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Success in collaborative construction through the lens of project delivery elements

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Abstract

Purpose – The emergence of collaborative delivery models and working practices in construction industry has created a potential area for project success research. Previous studies have addressed success factors of various collaborative delivery models (e.g. alliance and partnering). However, there is currently very limited research-based knowledge concerning core success factors for different collaborative delivery models, exploring the commonalities. Thus, this study aims to conceptualize a success model for collaborative construction projects by identifying and structuring their core success factors through the lens of project delivery elements.

Design/methodology/approach – A systematic literature review was conducted, and thematic as well as content analysis of the relevant studies led to the identification of mentioned success factors in the literature for different collaborative delivery models. Then, those common success factors were structured in a model based on factors' relation to project delivery elements.

Findings – The obtained results present eight core success factors (e.g. equality, mutual trust and commitment to win–win philosophy) for collaborative construction projects, structured in a model based on their contribution toward project organization, contractual relationships, and operational system in construction project delivery. Moreover, the differences between success factors for traditional and collaborative construction projects are discussed.

Originality/value – This study's findings provide insightful theoretical contributions on collaborative construction project success and providing a departure point for future studies based on the discussed differences between success factors of collaborative and traditional construction projects. The findings can be also practically insightful for the project professionals in collaborative construction projects to succeed in managing project organization, contractual relationships, and operational system.

Keywords Construction management, Collaborative delivery model, Integrated project delivery, Project success, Success factor

Paper type Research paper

1. Introduction

The emergence of collaborative delivery models and working practices (e.g. lean project delivery, alliance) in construction industry has had substantial impact on success of construction project delivery (Forbes and Ahmed, 2010). This contribution has led to the creation of a working environment (so-called collaborative construction projects) in which key project parties, with aligned interests and mutual trust, work together (collaborate) and exchange information (cooperate) for the good of the project (Chen *et al.*, 2015; Heidemann and Gehbauer, 2010; Ibrahim *et al.*, 2016, 2018; Kent and Becerik-Gerber, 2010; Moradi *et al.*, 2020a; Mesa *et al.*, 2019). Collaborative construction, relational contracting, and relationship-based procurement are the umbrella terms which have been frequently mentioned in the literature and refer to the existing collaborative delivery models (alliance, partnering, integrated project

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delivery, lean project delivery) and working practices (traditional project delivery equipped with collaborative practices) (Engebø *et al.*, 2020; Lloyd-Walker and Walker, 2015; Moradi, 2021; Rahman and Kumaraswamy, 2005).

In collaborative delivery models, joint design, planning, control and management of construction projects are managed by the key parties based on their early involvement in the project, trust-based relationships, collaboration and cooperation, open communication, and fair share of risk-reward (Fischer *et al.*, 2017; Hosseini *et al.*, 2016, 2017; Hietajärvi *et al.*, 2017a, b, c; Lahdenperä, 2012; Love *et al.*, 2010; Moradi, 2021; MacDonald *et al.*, 2012, 2013; Oakland and Marosszeky, 2017; Walker and Jacobsson, 2014). Collaborative delivery models are different from the traditional ones (e.g. design-bid-build, design-build) in four aspects. First, the focus of the collaborative construction is on the production system, not the transactions and contracts. Second, in collaborative context, design and planning of the product and process are accomplished concurrently and activities are performed at the last responsible moment, not as soon as possible. Third, project team members in collaborative construction make decisions unanimously, not in silos. Fourth, learning in collaborative construction occurs continuously throughout the project, not sporadically. Finally, the commercial interests of the stakeholders in collaborative construction projects are aligned, unlike the traditional construction delivery models (Ballard and Howell, 2003; Ballard, 2008; Moradi *et al.*, 2022). In this study, construction projects with collaborative delivery models and/or working practices are called collaborative construction projects.

