



COLLABORATIVE PROJECT DELIVERY METHODS: A SCOPING REVIEW

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Abstract. Understanding how to systemise, organise, and finance the design, construction, operation, and maintenance activities are all parameters needed to be optimised simultaneously in a Project Delivery Method. To meet the challenges of increasingly complex projects, a new class of delivery methods is emerging. These methods are often labelled “collaborative” since they seek to align the client’s interest with those of the supply chain. The purpose of this article is to present the current state-of-the-art through a review of 156 identified articles concerning Partnering, Integrated Project Delivery, Alliancing, Relational Contracting, and Relationship-Based Procurement. A framework for the methodological procedure based on the state of the art within qualitative research was elaborated and is reported on in this paper. The results show that there is a range of research on collaborative project delivery methods across the world. By analysing the study purposes, important themes generated and delineated as a) Conceptualisation, b) Implementation and experiences, c) Pros & Cons, d) Building Partnership & Social Dimensions, and e) Performance and Success. The paper provides an overview of collaborative project delivery methods identified in the realm of academic journals. Secondly, knowledge gaps have been identified by creating a summary of the body of evidence.

Keywords: project delivery methods, collaboration, partnering, integrated project delivery (IPD), alliancing, relational contracting (RC), relationship based procurement (RBP), partnerships, contracting, procurement.

Introduction

Demand for resource efficiency, emerging Health, Safety, and Environment (HSE) issues, advances in building technology, requests for sustainable production as well as more demanding Building Acts and Regulations, etc. all lead to the continuous increase of contemporary construction project complexity. To address this, Fischer et al. (2017, p. 69) maintain that construction projects need to be optimised according to four parameters: buildable, operable, usable and sustainable. To optimise all parameters, a suitable project delivery method (hereafter PDM) must be selected.

To clarify the use of the term PDM, this study follows the definition outlined by Miller et al. (2000), defining it as “a system for organizing and financing design, construction, operations and maintenance activities that facilitates the delivery of a good or service”. New delivery methods typically emerge as a response to increasingly complex construction projects. These methods are often labelled “collaborative” due to the focus on aligning the

interests of the client with the rest of the project supply chain (Oakland & Marosszeky, 2017, p. 15). A plausible argument for this shift is that complex projects require all parties involved to focus on the final product, i.e. find a proper solution to the problem, and not focus on shifting risk or claims procedures, as is often the case in the industry. Another argument for the shift is the risk for work-related crime and other ethical challenges associated with traditional project delivery (Engebø et al., 2017, 2018; Lohne, 2017; Vee & Skitmore, 2003). Actors should seek collaboration to achieve common objectives, instead of competing to achieve diverging ones.

According to the Construction Industry Institute (2003), the purpose of a PDM is to facilitate maximum achievement of the project owner’s objectives. The attention on the project owner’s objectives is well anchored through the Principal-Agent theory. This is, however, challenged by actors and academics seeking to broaden the perspective towards user’s objectives and societal ob-

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jectives such as sustainability. The PDM defines the roles through the procurement route, the sequence of project phases, as well as setting a framework for organisation, roles and responsibilities. Tran and Molenaar (2015) state that the choice of PDM is often made ad hoc with little insight into how the decision will influence the final project risk allocation. This argument is supported by, for example, Lædre et al. (2006), maintaining that clients continue to select the same method based on habit, without necessarily considering what suits each project. When choosing PDM, the responsible party may choose from many different types of PDMs currently used in the construction industry. However, the no formalised and structured selection process exists for choosing a suitable PDM (Construction Industry Institute, 2003; Oyetunji & Anderson, 2001). Furthermore, Tran and Molenaar (2015) underline that actors in the construction industry are seeking out alternative PDMs, most notably Partnering, Integrated Project Delivery (IPD) and Alliancing.

Emerging forms of PDMs emphasise aspects such as collaboration throughout the project (Fischer et al., 2017, p. 314). Walker and Lloyd-Walker (2015, p. 95) state that trust, commitment, and the nature of co-learning through collaboration are all linked elements at the core of collaborative PDMs. The research presented in this article assesses the most common collaborative PDMs, notably Partnering, Integrated Project Delivery (IPD), Alliancing, Relational Contracting (RC) and Relationship-Based Procurement (RBP). The classification are loosely based on Walker and Lloyd-Walker (2015).

The use of collaborative PDMs for construction projects raises concerns such as practicalities, organisation, the extensiveness, the process, etc. To pursue consolidation in the research on collaborative PDMs, a scoping review according to the prescription of Arksey and O'Malley (2005) was undertaken. The study addresses the following two research questions:

1. What research has been carried out on Collaborative Project Delivery Methods?
2. What are the most important gaps in the research?

The paper is divided into the following sections. To begin, the theoretical framework is presented in the next section. Next, in the “Methodology” section, the scoping literature review method and how it was carried out. Then, the findings are presented under the sub-sections: “Partnering”, “Alliancing”, “Integrated Project Delivery”, “Relational Contracting”, “Relational-based Procurement”, and “Comparative Studies”. The results are then discussed, following the same structure as the result section. The last section offers the answers to the research questions, identifying the gaps in the literature on collaborative project delivery methods for construction projects and concludes by providing suggestions for future research.

1. Theoretical framework

PDMs are important for everyone that conducting projects, regardless of industry. Further, every project across sector- and industries has a PDM. The PDMs discussed

in this paper are mostly applicable to the construction industry as contract and organization is essential parts of the PDM and both contract and organizational structures (traditions and practices) are specific to industries. Following Söderlund (2011, p. 43) projects are classified according to four logics, that is size, institutional and industry context, organisational context, and lastly task features (complexity, uncertainty, etc.). This article emphasises the construction industry context.

Construction projects are described as being unique and not repetitious coming in various shapes, sizes, and complexities (Forbes & Ahmed, 2010, p. 8). They work towards specific schedules and budgets to produce a specific result (Miller et al., 2000). For construction projects, complexity can be understood in terms of differentiation (the number of varied elements) and interdependencies (degree of interrelatedness between these elements). Furthermore, it is proposed that differentiation and interdependencies are seen in the context of organisational, technological, informational complexity dimensions (Baccarini, 1996). These characteristics determine the appropriate actions to manage them successfully, meaning that management techniques must similarly adapt to the environment.

As complexity increases, changes need to be made to the management structures within projects. Project management is based on elements such as integration, systemic management, simultaneous management, the use of teams, and managing functional plans simultaneously and interdependently internal (Williams, 1999). Integration is proposed as a way of managing project complexity as collaborative working actors liaise closely in decisions, understand each other's requirements and constraints, and have confidence in one another's commitment to the achievement of a common aim (Austin et al., 2002). The management function of integration is therefore particularly important, and an essential function of project management (Baccarini, 1996). This sets the prerequisite and context for so-called collaborative project delivery methods. A common characteristic for all collaborative project delivery methods is that they seek to provide a framework for integration. Thus, as the trend is shifting towards more collaborative forms of project delivery, it creates a need to synthesise prior knowledge and research on these types of project delivery methods so that knowledge gaps are identified and, in the future, filled.

1.1. Types of project delivery methods

A PDM is a system used for organising and financing design, construction, operations, and maintenance services for a structure or facility by entering into legal agreements with one or more entities or parties (Miller et al., 2000). However, different terminologies concerning the phenomena exist, e.g.:

- Contract Strategy (Wearne, 1989);
- Construction Contracting Method (Gordon, 1994);
- Building Procurement Systems (Love et al., 1998b);
- Construction Procurement System (Rwelamila et al., 2000);

- Project Procurement System (Alhazmi & McCaffer, 2000);
- Project Delivery System (American Society of Civil Engineers, 1997; Anderson & Oyetunji, 2003; Migliaccio et al., 2008; William & Ying-Yi, 2011);
- Project Delivery Method (Miller et al., 2000; Touran et al., 2011);
- Project Delivery Strategy (Migliaccio et al., 2008);
- Procurement Method (Naoum & Egbu, 2015; Wardani et al., 2006);
- Project Execution Model (Mejlænder-Larsen, 2018).

Some common understanding can be extracted from different terms. For example, most researchers agree upon that the term project delivery describes how the project participants are organised to transform the owner's goals and objectives into finished products. Furthermore, PDMs are according to Touran et al. (2011) used as a reference to all contractual relations, roles, and responsibilities of the entities involved in a project. As a measure for providing some clarity, Miller et al. (2000) have developed a framework focussing on the integration of delivery and source of finance. The asset of this framework is that it cuts through the jargon and delineates project delivery methods by simplifying the classification that applies to project delivery methods by focusing on two key characteristics, integration of delivery and source of finance. Furthermore, studies on specific aspects of project delivery methods are abundant, see for instance:

- Project Delivery method selection (Chen et al., 2010, 2011; Mafakheri et al., 2007; Mostafavi & Karamouz, 2010);
- Characteristics affecting the choice of project delivery method (Liu et al., 2014, 2015, 2016, 2019).

1.2. Emerging project delivery methods

There exist several specific PDMs for designing and constructing buildings and infrastructure. Some PDMs have prevailed for decades, while others have emerged relatively recent. While terminology varies, the dominant paradigm within this field is the division between so-called traditional and relationship-based project delivery methods. This is not a discrete categorisation, rather a continuum. Table 1 provides a categorisation given by Walker and Lloyd-Walker (2015, p. 16): “Traditional – Segregated Design and Delivery procurement Forms”, “Focus on Integrating design & delivery processes – emphasising planning and control” and “Focus on integrating project design & delivery teams – emphasising collaboration and coordination”. Traditional is described as forms of procurement that tends to separate the design and delivery, typically Design-Bid-Build (DBB). Traditional project delivery is also characterised by a large degree of responsibility for the client. Focus on Integrating design & delivery processes are methods that have some degree of integration, mainly through contractual or physical planning and control systems. As opposing to methods that segregates the Design and Delivery, emerging delivery methods empha-

sises integrating the design and delivery. Integrated forms of project delivery are often aligned towards the formation of one project team to deliver both design and construction. This may be achieved through a variety of methods, for example Project Partnering, Project Alliancing, Early Contractor Involvement, Framework agreements, Integrated Project Delivery (IPD) to name just some of the most prominent.

While Table 1 provides some examples of the specific approaches available within the different categories offered by Walker and Lloyd-Walker (2015, p. 16), the literature operates with what might be considered a jungle of terminology. Table 2 outlines an insight into this diversity.

As collaborative PDMs are gaining momentum, the change from so-called traditional project delivery methods is perceived not to be easy. Changing from one way of doing things to another will always impose challenges; this is also true for collaborative project delivery. Firstly, one needs some sort of innovation, conceptualisation and practical description (what & how). Secondly, one must substantiate that changes are for the better, creating a need for pioneers willing to try. Thirdly, new project delivery methods need to be researched and documented, especially concerning effect, barriers & drivers, and success factors.

Collaborative PDMs impose the need for contractual, organisational, and social changes. On a social level, researchers have found that collaborative project delivery creates confusion related to roles, responsibility, structure, and the process (Aarseth et al., 2012; Engebø et al., 2019). The same researchers elaborated that many challenges relate to a lack of a unified applied collaborative project delivery methods to be used in projects. A specific challenge is that too many elements is attempted implemented at once, causing a tendency to fall back on traditional ways of doing things when the project faces obstacles (Simonsen et al., 2019). Information on how transformation should be implemented is limited, especially at the organisation-wide level (Migliaccio et al., 2008). van de Velde and Ernst (2008) sketch several considerations when implementing new practices in project delivery. First, optimising phase by phase might hamper optimal arrangement across all phases. Secondly, contractors receiving a fully specified call for tender have little room for performing the task in the best possible way as according to their own resources and skills. Thirdly, it is questionable whether and to what extent the advantages of integration outweigh its disadvantages. Fourthly, to which extent the owner allows the contractor room to carry out their tasks optimally by reducing their own option to steer and adjust. Lastly, a problem with traditional contracting is the information disadvantage of the owner compared to the contractor. Information disadvantages make it more difficult to steer and check. The type of project owner is also a critical axis to consider, as public owners often are bound by a clear set of principles to follow. Furthermore, economic conditions and social policies, value, transparency, competition, the scope of work, risk, revenues, and owner sophistication

Table 1. Elaboration of the continuum between traditional and relationship-based project delivery

Traditional	Focus on Integrating design & delivery processes	Focus on integrating project design & delivery teams
Design-Bid-Build (DBB)	Design & Construct (DC)	Partnering
Cost reimbursable	Integrated SCM	Alliancing
	Management Contracting	Early Contractor Involvement
	Joint Venture consortia	Framework agreements
	BOOT family/ PFI/ PPP	Integrated solutions

Table 2. Diversity of terminology on project delivery

Terms describing project delivery	Terms describing Relationship-based project delivery	Terms describing particular Relationship-based project delivery method
Project Delivery System	Collaborative Project Procurement	Project Partnering
Project Delivery Model	Collaborative Project Delivery	Strategic Partnering
Project Delivery Method	Collaborative Procurement	Integrated Project Delivery
Project Delivery Strategy	Integrated Project Delivery (IPD, IPD-ish, Lean IPD, IPD Lite)	Project Alliancing
Procurement Method	Relationship-Based Project Delivery	Strategic Alliancing
Procurement Arrangement	Relational/Relationship Contracting	Early Contractor Involvement
Project Procurement	Partnering/Partnership	Collaborative Procurement
Contract Strategy	Framework Agreements	Competitive Dialog
Contract Arrangement		BOOT/PFI/PPP

are all principles needed to be considered when choosing a delivery method (Miller et al., 2000). In summary, the literature is rich in descriptions regarding the need for collaborative project delivery methods, and considerations to be made when implementing such. While actors in the construction industry continuously test new project delivery methods, there exists no coherent framework describing a uniform approach to collaborative project delivery methods.

Collaborative project delivery methods in the context of the construction industry imply a variety of topics like economics, organisation, contracts, procurement, technology, people management, risk management among others. Furthermore, project delivery covers a range of perspectives, i.e. industry, organisation, actors or society. Sullivan et al. (2017) state that researchers need identifying clear advantages and disadvantages of each PDM in specific situations. However, before moving forward, it is evident that there exists a need for a comprehensive review of the current state of research on collaborative project delivery methods. This is especially true for relatively new types of collaborative PDMs that lack empirical based evidence regarding performance (Mesa et al., 2016). PDM is important for every instance that conducts project work, regardless of industry. Thus, it is of importance to project management as a field. Every project (across sector- and industries) has a PDM. Professional actors have well developed PDM's, while others may have less so. The PDM forms the structure of the decision-making- and of the project, on which every project owner depends to achieve effective governance, and every project manager needs to control his/ her project. The project delivery methods discussed

in this paper is mostly applicable to the construction industry as contract and organization is essential parts of the PDM and both contract and organizational structures (traditions and practices) are specific to industries.

2. Methodology

This study uses a scoping review methodology. The scoping methodology was chosen as the strengths of this method is that it provides a framework for creating an overview of the state of a field as well as serving as a specific tool for mapping a broad and diverse topic that collaborative project delivery methods is. Since the method is less rigid than a systematic review, it is possible to impose flexibility in selection and inclusion of literature; for example, by including literature with a wide range of study designs and methodologies, and to combine qualitative and quantitative studies, which again is a necessity when assessing literature within the field of project management and project delivery method where no coherent paradigm regarding study design exists.

The methodology originates from the field of medicine, but have been successfully adopted within other fields (see for example, Davis et al., 2015; Griffiths et al., 2009; Lohne et al., 2019; O'Donnell et al., 2017). Furthermore, the methodological approach is concerned with the identification of the current state of understanding within a chosen field. Often, it addresses an exploratory research question aimed at mapping key concepts and research gaps, by searching, selecting and combining existing knowledge (Arksey & O'Malley, 2005; Colquhoun et al., 2014). According to Arksey and O'Malley (2005), there

are at least four common reasons for undertaking scoping reviews. This paper is concerned with identifying gaps in the existing research literature regarding Collaborative Project Delivery Methods.

This scoping review implements the framework outlined by Arksey and O'Malley (2005). The framework consists of five steps: 1. Identify the research question; 2. Identify relevant studies; 3. Study selection; 4. Chart the data; and 5. Collate, summarise and report the results. However, it also implements the contribution to the methodology made by Levac et al. (2010), Daudt et al. (2013), and Colquhoun et al. (2014). Levac et al. (2010) propose some clarification regarding the particular framework, drawing from their own experience. Daudt et al. (2013) offer specific recommendations such as being flexible regarding the research questions and engaging the whole research team throughout every step of Arksey and O'Malley's (2005) framework. Colquhoun et al. (2014) contribute with clarity to the definition and methodology itself.

Before starting the review, methodical guidelines were set. In the initial stages, it was chosen to emphasise original studies published in peer-reviewed journals and conference proceedings from the last 30 years. Articles published in conference proceedings were filtered out later in the review process. These boundaries sharpened the scope of the search, as the study is limited to a population of publications that exclude popular science, industry reports, and Governmental reports. The methodical guidelines gave clear boundaries for the scoping review. The methodical guidelines are summarised in Table 3.

Studies regarded as relevant were identified within the sources presented in column 2, Table 3. The chosen databases were perceived to comprehend key publishers and journals concerning the scientific field of project management in an unbiased manner. Keywords for the literature search were selected from a broad area: project delivery methods. However, since standard terminology does not exist within the area of research, several combinations of keywords were used, such as project delivery, project delivery model, project delivery method, project delivery system, project procurement, procurement strategy, and contract strategy. To narrow the search towards collaborative project delivery methods, more specific terms – such as partnering, alliancing, integrated project delivery (IPD),

collaborative, cooperative, relational contracting (RC) and early contractor involvement – were used. The next step was to combine these keywords into search queries. Almost all combinations were tried, as shown in Table 4.

Some of these search queries gave an unmanageable amount (>10000) of hits, and as a response, operators such as “NOT,” “OR” and “*” were used to narrow the search. Furthermore, the hits were filtered using operators such as “TITLE-ABS-KEY” as well as limitations such as “CONSTRUCTION” or “CONSTRUCTION*”. After implementing these limitations, 489 articles were selected for a second refining process. Table 4 gives an extract and overview of the search history. The table shows the number of hits in the respective databases. The numbers in parenthesis are the searches that were thoroughly examined.

In the second refining step, two of the authors filtered out articles after having read the abstracts. Due to the ambition of tightening the scope, a set of exclusion and inclusion criteria was adopted for reducing the number of articles. First, studies considered too narrow were excluded. To elaborate, articles focusing on highly specific aspects of project delivery such as the use of a particular tool (e.g., BIM, co-location, and risk assessment amongst other) were sought to be excluded. Secondly, studies focusing on so-called traditional project delivery (DBB, DB, and Construction manager-at-risk etc.) were excluded. Finally, the included studies had to address specific collaborative project delivery methods according to the categories set in the theoretical framework (notably Partnering, Integrated Project Delivery, Alliancing, Relational Contracting, and Relationship-Based Procurement). When the abstracts were reviewed, and the relevance was unclear, an investigation of the full article was conducted. In this step, two particular recommendations made by Levac et al. (2010) was followed: two researchers including the main author independently reviewed full articles for inclusion, and if a disagreement occurred, a third researcher was included to discuss the matter. At the end of this step, 237 articles remained.

After the second refining step, the necessary data and information on each article was collected. This included geographical location, study purpose, methodology, means of data collection, and important findings.

Table 3. Methodical guidelines for this scoping review

1. General guidelines	2. Sources	3. Collected data	4. Reporting the Results
<ul style="list-style-type: none"> • Sources: electronic databases, selected journals, and specific recommendations; • Timespan: last thirty years (1987–2017); • Sources must be peer-reviewed • Access to full-text; • English language 	<ul style="list-style-type: none"> • Oria (Norwegian university libraries); • Scopus; • Elsevier Engineering Village; • Web Of Science; • ASCE Library; • Science Direct; • Personal database/ highly; recommended articles by members of the research team 	<ul style="list-style-type: none"> • Title, author(s), year of publication, study location; • Thematic category (delivery method scrutinised); • Keywords; • Aim/ purpose of the study; • Methodology; • Important results 	<ul style="list-style-type: none"> • Statistical summaries; • Charts/graphs/visual illustrations; • Tables sorting findings after study purpose

Table 4. Overview of search history – numbers in brackets are search queries thoroughly reviewed

Search number	Additions to the search string (represented using a Scopus search format)	Oria	Web of Science	ASCE	Scopus	Science Direct
1	TITLE-ABS-KEY (Project delivery (system OR model OR method) AND All Fields (Collaborative OR Integrated))	265 (43)	158 (17)	88 (54)	1727 (67)	2074 (350)
2	TITLE-ABS-KEY Project procurement (system OR model OR method) AND All fields (Construction) AND TITLE-ABS-KEY (Collaborative OR Integrated) And Peer-reviewed	(70) – –	(42) – –	(16) – –	4699 328 (154)	537 213 (194)
3	TITLE-ABS-KEY (Integrated OR Collaborative) Project Delivery AND All fields (Construction)	286 (75)	53 (29)	31 (31)	5437 (82)	379 (129)
4	TITLE-ABS-KEY Project Partnering AND TITLE-ABS-KEY (construction) AND Peer reviewed	672 199 (85)	459 77 (70)	113 110 (59)	1836 89 (84)	2130 696 (23)
5	TITLE-ABS-KEY Project alliancing AND TITLE-ABS-KEY (construction) AND Peer reviewed	409 97 (38)	(10) – –	(1) – –	126 81 (71)	402 25 (25)
6	TITLE (Collaborative OR Cooperative OR Relational OR Integrated) Project ((system OR model OR method OR Arrangement) AND TITLE-ABS-KEY (construction) AND Peer reviewed	831 64 (39)	869 80 (79)	65 24 (24)	1189 106 (104)	8689 763 763
	Total	350	247	185	563	721

Geographical location was recorded according to the first author's institutional belonging. The purpose of the study was identified – in the authors' own words – and categorised. Regarding methodology, the articles were classified as either "Qualitative", "Quantitative", or "Mixed method". While "mixed method" is a broad term the classification was used when the study had both quantitative and qualitative aspects of equal importance (i.e., if a study used a preliminary and generic questionnaire, but reported and discussed its findings on qualitative interviews it would not be a mixed method-study, but a qualitative one). For data collection, we identified the categories observation study, case study, interviews, survey, document study or other. A few studies did not inform on these matters, so a qualified assessment of the data collection method was undertaken. An "important results" category was added for statements that represented a contribution or answer produced by the particular study. All the data and information on each article was recorded in a spreadsheet.

The third refining step started with 237 articles. A significant reduction in the number of articles was achieved after it was decided to exclude conference proceedings publications. The assumptions were that authors with high esteem of their work would aim for an acknowledged journal rather than conference proceedings. Next, all articles that did not address one of the pre-defined categories regarding collaborative project delivery was scrutinised, and articles with research purpose considered outside the scope of this review were removed. After this step, the final sample consisted of 156 articles. In the final step, the 156 articles that met al. the inclusion criteria were analysed. The sample was divided into six subsets – 62 articles concerning Partnering, 27 articles concerning Alliancing, 28 articles concerning Integrated project delivery, 8 articles concerning Relational-based procurement, 22 articles

concerning Relational contracting, and 9 articles concerning a comparative viewpoint. The results were structured chronologically according to the research questions.

When it comes to collating, summarising and reporting the results, we did not assess the quality of the studies, as this is – according to Arksey and O'Malley (2005) – outside of the purpose of a scoping review. We realise that the collected data, such as thematic category and methodology, may contain errors. To elaborate, some publications did not offer a description of methodology and others did not provide exact labels such as "qualitative" or "quantitative" leading to some cases where the researchers had to interpret. As a scoping review should provide a narrative or descriptive account of available research, reducing the number of articles included is often necessary, which again raises the question about finding the right balance between breadth and depth, i.e. focusing on covering all available research or provide a detailed analysis of the study.

Within the final sample there was a wide array of purposes. A paper regarding conceptualisation (e.g. a discussion on definitions) is structurally, and in terms of impact, different from a paper reporting and evaluating on performance and success. To better understand where the body of knowledge is most mature it was decided to sort papers between six sub-categories: "Conceptualisation", "Implementation and experience", "Pros & Cons", "Building partnership & Social Dimensions", and "Performance and success". The categories were based on the sample of literature and were made to draw more distinct lines between them. While this is a simplification (i.e. a paper can report on Performance, but also discuss Pros & cons overall), an approach where a paper could inhabit several sub-categories would muddy the field. The sub-categories with central keywords are found in Table 5.

Table 5. Study purpose categorisation and keywords

Study Purpose	Keywords
Conceptualisation	Overview / Definition / Description / Conceptualisation / Philosophical Framework / Infrastructure / Model / Procurement Approach
Implementation and Experiences	Implementation / Adoption / Lessons Learned / Adoption of the Practice
Pros & Cons	Benefits/ Problems/ Issues/ Barriers Incentives/ Reasons for Partnering/ Success Factors
Building Partnership & Social Dimensions	Trust, Motivation, Commitment, Personal Behaviour, etc. Owner-Contractor Relationship Partnering Relationship
Performance and Success	Analysis of Project Performance for Partnering Projects/ Project Control/ Partnering Assessment/ Assessment Tools

The review has certain of limitations. First, the “scoping review” approach is less strict than, for example, “systematic reviews”, however, this allows for a more rapid mapping that again is beneficial for an expanding research field. Secondly, it is not a quality assessment, i.e. it takes findings at face value and does not evaluate the quality or the validity of the research. Thirdly, it is not a recommendation or ranking of the body of literature. Fourth, all included articles are written in English.

3. Results

The following section outlines the findings from the review process, as according to the research questions. A categorisation of the 156 articles in the final sample resulted in the distribution shown in Figure 1. The final sample

included 62 “Partnering” articles, 27 “Alliancing” articles, 28 “Integrated project delivery” articles, 8 “Relational-based procurement” articles, 22 “Relational contracting” articles and 9 “comparative” articles. Figure 2 shows the method distribution. As we can see, the distribution is relatively even, indicating that there does not exist one favoured or dominant method for researching project delivery methods.

Figure 3 shows publications sorted after the geographical (based on institution/ university) belonging of the main author. As we can see, only 21 different countries are represented which is just above 10% of all countries recognised by the UN. The low representation implies that this research field is still immature, at least in regards of global reach. Furthermore, there is an Anglo-American dominance, followed by China/ the South-East Asia region, and then the Nordic countries.

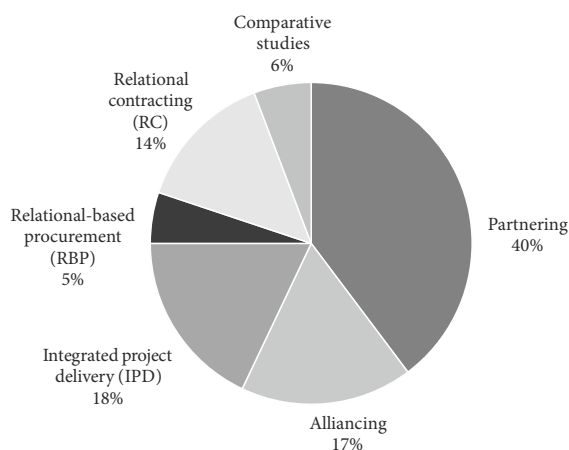


Figure 1. Distribution according to categories

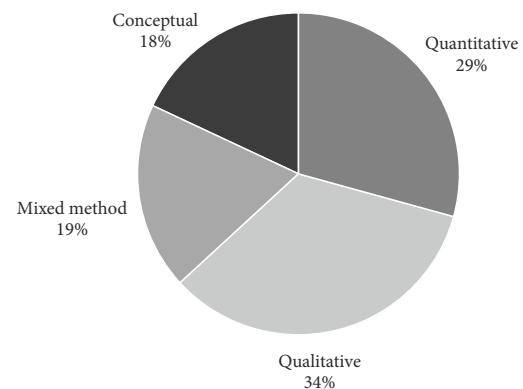


Figure 2. Methodical distribution

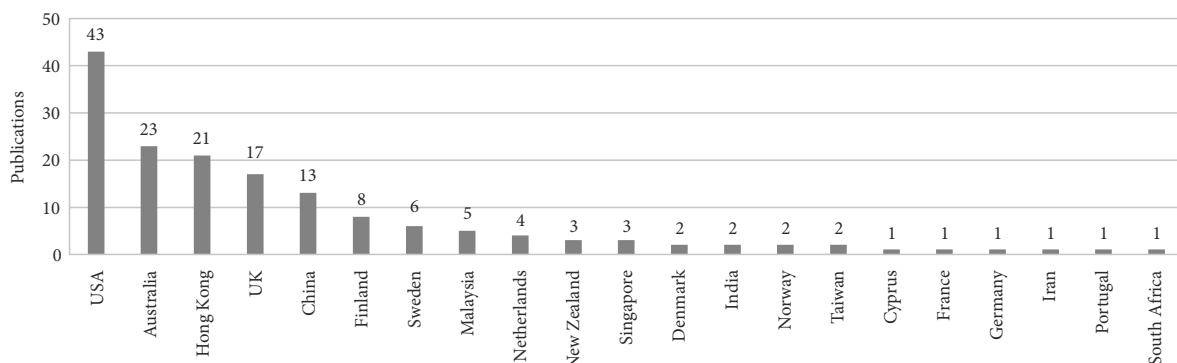


Figure 3. Countries & publications

Another observation is that we can to some degree connect geographical distribution and the thematic categories. Even though the sample is small, we can see that the USA is the most prominent promoter of IPD research. Australia has the same role regarding Alliancing research. Partnering is more divergent with the most prominent publishers being USA (17), UK (14), Hong Kong (11), China (6) and Sweden (6). The same goes for research labelled as RC and RBP, with the most prominent being Hong Kong (8), Australia (7), USA (7), Singapore (3) and UK (3). Despite being an interesting observation, it is not possible to generalise based on such a small sample. However, it is possible to argue that the prominence of research on specific methods in geographical areas is possibly correlated to which methods are used by industry in that area. It could also correlate with prominent researchers in each respective area (like Bresnan, Walker, Love, Rahman, etc.). Both are likely to influence the direction of conducted research.

Figure 4 shows publications per year. As we can see, there is a steady increase in publications in this field since emerging in the early nineties. For example, partnering research emerged during the early nineties, while IPD research appeared more than ten years later.

As Figure 5 shows, around 50% of the sample is published in the following four journals: “Journal of Manage-

ment in Engineering”, “International Journal of Project Management”, “Journal of Construction Engineering and Management” and “Construction Management and Economics”. This observation is valuable for everyone interested in the subject; it gives a clue to where to find relevant research as well as where to submit research. A limited number of authors stand behind a substantial part of the final sample, as indicated by Figure 6. The figure shows authors on at least four publications.

When it comes to what research has been carried out, specific findings can be derived. There seems not to be one particular methodical approach that stands out. Research on collaborative PDMs is carried out using methods categorised as qualitative, quantitative, conceptual and mixed. A substantial number of the publications within the category partnering, could be due to the loose definition of partnering. Together, the three categories partnering, alliancing and IPD contain 75% of the publications. They represent a substantial part of the identified research on collaborative PDMs. The research field seems to be driven by a limited number of researchers that come from a limited number of countries. Besides, it appears that four journals have published a substantial part of the research. Even though there is confusion in terminology, the field of research seems more concentrated than what was expected from the outset. One reason for the Anglo-

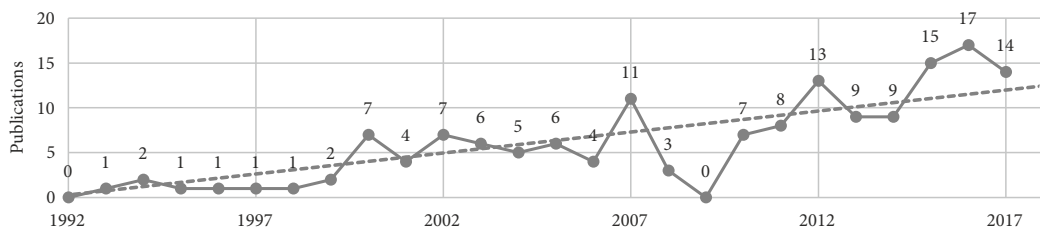


Figure 4. Publications per year, no articles registered prior to 1992

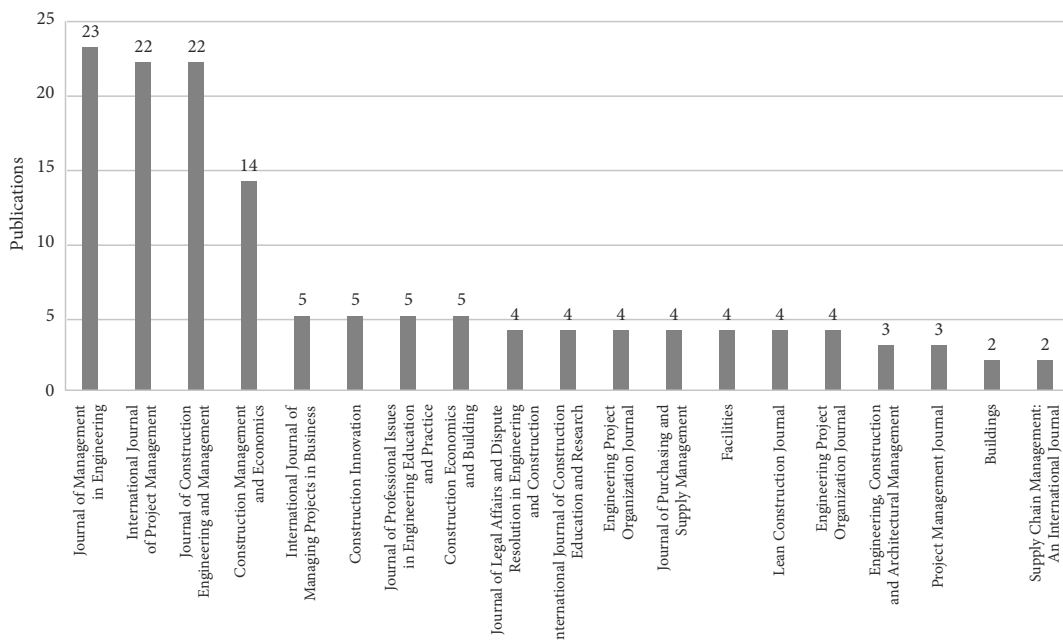


Figure 5. Journals publishing PDM research

American dominance may be that English is the lingua franca of scientific publication and that this article concerns only publications written in English. Furthermore, it is not farfetched to believe that countries such as France and Germany (one publication each in this sample) are publishing research on the topic, but in their own languages. Table 6 shows research on collaborative PDMs according to the categories and research method. Overall, 29 (18.6%) studies used non-empirical method. There were 53 (34%) studies classified as using a qualitative research approach, and 45 (28.8%) studies classified as using a quantitative research approach. Among the 156 studies, 29 (18.6%) were identified as having a mixed research approach. Conceptual approaches were most prominent in Partnering and Relational-based procurement (22.6% and 25.0%, respectively). For Alliancing, qualitative studies dominated (55.6%). The choice of a qualitative research approach may be due to the ability of qualitative research to provide insight into phenomena. The IPD category was very empirical-heavy (90%) with qualitative (35.7%), quantitative (35.7%) and mixed method (17.9%). Surprisingly, the comparative studies category was not dominated by quantitative research (11.1%), but instead qualitative (44.4%). However, the low number of studies included in the category makes the notion less significant.

3.1. Partnering

Partnering was the largest ($n = 62$) PDM category within the sample. This might be explained by its loose definition or that it was the first “collaborative” PDM to be written about until 1998 (i.e. the only one which “existed”). Partnering may be viewed as the basic – or rather – original collaborative project delivery method, and the starting point from where the others have sprung from. The study purposes show an even distribution of articles across Conceptualisation (25.8%), Implementation and Experiences (12.9%), Pros & Cons (22.6%), Building Partnership & Social Dimensions (22.6%), and Performance and Success (14.5%).

Table 7 below shows the Partnering articles sorted by study purpose and Figure 7 shows the partnering articles by year. As we can see from Figure 7, Partnering seemed to peak at three different occasions, first in 2000, 2003 and then in the year 2007. There are zero publications in this particular sample in the years 1998, 2006 and 2009. After the peak year of 2007, we have seen a steady stream (except in 2009) of publications over the years, albeit no year has more than half the number at the peak. The year without publications may be explained by the emerging and rival concepts or the use of terminology such as integrated project delivery.

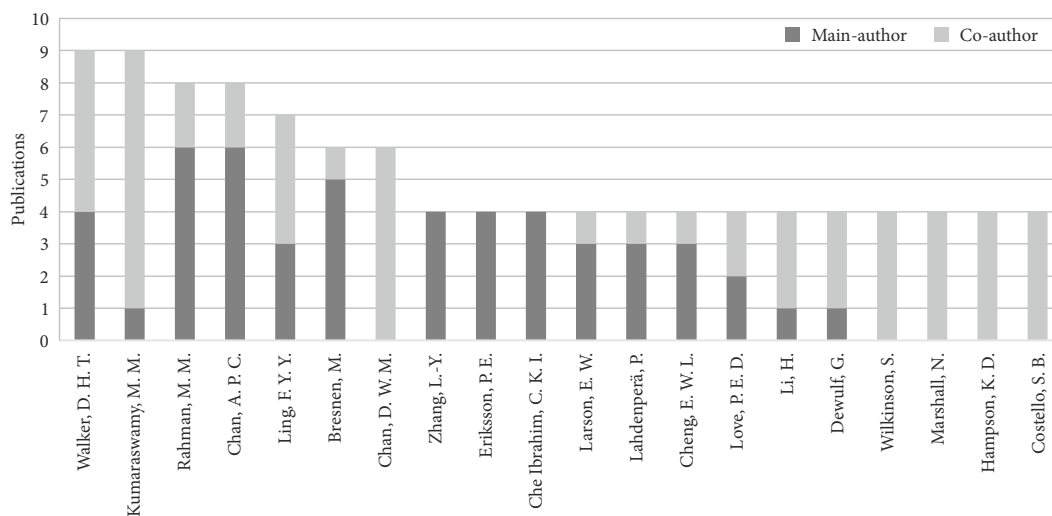


Figure 6. Most prolific researchers with four or more publications in the final sample

Table 6. Collaborative PDMs according to the categories and research method

Category	Conceptual	Qualitative	Quantitative	Mixed method	Grand Total
Partnering	14 (22.6%)	17 (27.4%)	19 (30.6%)	12 (19.4%)	62 (39.7%)
Alliancing	4 (14.8%)	15 (55.6%)	3 (11.1%)	5 (18.5%)	27 (17.3%)
Integrated project delivery	3 (10.7%)	10 (35.7%)	10 (35.7%)	5 (17.9%)	28 (17.9%)
Relational contracting	4 (18.2%)	3 (13.6%)	10 (45.5%)	5 (22.7%)	22 (14.1%)
Relational-based procurement	2 (25.0%)	4 (50.0%)	1 (12.5%)	1 (12.5%)	8 (5.1%)
Comparative studies	2 (22.2%)	4 (44.4%)	2 (11.1%)	1 (11.1%)	9 (5.8%)
Total	29 (18.6%)	53 (34.0%)	45 (28.8%)	29 (18.6%)	156 (100%)

Table 7. Partnering

Study purpose	Authors	Weight (n/%)
Conceptualisation	Bresnen and Marshall (2000c); Cheng et al. (2001); Naoum (2003); Cheng and Li (2004); Lu and Yan (2007b); Bresnen (2007); Bygballe et al. (2010); Eriksson (2010); Hartmann and Bresnen (2011); Gottlieb and Jensen (2012); Eriksson (2015); Du et al. (2016); Børve et al. (2017); Anthony et al. (2017); Conley and Gregory (1999); Eriksson and Pesämaa (2013)	n = 16 25.8%
Implementation and Experiences	Osama (1994); Larson and Gray (1994); Peña-Mora and Harpoth (2001); Humphreys et al. (2003); Manley et al. (2007); Eriksson and Nilsson (2008); Bayliss et al. (2004); Beach et al. (2005)	n = 8 12.9%
Pros & Cons	Li et al. (2001); Ng et al. (2002); Packham et al. (2003); Chan et al. (2003a, 2003b); Wood and Ellis (2005); Lu and Yan (2007a); Alderman and Ivory (2007); Crespín-Mazet and Portier (2010); Chan et al. (2013); Mollaoglu et al. (2015); Black et al. (2000); W. T. Chen and T.-T. Chen (2007); Chan et al. (2008)	n = 14 22.6%
Building Partnership & Social Dimensions	Drexler and Larson (2000); Bresnen and Marshall (2000a, 2000b, 2002); Swan and Khalfan (2007); Kadefors et al. (2007); Mason (2007); Laan et al. (2011a); Du et al. (2016); Cheng (2016); Wang et al. (2016); Lazar (2000); Cheung et al. (2003); Cacamis and Asmar (2014)	n = 14 22.6%
Performance and Success	Weston and Gibson (1993); Larson (1995, 1997); Krebs and Epstein (1996); Gransberg et al. (1999); Black et al. (2000); Ali et al. (2010); Anderson and Polkinghorn (2011); Chen and Wu (2012)	n = 9 14.5%

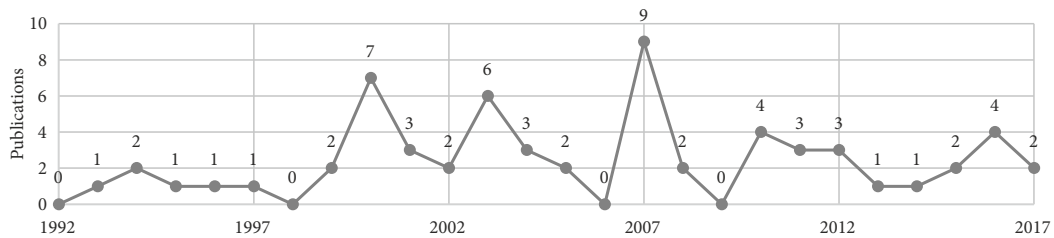


Figure 7. Partnering

3.2. Alliancing

Most of the articles which fall under “Alliancing” can be traced back primarily to Australia and New Zealand. The earliest studies followed the National Museum of Australia-project (Walker, 2002; Hauck et al., 2004), however, as the PDM matured it was adapted into a wider range of projects. The recent years has seen a surge in research interest into Alliancing projects, as shown in Figure 8. A possible explanation for this is due to the increasing number of projects available for post-evaluation and a maturing industry. Table 6 presents the identified literature, categorised by purpose.

The Table 8 below shows the Alliancing articles sorted by study purpose. As seen, Alliancing in a ten-year pe-

riod from 2001 to 2011 were characterised by sporadically publications. After 2011 a steady increase of publications emerges, possibility due to the growing number of projects using the Alliancing approach.

3.3. Integrated Project Delivery

IPD is an emerging category dominated by conceptual papers, and papers focusing on social dimensions. The emphasis on social dimensions as trust, motivation, commitment, personal behaviour etc. may arise because these factors often are pointed out as benefits from using this project delivery method. As Figure 9 reveals, studies on IPD have increased somewhat consistently since 2013–2014.

Table 8. Alliancing

Study purpose	Authors	Weight (n/%)
Conceptualisation	Sakal (2005); Yeung et al. (2007); Chen et al. (2012); Johnson et al. (2013); Hosseinian and Carmichael (2013); MacDonald et al. (2013); Vilasini et al. (2014); Lahdenperä (2017)	n = 8 29.6%
Implementation and experiences	Walker et al. (2001); Walker (2002); Keniger and Walker (2002); Hauck et al. (2004); Che Ibrahim et al. (2017); Fernandes et al. (2017); Hietajärvi et al. (2017a, 2017b)	n = 8 29.6%
Pros & Sons	Love et al. (2010)	n = 1 3.7%
Building Partnership & Social Dimensions	Davis and Love (2011); Laan et al. (2011b); Yitmen (2013); Lloyd-Walker et al. (2014); Hietajärvi and Aaltonen (2018)	n = 5 18.5%
Performance and Success	Che Ibrahim et al. (2013, 2014, 2015); Chen et al. (2015); Walker et al. (2015)	n = 5 18.5%

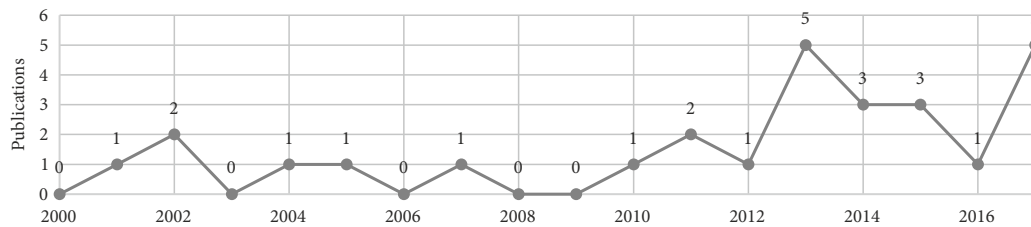


Figure 8. Alliancing

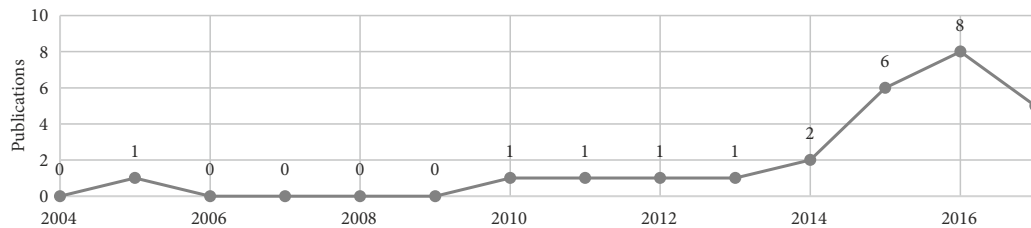


Figure 9. IPD

The detailed categorisation of study purposes related to IPD is recorded in Table 9. A reflection from this sub-sample is that the very definition of IPD varies from publication to publication and that sub-terms such as IPD Lite, Lean IPD, etc. have emerged. The fact that the definition fluctuates creates challenges when comparing articles in the sample. The differentiation between IPD and IPD Lite may be that IPD Lite methods do not utilise the Multi contractual framework that so-called “true” IPD projects uses. Instead they seek to emulate the perceived consequences and effects provided by the IPD method.

3.4. Relational contracting

The articles on relational contracting do not point towards a specific research problem. Contrary to the previous cat-

egories, relational contracting mainly implies a conceptual approach to procurement, contracting and project delivery. Figure 10 illustrates that relational contracting peaked on two occasions (2006 and 2012) and that no significant trend is emerging, except the period 2012–2015.

As seen in Table 10, the most commonly reported study purpose was “Pros & Cons” (36%), namely articles focusing on benefits, problems, issues, barriers, incentives, and success factors amongst other.

3.5. Relational-based procurement

The term “Relational-based procurement” is defined as an umbrella term envisaging a spectre of collaborative project arrangements. We have chosen to include this search term/category in this scoping review. The following is a

Table 9. IPD

Study purpose	Authors	Weight (n/%)
Conceptualisation	Matthews and Howell (2005); Kraatz et al. (2014); Sarkar (2015); Zhang et al. (2016); Sarkar and Mangrola (2016); Ma et al. (2018); Osman et al. (2015, 2017)	n = 8 28.6%
Implementation and Experiences	Bygballe et al. (2015); Esther Paik et al. (2017); Rowlinson (2017)	n = 3 10.7%
Pros & Cons	El-adaway (2010); Ghassemi and Becerik-Gerber (2011); Nejati et al. (2014); Nida et al. (2015); Nanda et al. (2017)	n = 5 17.9%
Building Partnership & Social Dimensions	Zhang et al. (2012, 2013); Sun et al. (2015); Paolillo et al. (2016); Pishdad-Bozorgi and Beliveau (2016b; 2016a); Pishdad-Bozorgi (2017); Kokkonen and Vaagaasar (2018)	n = 8 28.6%
Performance and Success	Hanna (2016); Asmar et al. (2016); Xie and Liu (2017); Mesa et al. (2016)	n = 4 14.3%

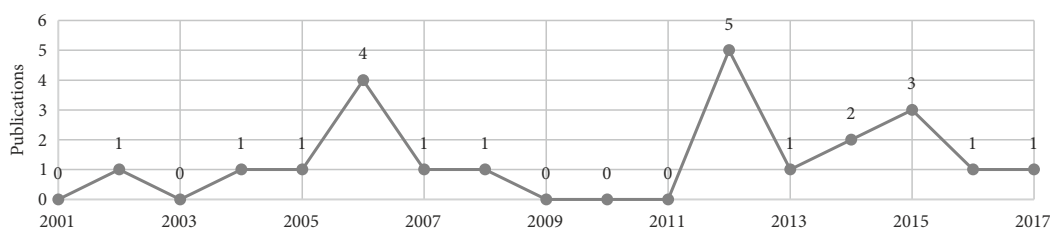


Figure 10. RC

Table 10. RC

Study purpose	Authors	Weight (n/%)
Conceptualisation	Rahman and Kumaraswamy (2002, 2004); Cheung et al. (2006); Yeung et al. (2012); Zhang and Li (2015); El-adaway et al. (2017)	n = 6 27.3%
Implementation and Experiences	Ling et al. (2006); Zou and Zillante (2012); Ning and Ling (2015); Ling et al. (2014); Harper et al. (2016)	n = 5 22.7%
Pros & Cons	Kumaraswamy et al. (2005); Yates and Duran (2006); Yates and Epstein (2006); Cullen and Hickman (2012); El-adaway (2012); Rahman et al. (2007); Rahman and Kumaraswamy (2008, 2012)	n = 8 36.4%
Building Partnership & Social Dimensions	Gil and Marion (2012); Ling et al. (2015)	n = 2 9%
Performance and Success	Ke et al. (2015)	n = 1 4.5%

short summary of our findings. Publications reporting on Relational-based procurement do not follow any particular trend; instead, the term is just sporadically used in research reporting on the phenomena, as seen in Figure 11.

Table 11 profiles how the articles concerning Relational-based procurement were organised according to study purpose. The Relational-based procurement category is dominated by research focusing on Conceptualisation (37.5%), Pros & cons (25%), and Building partnership & Social dimensions (25%). It was rather surprising to see that this category was not dominated by empirical case studies, as the “procurement” label implies some practicality regarding this category. An explanation may be, as seen with some of the other categories, that the case studies seem to use industry labels such as Alliancing, and IPD.

Table 11. Relational-based procurement (RBP)

Study purpose	Authors	Weight (n/%)
Conceptualisation	Love et al. (1998a); Rahman and Kumaraswamy (2005); Kantola and Saari (2016)	n = 3 37.5%
Implementation and Experiences	Mollaoglu-Korkmaz et al. (2011)	n = 1 12.5%
Pros & Cons	Ey et al. (2014); