitly, the factors of trust refer to involved partners	Meng (Meng, 2012)
		Lau and Rowlinson (Lau and Rowlinson, 2009)
		Wong and Cheung (Wong and Cheung, 2005)
		Cheung, Ng et al. (Cheung et al., 2003)
	Require trust between "all stakeholders"	Kaluarachchi and Jones (Kaluarachchi and Jones, 2007)
	Related to the no-blame factors	Suprapto, Bakker et al. (Suprapto et al., 2015)
		Meng (Meng, 2012)
	Trust-control balance	Walker and Lloyd-Walker (Walker and Lloyd-Walker, 2015)
Communication	Just "communication"	Meng (Meng, 2012)
		Doloi (Doloi, 2009)
		Cheung, Ng et al. (Cheung et al., 2003)
	"Effective communication"	Black, Akintoye et al. (Black et al., 2000)
	"Open and honest communication"	Suprapto, Bakker et al. (Suprapto et al., 2015)
	"Permeability of partners" comprising communication, information flow and openness	Wong and Cheung (Wong and Cheung, 2005)
	"Early contractor involvement" to explain "effective communication"	Kaluarachchi and Jones (Kaluarachchi and Jones, 2007)
Commitment	"Commitment to teamwork"	Larson (Larson, 1997)
	"Commitment from senior management"	Black, Akintoye et al. (Black et al., 2000)
	"Long-term-" and "resource commitment"	Cheung, Ng et al. (Cheung et al., 2003)
	"Top management support" (as a kind of internal or external commitment)	Suprapto, Bakker et al. (Suprapto et al., 2015)
		Cheng and Li (Cheng and Li, 2001)
		Larson (Larson, 1997)
	"Equity" (to have something to lose)	Du, Tang et al. (Du et al., 2016)
	"Joint risks"	Doloi (Doloi, 2009)
Collaborative problem-solving	"Conflicts"	Cheng, Li et al. (Cheng et al., 2000)
	"Problems"	Du, Tang et al. (Du et al., 2016)
		Meng (Meng, 2012)
		Kaluarachchi and Jones (Kaluarachchi and Jones, 2007)
		Cheung, Ng et al. (Cheung et al., 2003)
		Bennett and Jayes (Bennett and Jayes, 1995)
	"Joint governance structure" (applies to both project risks and opportunities)	Walker and Lloyd-Walker (Walker and Lloyd-Walker, 2015)
Mutual project objectives	"Measurable objectives" fits well with the "continuous evaluation" and "annual review of performance"	Bennett and Baird (Bennett and Baird, 2001)
	"Benchmarks"	Bresnen (Bresnen, 2007)
	"Performance measurement"	Meng (Meng, 2012)

In literature, the wording of *communication* varies, with examples ranging from just "communication" (Doloi, 2009; Cheung et al., 2003; Meng, 2012) to, "effective communication" (Black et al., 2000) and, "open and honest communication" (Suprapto et al., 2015), whereas (Kaluarachchi and Jones, 2007) utilized the term "early contractor involvement" to explain "effective communication".

Commitment is the third most frequent factor. Formulations used to describe this factor vary from "commitment to teamwork" (Larson, 1997), and "commitment from senior management" (Black et al., 2000) to "long-term-" and "resource commitment" (Cheung et al., 2003). Furthermore, commitment is related to "top management support" (Larson, 1997; Suprapto et al., 2015; Cheng and Li, 2001) as a kind of internal or external commitment.

Collaborative problem-solving varies in literature from "joint risks" (Doloi, 2009) and "conflicts" (Cheng et al., 2000) to the broader "problems" (Cheung et al., 2003; Kaluarachchi and Jones, 2007; Meng, 2012; Du et al., 2016; Bennett and Jayes, 1995) and "joint governance structure" (Walker and Lloyd-Walker, 2015).

As to, *mutual project objectives*, examples used to describe this factor with exhibit little variation in wording and include "mutual", "joint", "common or shared objectives" or "goals". The concept of partnering evaluation has been developed into "performance measurement" by Meng (2012). "Benchmarks" are highlighted by (Bresnen, 2007). The term "measurable objectives" fits well with the terms "continuous evaluation" and "annual review of performance" emphasized by Bennett and Baird (2001).