Collaborative construction, as an arena, has received considerable attention from the research community, and several topics have been studied in the context of various collaborative delivery models (e.g. Aaltonen and Turkulainen, 2018; Lazar, 2000; Laan *et al.*, 2011a, b; Mollaoglu-Korkmaz *et al.*, 2013; Mihic *et al.*, 2014; Mulholland and Clevenger, 2018; Matinheikki *et al.*, 2019; Darrington and Howell, 2011; Piroozfar *et al.*, 2019; Rowlinson, 2017; Sankaran *et al.*, 2018; Wu *et al.*, 2019; Zhang and Hu, 2018). Success of collaborative construction projects is one of the topics which has been addressed by different scholars (e.g. Chan *et al.*, 2004a; Ghassemi and Becerik-Gerber, 2011; Lloyd and Varey, 2003; Ling *et al.*, 2020; Zhang and Kumaraswamy, 2001). These studies have specifically addressed construction project success in the context of a certain collaborative delivery model (e.g. alliance, integrated project delivery) (e.g. MohammadHasanzadeh *et al.*, 2014; Wang *et al.*, 2016; Young *et al.*, 2016). It means that there is a lack of the holistic view in the previous studies toward success factors of various collaborative delivery models. Although project success is a context-specific setting, it can also be generalized to different collaborative delivery models as they have some common elements and characteristics such as early involvement of key project participants, fair share of risk and reward, profit based on project outcome, trust-based collaboration and cooperation, and unanimous decision-making (Børve *et al.*, 2017; Franz *et al.*, 2017; Gomez *et al.*, 2018; Hauck *et al.*, 2004; Ibrahim *et al.*, 2015a, b; Kent and Becerik-Gerber, 2010; Ke *et al.*, 2015a, b; Lahdenperä, 2012; Lee *et al.*, 2013; Lichtig, 2005; Love *et al.*, 2011; Yeung *et al.*, 2009a, b; Zhang *et al.*, 2016).

According to the earlier explanations, it seems obvious that employing a holistic view toward success factors of various collaborative delivery models is a research gap which needs to be addressed. The importance of such perspective is high as it can be extremely helpful for revealing commonalities between success factors of different collaborative delivery models which are common in certain countries. Exploring these commonalities is essential for developing a frame of reference concerning key enablers of success in collaborative construction. Another research gap concerning success factors of collaborative construction is the absence of project delivery elements as the theoretical lens for modeling the relevant success factors based on their relation to those elements, which include project organization (clear definition of the roles and relationships between the participants), contractual relationships (delivered promises of project parties), and operational system (appropriate

timing and sequence of events and practices and techniques of management) (Mesa *et al.*, 2019).

Thus, it is imperative to employ a holistic perspective combined with a novel theoretical lens (focused on project delivery elements) for studying core success factors among collaborative delivery models. Therefore, this study aims to do so through identifying the commonalities between success factors of collaborative delivery models and modeling them based on their relation to the mentioned elements of construction project delivery.

The resultant article is structured in six sections. The next section presents the theoretical background, which is followed by the explanation of the methodology. Then, findings are presented and discussed. Finally, the conclusions are stated.

2. Theoretical background

2.1 Definition of success in construction projects

A successful project is the one, realizing technical performance goals and project stakeholders' satisfaction (de Wit, 1986). Baccarini (1999) stated that project success can be defined through its two distinct components which are project management success and product success. Another study conducted by Sanvido *et al.* (1992) defined project success as the realization of certain expectations for various stakeholders (e.g. owner, planner, engineer, contractor, or operator) of the project. Moreover, project success can be defined through its representing components which include project management success (meeting time, cost, scope, and quality), project execution success (meeting technical requirements and safety goals), business success (reoccurring business and meeting expected commercial success), and stakeholder satisfaction (meeting various expectations of different project stakeholders) (Moradi *et al.*, 2020a, b).

The given definitions of the construction project success in the literature have been mostly focused on the project itself in terms of the lifecycle and efficiency. However, findings of the recent research studies (e.g. Li and Wang, 2016; Oladokun *et al.*, 2020) show that construction projects have also various impacts (both negative and positive) on the local environment and society as well as on the quality of end-users' lives. Thus, it is imperative to define construction project success with a holistic view so that it can be utilized in different working cultures while being a frame of reference. Accordingly, this study defines construction project success as the realization of specific objectives of the project (the reason(s) for which the project is undertaken) while succeeding in six main challenges: (1) on time completion, (2) on budget completion, (3) meeting quality requirements, (4) stakeholder satisfaction, (5) accident-free construction, (6) low waste generation during construction, and (7) no harm to the local environment and people during and after construction phase.

2.2 Collaborative delivery modes in construction projects and their characteristics

Collaborative delivery models have been defined as the joint design, planning, control, and management of construction projects by the key parties based on their early involvement in the project, trust-based relationships, open communication, and fair share of risk-reward (Moradi, 2021). According to Lahdenperä (2012) and Mesa *et al.* (2019), it can be said that alliance, partnering, integrated project delivery (IPD), and lean project delivery (LPD) are the existing pure collaborative delivery models. Alliance delivery model promotes collaboration (working together) and cooperation (exchanging information) through a multi-party agreement between two or more entities, thereby fostering fair share of risk-reward, unanimous decision-making, no-blame culture, and trust-based relationships for the common good (e.g. Jefferies *et al.*, 2014; MacDonald *et al.*, 2012; Walker and Jacobsson, 2014). Partnering enables the integration of the project design and delivery by weighting

collaboration and coordination between involved parties (e.g. Fortune and Setiawan, 2005; Nyström, 2005; Spang and Riemann, 2014; Thompson and Sanders, 1998; Walker *et al.*, 2002).

The core of IPD and LPD is to encourage the use of integrated project organizations, relational contracting, and integrated process as mechanisms to integrate a project delivery system (Mesa *et al.*, 2019). The main difference between IPD and LPD delivery systems is that IPD addresses no specific operational system, whereas the LPD uses an operational system based on lean principles and the use of lean tools such as target value design, last planner system and set-based design (American Institute of Architecture, 2007; Ballard and Howell, 2003; Ballard, 2008; Mesa *et al.*, 2019; Nguyen and Akhavian, 2019).

In terms of the common characteristics of collaborative delivery models, it has been stated that collaborative delivery models have eight common features: (1) early involvement of key participants, (2) joint planning, design, and control, (3) open cost management, (4) fair share of risk-reward, (5) trust-based relationship, (6) joint decision marking, (7) open communication, (viii) multi-party agreement (e.g. Ballard and Howell, 2003; Lahdenperä, 2012; Moradi, 2021).

2.3 Evolution of success research in the context of collaborative construction projects

Construction project success knowledge has evolved during the recent decades alongside the changes and developments in project delivery models (Moradi, 2021). It has been also argued that both general and context-specific perspectives have been dominant in the previous studies concerning construction project success (Moradi, 2021). In terms of context-oriented studies on construction project success, some of the previous studies have addressed project success in construction projects with collaborative delivery models (alliance, partnering, integrated project delivery, lean project delivery) (e.g. Nevstad *et al.*, 2018; Jefferies *et al.*, 2014; Whang *et al.*, 2019). These studies can be also seen as a response to the changes in construction project delivery models. These efforts for customizing project success knowledge into the context of collaborative construction are explained and discussed in the following.

Construction projects with alliance delivery model is one of the areas in which project success has been addressed by different scholars. For instance, Lloyd and Varey (2003) stated that free-flowing, integrated, and bi-directional communication is an important success factor for alliance construction projects. In addition, a study conducted by Hietajärvi *et al.* (2017c) identified certain contractual, behavioral, relational, and operational skills as the key success factors for construction projects with alliance delivery model. Moreover, Young *et al.* (2016) carried out a study which resulted in the identification of 22 success factors (e.g. trust between parties, strong commitment by client and senior management, mutual goals and objectives, cooperative spirit and joint process evaluation) for alliance construction projects.

Construction projects with integrated project delivery (IPD) is another area in which a few research studies have been undertaken. For instance, the study conducted by Kent and Becerik-Gerber (2010), revealed that there are nine success factors for IPD construction projects, including well-defined contractual relationships, early definition of project goals, early team formation, and clearly defined scope of work. In addition, Ghassemi and Becerik-Gerber (2011) discovered that proper selection and involvement of all main players, mutual trust between these players, training, procurement ability and collaborative technology are of prime significance for IPD project success. Moreover, Xie and Liu (2017) stated that symmetrical alignment of shared responsibilities, financial incentives, and good communication approach are those factors that considerably contribute toward success of IPD construction projects.

Furthermore, the recent studies conducted by Whang *et al.* (2019) and Ling *et al.* (2020) have emphasized on the importance of factors such as collaboration, unanimous decision-making, appropriate staffing, reforming contract law and adopting appropriate IPD agreement form, and early involvement and enhanced role of key participants for success of

IPD construction projects. Success of construction projects with lean project delivery has also been addressed in a study conducted by Heidemann and Gehbauer (2010), which identified the following factors critical for the success: (1) a cooperative design phase including cross functional team members, (2) lean project delivery needs to be supported and supplemented by a corresponding contract and a procurement strategy, (3) competence-based selection of the contractor, (4) incorporating behavioral aspects (based on lean principles) into contract should include defined, (5) fair compensation in the commercial strategy combined with an incentive program.

In addition to the alliance, IPD and lean project delivery, success of construction projects with partnering delivery model has also received substantial attention from the research community (e.g. Ahmadabadi and Heravi, 2019; Almarri and Boussabaine, 2017; Dithebe *et al.*, 2019; Famakin *et al.*, 2012; Koutsikouri *et al.*, 2008; Osei-Kyei and Chan, 2018; Toriola-Coker *et al.*, 2021). One of the starting efforts in this regard is a study which was conducted by Antonson *et al.* (2000) and identified six success factors for partnering projects, including early identification and engagement of all potential stakeholders, early negotiations for property acquisition, building mitigation measures into the project to offset the disruption caused by construction, and developing a public information/relations program for the project. This study was followed by complementary research efforts carried out by Zhang and Kumaraswamy (2001) and Ng *et al.* (2002), which identified critical success factors for partnering projects, including clean administration, centralized decision-making, open markets and competition, stable and supportive public client, and financially strong, technically competent, and managerially outstanding concessionaire consortium.

In addition, success factors such as open communication, commitment to win–win attitude, mutual trust, and learning climate have been found of importance for partnering projects (Chan *et al.*, 2004a, b; Cheng and Li, 2004). Moreover, Cho *et al.* (2010) stated that there are 10 critical success factors for partnering projects, including owner capacity and organizations, experienced project team, good communication system, early involvement of the designer and contractor, quick decision-making process, and integrated team of all the parties. Furthermore, the undertaken research studies during the past decade have considerably emphasized on the importance of factors such as trust, communication, equality, mutual objectives, team building, collaboration and cooperation, top management support and incentive system (Bellini *et al.*, 2016; Doloi, 2013; MohammadHasanzadeh *et al.*, 2014; Nevstad *et al.*, 2018; Wang *et al.*, 2016).

3. Methodology

3.1 Research process

The literature study (systematic literature review (SLR)) behind this article aimed to identify the common success factors among collaborative delivery models and to structure them in a model based on their conceptual relevance to the elements of construction project delivery. SLRs entail the use of a transparent and rigorous approach for the entire research process, in order to reduce bias and enable future replication. A SLR usually relies on the use of databases that contain a large set of research publications as well as effective search mechanisms. Figure 1 shows the research process including data collection and analysis.

The search for finding the relevant studies was completed in December 2020 using six key words: (1) alliance projects, (2) lean project delivery, (3) partnering projects, (4) integrated project delivery, (5) relational contracting, and (6) relationship-based procurement. The keywords were selected based on their high relevance to the collaborative delivery models of construction projects. Moreover, the selected keywords have been frequently mentioned in the state-of-the-art studies on collaborative delivery models (e.g. Engebø *et al.*, 2020; Lloyd-Walker and Walker, 2015; Lahdenperä, 2012). The employed databases for the search

Figure 1.
The research process

included American Society of Civil Engineers (ASCE), Emerald, and ScienceDirect. Among the selected keywords, the search with two of them (relationship-based procurement and lean project delivery) in the mentioned databases was resulted in the identification of very few studies. Therefore, the search with these two keywords were also performed in Google Scholar database. The conducted search included no specific time span to ensure the comprehensiveness of the located studies. As can be seen in Figure 1, the performed search resulted in locating 318 studies of which 117 ones were excluded because of repetitions and/or irrelevant content, and the remaining 201 studies were analyzed (see Table 1 for more details). The time span of those 201 studies was between 1998 and 2021. In terms of the publication period of those 201 studies, 61% of them were published between 2011 and 2020, 33%

Applied keywords	Databases	Located studies	Excluded studies	Criteria for exclusion	Analyzed studies
Alliance projects	ASCE	10	1	Irrelevant to alliance	9
	Emerald	14	1	delivery model in the	13
	ScienceDirect	19	13	construction context	6
Integrated project	ASCE	32	8	Irrelevant to integrated	24
delivery	Emerald	7	1	project delivery in the	6
	ScienceDirect	16	1	construction context	15
Lean project	ASCE	2	0	Irrelevant to lean project	2
delivery	Emerald	2	1	delivery in the construction	1
	ScienceDirect	1	0	context	1
	Google Scholar	32	9		23
Partnering	ASCE	33	2	Irrelevant to partnering	31
projects	Emerald	20	4	delivery model in the	16
	ScienceDirect	42	26	construction context	16
Relational	ASCE	28	8	Irrelevant to relational	20
contracting	Emerald	13	8	contracting in the	5
	ScienceDirect	36	32	construction context	4
Relationship-	ASCE	0	0	Irrelevant to relationship-	0
based	Emerald	0	0	based procurement in the	0
procurement	ScienceDirect	1	1	construction context	0
	Google Scholar	10	1		9
Total		318	117	–	201

Table 1.
Results of the conducted search for locating the relevant studies

between 2000 and 2010, and 6% before 2000. Table 1 shows results of the conducted search for locating the pertinent studies.

3.2 Analysis and model development

The result of the full-text review of those 201 located studies provided a basis for undertaking a thematic analysis (Saunders *et al.*, 2019) through coding the extracted research data in order to detect those studies which were specifically focused on the *success of collaborative delivery models in construction projects*. Accordingly, the codes representing project success factors were identified and analyzed through content analysis for exploring the mentioned success factors in the literature. Then, a content analysis was performed on the findings of those studies, which were focused on the success of collaborative construction. This was accomplished through identifying the mentioned success factors for different collaborative delivery models and detecting the commonalities based on the similarity and/or sameness of the meaning and/or the title. This was followed by matching those common success factors to the elements of construction project delivery based on the conceptual relevance, resulting in the completion of the model.

4. Findings

4.1 Success factors for collaborative delivery models

The findings suggest that there are eight common success factors for construction projects with collaborative delivery models (see Table 2). These success factors are appropriate and relevant contract, commitment to win–win philosophy, collaboration and cooperation, equality, incentive system, open communication, mutual trust, and selecting competent people for the project. These identified success factors were common for construction projects

Table 2.
Core success factors for collaborative construction projects

Success factor	Alliance	IPD	Partnering	Reference
Appropriate and relevant contract	√	√	√	Hietajärvi *et al.* (2017), Kent and Becerik-Gerber (2010), Zhang and Kumaraswamy (2001)
Commitment to win–win philosophy	√	√	√	Chan *et al.* (2004a, b), Cheng and Li (2004), Cho *et al.* (2010), Kent and Becerik-Gerber (2010), MohammadHasanzadeh *et al.* (2014), Ng *et al.* (2002), Raslim and Mustaffa (2017), Wang *et al.* (2016), Young *et al.* (2016)
Collaboration and Cooperation	√	√	√	Bellini *et al.* (2016), Ling *et al.* (2020), Nevstad *et al.* (2018), Young *et al.* (2016)
Equality	√	√	√	Kent and Becerik-Gerber (2010), Lichtig (2005), Wang *et al.* (2016), Young *et al.* (2016)
Incentive system	√	√	√	Bellini *et al.* (2016), Kent and Becerik-Gerber (2010), Young *et al.* (2016)
Open communication	√	√	√	Bellini *et al.* (2016), Cheng and Li (2004), Cho *et al.* (2010), Doloi (2013), Lloyd and Varey (2003), Kent and Becerik-Gerber (2010), Nevstad *et al.* (2018), Raslim and Mustaffa (2017), Wang *et al.* (2016), Young *et al.* (2016)
Mutual trust	√	√	√	Bellini *et al.* (2016), Cheng and Li (2004), Doloi (2013), Ghassemi and Becerik-Gerber (2011), Kent and Becerik-Gerber (2010), Nevstad *et al.* (2018), Raslim and Mustaffa (2017), Whang *et al.* (2019), Wang *et al.* (2016), Young *et al.* (2016)
Selecting competent people for the project	√	√	√	Ghassemi and Becerik-Gerber (2011), Ling *et al.* (2020), MohammadHasanzadeh *et al.* (2014), Young *et al.* (2016)

with alliance, IPD (integrated project delivery) and partnering delivery model. Moreover, those success factors which were identified in the data analysis process and were not common between collaborative delivery models can be seen in Appendix. It is important to note that the identified common success factors have a situation-specific nature, meaning that although their presence is common, but their degree/level of appearance in various collaborative delivery models might be different.

It is also important, here, to explain the main reason behind the exclusion of LPD from Table 2 despite of being primarily addressed in this study. Although there have been a few studies in the literature (e.g. Sarhan *et al.*, 2019) addressing success factors for implementation of lean principles in construction projects in a generic manner, the lean project delivery model as a certain topic was found to be rarely addressed among the studies looking into the project success factors. Among those 201 analyzed studies in this research, only one study was found to be fully focused on success factors for lean project delivery (see Appendix). And the mentioned factors in that study showed insufficient amount of commonality with the listed factors in Table 2. This issue, in turn, reveals a potential area for future success research in the context of lean project delivery.

4.2 Success model for collaborative construction projects

The identified commonalities between success factors for various collaborative delivery models provided the basis for developing a success model. The development of this success model (see Figure 2) was accomplished through structuring the identified common success factors between collaborative delivery models (Table 2) based on their conceptual relevance to project organization, contractual relationships, and operational system, as the key elements of construction project delivery.

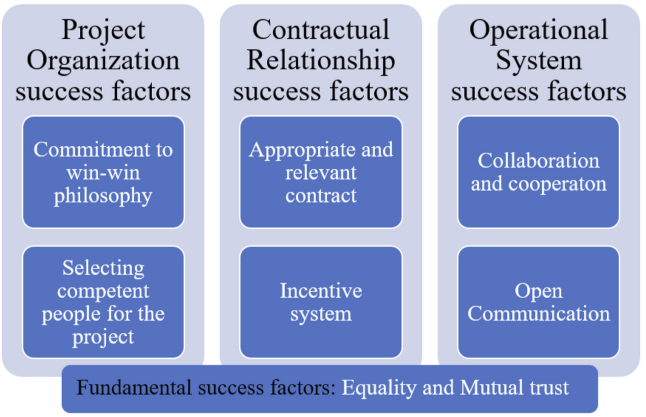

Figure 2.
Success model for construction projects with collaborative delivery models

Among the identified success factors, equality and mutual trust were found to be the fundamental ones for all three elements of collaborative delivery models. These two success factors, in other words, are the underlying constructs for the realization and constructive impact of the other factors in Figure 2, which represent project organization, contractual relationships, and operational system. Regarding project organization, selecting competent people for the project, and commitment to win–win philosophy were found to be crucial for having a collaborative project organization and governance. Concerning contractual relationships, reasonable contract and constructive incentive system, as the success factors, are of prime importance. Finally, a productive operational system requires collaboration and cooperation between participants as well as open communication between them, as they have been presented in the model (see Figure 2). The developed model provides a new departure point in the construction project success research for addressing success factors and criteria through the lens of project delivery elements.

5. Discussion

The obtained results in this study showed that there are eight core success factors for collaborative construction projects. These success factors were then structured in a model based on their relation to the project delivery elements. The findings seem to reflect insightful alignment and difference with previous studies on construction project success. In terms of the alignment, it can be argued that the obtained results in this study are somewhat in line with the identified success factors for collaborative projects in the previous studies. For instance, several research studies have stated that communication (e.g. Chua *et al.*, 1997, 1999; Chan *et al.*, 2004a, b; Whang *et al.*, 2019), reasonable contract (e.g. Phua and Rowlinson, 2004; Sanvido *et al.*, 1992), appropriate staffing (match between competencies and project context) (Das and Ngacho, 2017; Nguyen and Hadikusumo, 2018; Omran *et al.*, 2012; Tsiga *et al.*, 2017), and cooperation (e.g. Doulabi and Asnaashari, 2016; Frödell *et al.*, 2008; Famakin *et al.*, 2012; Maqbool and Sudong, 2019; Zuo *et al.*, 2018) are critical for project success both in traditional and collaborative contexts.

There also seems to be an interesting message in the findings in terms of the differences between the success factors listed in Table 2 and those ones mentioned in the previous studies for traditional construction projects. Comparing the findings of recent studies (e.g. Gunduz and Yahya, 2018;Ramlee *et al.*, 2016) on construction project success with the results of this study shows that there are considerable differences between critical success factors for

collaborative construction projects and the traditional ones. Almost four out of eight success factors, identified in this study, have been mentioned in the previous studies as the appropriate success enablers mainly for collaborative delivery models. These factors are commitment to win–win philosophy, equality, mutual trust, and incentive system. These success factors, in the big picture, represent the core elements of collaborative construction projects (e.g. mutual trust, fair share of risk-reward, profit based on project outcome), mentioned by different scholars (Engebø *et al.*, 2020; Fischer *et al.*, 2017; Lloyd-Walker and Walker, 2015; Oakland and Marosszeky, 2017).

The discovered differences can be also explained through highlighting the significant role of elements as well as characteristics of collaborative and traditional delivery models (e.g. trust-based vs. adversarial working relationships), as the antecedents of their success factors. This, in turn, reflects on the importance of addressing success through the lens of project organization, contractual relationships and operational system which are the key components of project delivery. Consequently, it can be stated that *project characteristics and elements affect the type of success factors*. This hypothesis, which needs to be tested in the future studies, is in line with prior developments in the contingency theory for projects where it has been stated that project type not only affects the selection of the project human resources and their required competencies but also requires defining specific criteria, for measuring project success, and identifying certain factors, for facilitating the realization of project success criteria (Moradi *et al.*, 2020a, b; Shenhar, 2001). Furthermore, the developed hypothesis can be also supported by emphasizing considerable contribution of the project delivery model on project success since delivery model provides a systematic way for accomplishing the project (Alarcón *et al.*, 2013; Mostafavi and Karamouz, 2010).

The findings of this study provide insightful theoretical contributions through employing a novel theoretical lens (project delivery elements) for modeling project success factors in collaborative construction. Moreover, the identified commonalities between success factors of various collaborative delivery models revealed the key enablers for successful collaborative construction. The obtained results also provide a departure point for future studies to test the employed theoretical lens and identified commonalities in case projects. Furthermore, the findings of this study have obvious implications for practice which can be insightful for project professionals. First, the identified success factors support the earlier research findings (e.g. Moradi *et al.*, 2021a, b) concerning the required change in the working culture and mindset of collaborative construction professionals, compared to the typical one in the traditional context. This means that realizing a collaborative working environment and its benefits requires the project professionals to possess certain behavioral competencies (e.g. trustworthiness, optimism, imitative, teamwork, stress tolerance, conflict management, flexibility) which contribute toward establishment of the key characteristics of collaborative construction (e.g. mutual trust, equality, respect and open communication) to work together for the good of the project (Moradi *et al.*, 2021a, 2022). Second, the developed success model provides practical knowledge for utilizing the identified success factors based on their functionality and effect on project organization, contractual relationships, and the operational system.

6. Conclusions

This study aimed to explore the connection between success factors of various collaborative delivery models by discovering the commonalities. This was performed through conceptualizing a success model for collaborative construction projects. This model includes the core success factors for collaborative delivery models, structured based on their conceptual relevance to the project delivery elements. The obtained results in this study, which were discussed earlier, provided a basis for the following conclusions concerning

success factors of construction projects with collaborative delivery models (particularly alliance, integrated project delivery and partnering):

(1) Characteristics and elements of construction project delivery models affect the type of relevant success factors.

(2) Project organization, contractual relationships, and operational system, as the key components of project delivery, provide an efficient theoretical lens for addressing success factors.

(3) Appropriate and relevant contract, commitment to win–win philosophy, collaboration and cooperation, equality, incentive system, open communication, mutual trust, and selecting competent people for the project are the core success factors.

(4) Among the above-mentioned success factors, equality and mutual trust are the fundamental ones.

The findings of this study contributed to the existing body of knowledge by exploring the commonalities between success factors of different collaborative delivery models and modeling those common factors based on their conceptual relevance to project delivery elements. As the limitations of this study, it is acknowledged that certain keywords were employed and searched in certain databases for locating the relevant studies, which consequently narrowed its scope and might have affected its reliability and validity. The developed success model, like all new concepts, needs validation in case projects to be considered as a generally accepted model. Thus, this is a potential area for future research and development.

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Appendix

Table A1.
List of those success factors which were identified in the data analysis process and were not common between collaborative delivery models

Keyword	Success factor	Reference	Success factor	Reference
Alliance	Sound relationship	Young *et al.* (2016)	Shared knowledge	Young *et al.* (2016)
	Mutual goals and objectives		Integrated alliance office	
	Dispute resolution process		Stretch targets	
	Joint process evaluation		Staging of project and stretch targets	
	Flexibility and adaptability		Establishing project specific KPIs	
	Tight alliance outline		Facilitating on-going workshops that include site personnel	
	Alliance structure		Integration of a web-based management programme	
IPD	Early and clearly defined project goals and scope	Kent and Becerik-Gerber (2010)	Improvement and utilization of BIM for collaborative process of IPD	Whang *et al.* (2019)
	Early team formation		PMIS for collaborative decision-making and networked sharing system	
	Clearly defined roles relationships and responsibilities between the project participants		Training	Ghassemi and Becerik-Gerber (2011)
	Early involvement and enhanced role of key participants (including client)	Ling *et al.* (2020), Whang *et al.* (2019)	Procurement ability	
	Team building and management for collaborative business process	Whang *et al.* (2019)	Collaborative technology	
	Intensified planning and management from early project stage			

(*continued*)

Table A1.

Keyword	Success factor	Reference	Success factor	Reference
Partnering	The establishment and communication of a conflict resolution strategy	Chan *et al.* (2004a, b)	Building mitigation measures into the project to offset the disruption caused by construction	Antonson *et al.* (2000)
	A willingness to share resources among project participants		Developing a public information/relations program for your project	Antonson *et al.* (2000)
	Common understanding of roles and responsibilities	Chan *et al.* (2004a, b), Nevstad *et al.* (2018)	Including additional funding in the project's budget for an effective partnering	Antonson *et al.* (2000)
	Regular monitoring and control of partnership performance	Chan *et al.* (2004a, b), Ng *et al.* (2002), MohammadHasanzadeh *et al.* (2014)	Involvement of multiple departments and External stakeholders to participant selection	Nevstad *et al.* (2018)
	Effective coordination	Cheng and Li (2004)	Proactive relationship building	Nevstad *et al.* (2018)
	Top management support	Cheng and Li (2004), MohammadHasanzadeh *et al.* (2014), Bellini *et al.* (2016)	Preventing opportunistic behavior	Nevstad *et al.* (2018)
	Continuous improvement	Cheng and Li (2004)	Being solution oriented	
	Partnering experience		Common understanding	Nevstad *et al.* (2018), Ng *et al.* (2002), Memon *et al.* (2015)
	Learning climate	Cheng and Li (2004), Bellini *et al.* (2016)	Accurate handover	Nevstad *et al.* (2018)
	Owner capacity and organizations	Cho *et al.* (2010)	Meeting objectives of client	Hughes *et al.* (2012)
	Experienced project team		Compromising the regulations and organizational structure	Ng *et al.* (2002)
	Early identification and engagement of all potential stakeholders	Cho *et al.* (2010), Antonson *et al.* (2000), Bellini *et al.* (2016)	Implementing less restrictive tendering agreements	
	Quick decision-making process	Cho *et al.* (2010)	Centralized decision-making	
	Integrated team of all the parties		Providing comprehensive training and guidance	
	Holding of the design information in common		Integrated team, agreement	MohammadHasanzadeh *et al.* (2014)
	Effective process of the change orders establishment of the design criteria at an early stage	Cho *et al.* (2010)	Long-term perspective Selection of an appropriate partner	
	Cost efficiency	Doloi (2013)	Incentives-reward system	Bellini *et al.* (2016)
	Mutual objectives	Wang *et al.* (2016), Bellini *et al.* (2016)	Commitment-willingness to share	
	Early negotiations for property acquisition	Antonson *et al.* (2000)	Team building activities	
	Holding public meetings during and prior to design to get the residents "on your side"		Workshops and meetings Co-location	
LPD	A cooperative design phase including cross functional team members	Heidemann and Gehbauer (2010)	Fair share of risk/reward	Heidemann and Gehbauer (2010)
	A supportive contract and procurement strategy		Incentive system	
	Incorporating behavioral lean-based principles in the contract		A combination of price competition and competence-based criteria for selecting project team	
Relational contracting	Clients and contractors must identify motivational factors	Memon *et al.* (2015)	Establishing structured interactions	Memon *et al.* (2015)
	Developing a collaborative culture			
Relationship-based procurement	Workshop and facilitator	Raslim and Mustaffa (2017)	Experienced partners	Raslim and Mustaffa (2017)
	Competence		Early implementation of partnering	
	financial capability			