Not surprisingly, success factors for projects in general (Pinto and. Slevin, 1987) also apply to partnering projects. For example, Haaskjold, Andersen et al. (Haaskjold et al., 2019) identified the quality of communication and trust between the parties to be the two out of five most important factors for project practitioners to prioritize in order to reduce transaction costs through improved collaboration.

3. Research methodology

In this section, we present our choice of industry as empirical base. Further, we describe in detail how we conducted two nation-wide surveys in the engineering consultancy industry, including both a Danish and a Norwegian dataset. In addition, we present how we developed the questionnaire and conducted the data analysis. The section is finalized by a thorough assessement of our research method.

3.1. Selection of industry as empirical base

Engineering consultancies are often involved in multi-partner projects of high complexity. Furthermore, engineering consultancies often act in international markets and have significant influence on the productivity and growth of other industries because they act as facilitators in the business-to-business market. Therefore, a study of multi-partner projects involving engineering consultancies has the potential to bring significant value to research as well as to practice in different industries. Danish engineering consultancies are almost entirely micro or small and medium-sized enterprises (SMEs). It is well known that such SMEs play an important role in growth, innovation and development in many industries (OECD, 2009; Lu and. Beamish, 2006), an effect that has also been demonstrated in Denmark (Madsen et al., 2006) and Norway (Azari and Madsen, 2017; Steinmo and Rasmussen, 2016). In sum, the engineering consultancies provide a highly appropriate setting, as their main business model is multi-partner projects in which the participants are specialized in different knowledge areas. Thus, this industry has been selected as the research's empirical base.

The surveys were conducted using a quantitative method (Vaus and D.A, 2014). Our quantitative data were collected through two nation-wide surveys, one carried out in the Danish and one in the Norwegian engineering consultancy industry. Our interest was in on-going multi-partner projects measuring individual-level perceptions of collaborative behaviors. The surveys were carried out in the respective native languages (which are very similar).

3.2. Two nation-wide surveys in the engineering consultancy industry

The two nationwide surveys were conducted as described below

3.2.1. The Danish dataset

The population of the study was defined as engineering consultancies in the NACE codes 71.12.10 (building and infrastructure) and 71.12.20 (production and machinery). In Denmark, firms were selected from the database 'Navne & Numre' ('Names & Numbers'), which registers information about all on-going Danish firms.

For the purpose of this study, all identified firms with more than two employees were included. The cut-off point of two employees was decided to ensure that only truly multi-partner projects of a certain size were included.

This population of the study ended up being 352 firms. This number was quality-checked by contacting The Association for Consulting Engineers in Denmark (FRI). As the association comprised approximately 300 firms at the time of the survey, the number seemed reasonable.

Each firm was contacted by telephone in order to detect wrong registration, to identify a relevant informant, and to invite the firm to participate in the survey.

There was no prior information about the number of multi-partner projects in these firms. As mentioned, our interest focused on on-going multi-partner projects. We asked the firms to identify the on-going multi-partner project which involved most man-hours and use this as the basis when responding to the survey questionnaire. The reason for this selection criterion was that we wished to examine multi-partner projects of high importance for the responding firm, and multi-partner projects in which the firm was highly involved. The number of man-hours was thought to represent the best proxy for these criteria.

The participating firms received a cover letter as well as a questionnaire that was sent to the contact person through SurveyXact. This resulted in 76 responses out of the population of 352 firms, i.e. a response rate of 22 percent.

3.2.2. The Norwegian dataset

The Norwegian population was identified in a similar way. In line with the approach used in Denmark, the selection of empirical base in Norway was based on members of RIF Norway (Norwegian engineering consultancies). This was done to ensure the robustness of the research - that the same method was applied to the selection of both populations.

The data collection in Norway was undertaken as follows: Initially, the university in Norway was contacted by the university in Denmark and asked to do a similar study about multi-partner projects in Norway. The data from Denmark would then be compared to the data from Norway. Then, the Norwegian university contacted RIF Norway to ask if they would be interested in participating in the survey. RIF Norway agreed to let the Norwegian university contact all their members and ask them to answer the questionnaire about multi-partner projects.

The 201 firms in the population were contacted by email. Some of the email addresses bounced and had to be updated. Attached to the invitation to participate and the link to the survey from SurveyXact was a letter, describing the purpose of the survey. The first email revealed that several firms were too small or did not engage in multi-partner projects, thus reducing the population of the study. Some firms answered right away, and some declined to participate in the survey, mainly because of lack of time and an unwillingness to participate in surveys.

A total of two reminders were sent. First, firms who had not replied received a reminder. This was sent to non-respondents as well as to respondents that had not answered the whole questionnaire after a certain amount of time. Finally, all firms that had not answered the whole questionnaire were contacted a last time by telephone or were sent a final reminder. The latter included firms that were contacted in a more extended form, namely those who explicitly had promised to answer the questionnaire but had failed to do so. These efforts raised the total number of respondents to 48.

In sum, the population (the members of RIF Norway) was 201 firms, of which 48 answered the questionnaire, i.e. 24 percent.

3.3. The questionnaire development

In addition to the understanding of the core concepts generated by the literature review by Nevstad, Børve et al. (Nevstad et al., 2018) mentioned above, the questions in the questionnaire were formulated directly on the basis of previous questions from similar studies in order to draw on existing knowledge.

3.3.1. Trust

Relational norms refer to norms of reciprocity and trust that develop during the course of an inter-firm relationship (Morgan and Hunt, 1994). The stronger the relational norms, the more protection the partners have against opportunistic behavior without having to rely on explicit formal contracts as safeguarding mechanisms (Das and Teng, 2001). This made us develop these two questions linked to trust (with the variable name for the indicators used in the quantitative analysis included in hard brackets):

"*We trust that the knowledge we transfer to the project will not be misused by our partner should they collaborate with our competitors in the future*" [Trust know]

"*We trust that our partner shows consideration for our interests*" [Trust interest]

3.3.2. Communication

The question about communication corresponds to a survey question presented in Hoegl and Gemuenden (2001) that suggests that communication between partners is important to project success:

"*There is often communication happening between the participating partners*" [Communication]

3.3.3. Commitment

In our research, commitment relates both to support by project representatives and to allocation/investment of resources.

The first question on commitment is adapted from Andersen and Jessen (2000). The survey underlying the article by Andersen and Jessen (2000) was conducted in the Norwegian language, thus the original question was already in Norwegian (which is easily adaptable to Danish).

"*All persons involved in the project (project manager, project owner, steering groups, top management, etc.) are actively supporting the project*" [Support]

Relation-specific assets refer to investments that a firm undertakes with a partner that are specific to that relation ("idiosyncratic") and have only salvage value outside the focal relation (Williamson, 1975). Investments can e.g. be in human resources (e.g. dedicated personnel) or in physical capital resources (e.g. locating a production site adjacent to a partner's). As to transaction cost, literature in the field of economics argues that the more a firm invests in relation-specific assets, the higher its switching costs, and thus the higher the risk that it will fall victim to a "hold-up" by a partner trying to extract ex post rents (Williamson, 1975). Inspired by Nyaga, Whipple et al. (Nyaga et al., 2010): "We have dedicated significant investments (e.g. equipment, personnel) to partner relationships", and "We needed to dedicate a lot of resources (human, capital) to our relationships with our partners". This caused us to develop the second question linked to commitment:

"*We allocate many resources (people, money) to the collaboration with partners*" [Resources]

3.3.4. Collaborative problem-solving

Effectuation has been suggested as a viable theoretical frame for the analysis of individual behavior in environments characterized by high uncertainty (Sarasvathy, 2001). In entrepreneurship research, effectuation adopts the view that the process of decision-making involves both prior beliefs about ourselves and prior knowledge and networks, bringing the entrepreneur to the center of the stage (Sarasvathy, 2004). Although the theory has found a strong interest from related fields such as marketing (Read et al., 2009), economics (Dew et al., 2004), management (Augier and Sarasvathy, 2004) and R&D management (Brettel et al., 2012), effectuation has yet to be employed in the study of how managers in consulting engineering firms engage in multi-partner projects. Inspired by the questionnaire and the scales developed by Brettel, Mauer et al. (Brettel et al., 2012)'s work on R&D management and effectuation, we aimed to contribute to the understanding of how key managers engage in collaboration in MPPs by posing a question related to collaborative problem-solving:

"*We try to overcome barriers to project completion through continuous collaboration with customers and partners*" [Overcome barrier]

3.3.5. Mutual project objectives

With regard to mutual project objectives, two questions included in the analysis correspond with survey questions presented in Hogel and Gemuenden (2001) on their empirical study of mutual project objectives:

"Goals for different project elements are clear and well understood across partner organizations" [Goals clear]

"Goals for different project elements are accepted across partner organizations" [Goal accept]

3.3.6. Project performance

The respondents were asked how the multi-partner project is presently evaluated in terms of whether it meets its time schedule, budget, and technical specifications (i.e. the dependent variables). Scales were inspired by Andersen and Jessen (2000) and Brettel, Mauer et al. (Brettel et al., 2012). Questions linked to project performance:

"The project so far follows the planned time schedule" [meets time schedule]

"The project is so far within budget" [meets budget]

"The project so far meets the agreed technical specifications" [meetstechnical specifications]

3.4. Data analysis

A series of statistical analysis was made using the Statistical Products and Services Solution (SPSS). Methods of data analysis in the common survey were cross tabulation, regression analysis, and analyses of variance, as the main interest was in testing whether different groups of firms or multi-partner projects exhibited differences in characteristics, mindsets, behaviors, and results.

3.5. Method assessment

Our study opens several avenues for limitations. First, when considering the generalizability of our findings, a potential limitation should be noted. Our sample consists of Norwegian and Danish project team members. We have treated the two countries as one sample, which may be a limitation. However, on the other hand, both countries are very similar and have certain unique characteristics that influence collaborations in teams, for instance it is said that Norwegian and Danish people have a very open and honest communication. Given this sample, it is uncertain whether the results reported here could be generalized to other samples as well, including other countries.

We especially focused on how five partnering success factors influence project performance. There are other partnering success factors that may influence project performance in multi-partner projects and that have not been included in this study. For instance, it may be interesting to investigate how "project uncertainty" or "change orders", two out of the five most frequently found factors, influence both project transaction costs and collaboration level (Haaskjold et al., 2019).

Validity refers to something about asking questions that measure what we want to measure. We have not designed the questions used in this dataset to specifically address the research question of this article. Instead, we have reviewed an existing dataset (Aagaard et al., 2012) and linked the questions from two existing datasets to the partnering success factors described in (Nevstad et al., 2018). We must be careful to avoid bias and to ensure that the data we use is relevant for our specific questions. To compensate for this, we have performed a questionnaire development and linked the questions to the partnering success factors, this is described in detail in the section on questionnaire development. To ensure the best possible reliability and validity of our study, the person within the engineering consultancy most knowledgeable about the multi-partner project was asked to complete the questionnaire.

As described in our theoretical background section, some researchers perceive "The Iron Triangle" concept as a poor definition of project success. As previously explained, we chose to focus on these dimensions - time schedule, budget, technical specifications - since these are critieria that most project managers would be able to relate to when responding to the survey. This may be a bias or a limitation, and can easily be solved by including other elements in future studies.

Furthermore, we know that being measured does effect behavior (Spitzer, 2007), and one can, therefore, argue that there is a risk of respondent bias as many of the respondents to some extent are responsible or accountable for the project performance and that this may have influenced how they have answered certain questions.

In the next section, we have carried out a correlation and regression analysis with three dependent variables and eight items indicating the five groups of partnering success factors mentioned previously. We hypothesize that all independent variables are positively associated with each of the three dependent variables (see Appendix for more precise formulations of independent and dependent variables): trust (trust know and trust interest), good communication, support, resources, collaboration as well as clear and accepted goals are positively associated with meeting time schedule, budget and technical specifications. To test these hypotheses, we initially considered bivariate correlations between independent and dependent variables. Somewhat surprisingly, only slightly more than half of these simple correlations show significant associations.

4. Findings and discussion

The following section reports how partnering success factors influence time schedule, budget, and technical specifications (RQ). As Table 2 shows, it appears to be very important across all three dependent variables that goals for different project elements are accepted by all participating partners (*mutual project objectives*), and that all persons involved in the project (project manager, project owner, steering groups, top management, etc.) are actively supporting the project (*commitment*). These two indicators are significantly correlated with all three dependent variables. *Trust* seems to be very important for meeting time schedule and technical specifications (both indicator items are significantly correlated).

One of the unexpected findings from the study was that *trust* is less important for meeting budgets. This can be interpreted from the fact that correlations between the two trust variables and the dependent variable "MPP meets budget" are non-significant. The latter result reflects that other variables are more influential for meeting budgets. Surprisingly, *communication* and collaboration to overcome barriers (*collaborative problem-solving*) have a negative (though not significant) correlation with the ability to meet budgets. One explanation may be that such communication and collaboration will be most prevalent in projects that are difficult and perhaps already suffering from too high costs. Another explanation could be that collaborative problem-solving takes time, and time is money. It is expensive to spend time dealing with arguing and disagreements internally and externally, with consultants, contractors, or others.

With regard to *commitment,* our results indicate that the allocation of resources (people and money) to the collaboration is only significantly associated with meeting the time schedule, whereas such commitments apparently do not meet budgets and technical specifications (correlations non significant). In line with the arguments above, such resource allocations are perhaps confined to projects that are more complex and thus require further resources. *Commitment* in terms of actively supporting the project, on the other hand, is positively and significantly associated with all three dependent variables. *Commitment* in terms of people's engagement thus seem to be more valuable than just pure allocation of resources. Our results also strongly suggest that it is extremely important that goals are accepted (*mutual project objectives*) by all partners - by far more important than goals being clear (*mutual project objectives*). This may be due to the fact that multi-partner project goals will be adapted along the way to some extent and that it is therefore very important that partners are involved in goal setting processes so that all of them accept (perhaps changing) goals of the multi-partner project.

Bivariate correlations do not take multicorrelation into consideration. For example, there may be a positive correlation, so that if we trust that the knowledge we transfer to the project will not be misused by our partner, then we also actively support the project. In a bivariate analysis, both independent variables have a positive association with meeting the time schedule. But, as we see below, when analyzing them together in a multiple regression analysis, only the commitment variable is significant because it (so to speak) incorporates also the trust aspect. Thus, we have carried out three multiple regression analyses in order to uncover the most influential independent variables when taking multicollinearity into consideration.

Table 3 provides the results of the analysis, using stepwise regression. A stepwise regression first picks up the independent variable with the highest association with the dependent variable. It subsequently picks up the second best independent variable, given that the first variable is already included. The procedure stops when no further independent variables are significantly associated with the dependent variable.

Table 3 reports the variables that remain significant in this analysis. As it appears many significant bivariate correlations in Table 2 are now insignificant, they are not included in Table 3. This is due to multicollinarity, as mentioned above. For example, when meeting time schedule is the dependent variable, then only "support" (*commitment*) and "goals accept" *(mutual project objectives)* remain significantly positively associated with "MPP meets time schedule". The *trust* and "resource" *(commitment)* variables that were significant in the bivariate correlation analysis are no longer significant because they are strongly correlated with "support" (*commitment*) and "goal acceptance" (*mutual project objectives*). Accordingly, the effect of these independent variables is shared among them, but in this case "support" (*commitment*) and goal acceptance (*mutual project objectives*) are most strongly associated with meeting time schedule.

The regression analysis shows that it remains very important across

Table 2
Results of correlation analysis.

	MPP meets time schedule	MPP meets budget	MPP meets technical specifications
Trust know - *trust*	.225*	.141	.314**
Trust interest - *trust*	.206*	.124	.282**
Communications - *communication*	.069	-.146	.234*
Support - *commitment*	.297**	.230*	.367**
Resources - *commitment*	.204*	.094	.160
Overcome barrier - *collaborative problem-solving*	.219*	-.024	.232*
Goals clear - *mutual project objectives*	.008	-.077	-.006
Goals accept - *mutual project objectives*	.286**	.421***	.347**

* = significant at 0.05 level; ** = significant at 0.01 level; *** = significant at 0.001 level; NS = not significant.

Table 3
Results of stepwise multiple regression analysis.

	MPP meets time schedule	MPP meets budget	MPP meets technical specifications
Constant	1.264***	.83**	1.926***
Trust know - *trust*			.264**
Trust interest - *trust*			
Communications - *communication*		-.419**	
Support - *commitment*	.319**	.295**	
Resources - *commitment*			
Overcome barrier - *collaborative problem-solving*		-.362**	
Goals clear - *mutual project objectives*			
Goals accept - *mutual project objectives*	.346**	.748**	.283**
R Square	.138	.327	.167
Adjusted R Square	.120	.297	.150
F-value	7.672***	10.589***	9.797***

* = significant at 0.05 level; ** = significant at 0.01 level; *** = significant at 0.001 level; NS = not significant.

all three dependent variables that goals for different project elements are accepted by all participating partners (*mutual project objectives*). In addition to this, in order to meet the time schedule of the project it remains important that all persons involved in the project (project manager, project owner, steering groups, top management, etc.) are actively supporting the project (*commitment*). For meeting technical specifications, however, it appears to be important that the knowledge transferred to the project will not be misused by partners should they collaborate with competitors in the future *(trust*).

The regression analysis reveals higher complexity when it comes to meeting budgets. "Support" (*commitment*) and "goals accept" *(mutual project objectives)* are significantly positively associated with meeting budgets. The stepwise regression analysis reveals, however, that the factors *communication* and collaboration to overcome barriers (*collaborative problem-solving*) have a significant and negative impact on this performance measure. Since our study is cross-sectional, the causal direction may go either way. We therefore interpret this result to indicate that when projects experience problems with meeting budgets, then the partners will increase their effforts to communicate and collaborate with each other. Table 4 shows the influence of partnering success factors on multi-partner projects' abilities to meet time schedule, budget, and technical specifications.

A summary of the findings is shown in Table 4. We found that *mutual project objectives* and *commitment* are important for meeting time schedule, budget and technical specifications. In literature, *mutual project objectives* are described using little variation in wording. Examples are "mutual," "joint," "common or shared objectives" or "goals." The term "objectives," which are measurable, is used more frequently than the more intangible "goals." The term "measurable objectives" fits well with the "continuous evaluation" and "annual review of performance" emphasized by Bennett and Baird (2001). Benchmarks are highlighted by Bresnen (2007), and the concept of partnering evaluation has been developed into "performance measurement" by Meng (2012). That top management must be involved, was supported by "top management support" (Larson, 1997; Suprapto et al., 2015; Cheng and Li, 2001) as a kind of internal or external commitment, and top management must allocate time and resources to partnering activities. Cheung, Ng et al. (Cheung et al., 2003) supported "Long-term-" and "resource commitment."

As shown in Table 4, *trust* and *collaborative problem-solving* are found to be important for meeting time schedule and technical specifications. Several support *trust*, e.g. trust is described as a prerequisite (Kaluarachchi and Jones, 2007; Construction Industry Institute (CII) and C, 1991; Aarseth, 2012), as a measure (Mesa et al., 2016; Meng, 2012; Chan et al., 2004), as an objective (Cheung et al., 2003; Construction Excellence, 2009), trust is described as an outcome (Eriksson, 2010), and Kaluarachchi and Jones (2007) require trust between "all stakeholders".

Finally, as Table 4 shows, we found that *communication* was particularly important for meeting technical specifications. Factors pertaining to *communication* vary in literature from just "communication," (Doloi, 2009; Cheung et al., 2003; Meng, 2012) via "effective communication" (Black et al., 2000) to "open and honest communication" (Suprapto et al., 2015).

Table 4
Partnering success factors' abilities to meet time schedule, budget, and technical specifications

Partnering success factors	MPP meets time schedule	MPP meets budget	MPP meets technical specifications
Trust	✓		✓
Communication			✓
Commitment	✓	✓	✓
Collaborative problem-solving	✓		✓
Mutual project objectives	✓	✓	✓

According to our findings, the expected benefits of implementing the five partnering success factors in construction projects include improved efficiency and cost-effectiveness, as well as improved quality of product, if successful partnership is achieved. Earlier research confirms this, for example partnering was documented to contribute positively to construction projects (Tabish and Jha, 2011; Xue et al., 2010; Jacobson and Ok Choi, 2008; Chan et al., 2004; Bayramoglu, 2001; Cheng et al., 2000; Larson, 1997). Further, Haaskjold, Andersen et al. (Haaskjold et al., 2020) report that there is a strong positive relationship between collaboration and project quality performance. There were fewer errors and deviations in projects with good collaboration, and deliverables more often delivered according to requirements and client expectations than projects with poor collaboration.

5. Conclusion, practical implications and further research

5.1. Theoretical implications

In this study, success was gauged according to the traditional criteria of time schedule, budget, and technical specifications. The key contribution of this study is the influence of partnering success factors on a multi-partner project's abilities to meet project performance. The overall review of the key findings has provided an interesting insight into human aspects in projects.

Addressing our research question (RQ), as shown in Fig. 1, we found that *mutual project objectives* and *commitment* influence all three dependent variables. To elaborate on this, *mutual project objectives* and *commitment* are important for meeting time schedule, budget and technical specifications. Additionally, *trust* and *collaborative problem-solving* are found to be important to meet time schedule and technical specifications. Finally, we concluded that *communication* was particularly important for meeting technical specifications.

Our findings confirm earlier research, as we have provided more empirical support in a field where several authors have highlighted the need for more empirical research into the relationship between project participants' collaboration and project performance (Silva and Harper, 2018; Bond-Barnard et al., 2018; Meng and Gallagher, 2012).

5.2. Practical implications

The five partnering success factors are important to project performance, and project managers must constantly ensure that they are present throughout the project. The performance outcome points to several benefits that can be obtained by working on the five partnering success factors, which should benefit both researchers and practitioners. This is explicitly explained in the bullet points below:

- *Mutual project objectives* and *commitment* are important for meeting time schedule, budget and technical specifications, i.e. to meet all three criteria, the project must know who their key stakeholders are and involve the appropriate internal (top management included) and external parties in an early phase, further the project must also ensure that goals for different project elements are accepted by all participating partners.
- *Trust* and *collaborative problem-solving* are important for meeting time schedule and technical specifications, i.e. to meet the two criteria, the parties must hold each other mutually informed based on respect and understanding, and have mechanisms in place for resolving disputes.
- *Communication* is important for meeting technical specifications, i.e. to meet the criterium, the project must ensure that there is extensive communication between the participating partners, and the parties must have a mutual desire to collaborate, communicate and build good relationships.

The implementation of the five partnering success factors could lead to major benefits in construction projects: Anticipated benefits of

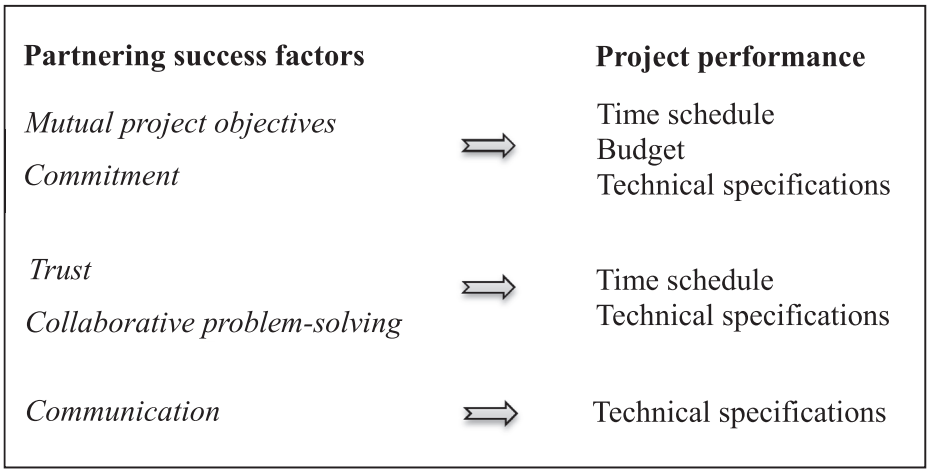

Fig. 1. How partnering success factors influence project performance.

ensuring the presence of the five identified partnering success factors throughout the project include improved efficiency and cost-effectiveness, and improved quality of product.

5.3. Further research

The survey is limited to engineering consultancies in Norway and Denmark. This aspect could be considered as a weakness or limitation but can also be easily improved in further research. Our research would benefit from further similar research in other industries and countries. Moreover, additional research is needed to determine whether these relationships are significant over time. It may be a weakness of the study that it is performed at a given point in time and does not follow the projects over time. The study can nevertheless provide a picture of a relationship between partnering success factors and project performance. Also, future research should investigate other potential elements in the relationship between collaboration and project performance in multi-partner projects.

Acknowledging that many projects cannot be accomplished without the efforts of several partners working together, it seems logical that a performance measurement of multi-partner projects must include measuring how smoothly the collaboration among the project partners unfolds. In practice, the various partnering success factors' influence on project performance can be utilized by project-based organizations and project managers to select and measure the various partnering success factors they find most suitable to improve their project performance. If put actively to use (by picking up the early warning signs of project problems), this should help improve the project performance of future multi-partner projects.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix

Dependent variables

- The project so far follows the planned time schedule
- The project is so far within budget
- The project so far meets the agreed technical specifications

Independent variables

Please notice that the specific questions are presented in the section on questionnaire development.

- Trust know - indicator for *trust*
- Trust interest - indicator for *trust*
- Communication - indicator for *communication*
- Support - indicator for *commitment*
- Resources - indicator for *commitment*
- Overcome barrier - indicator for *collaborative problem-solving*
- Goals clear - indicator for *mutual project objectives*
- Goal accept - indicator for *mutual project objectives*

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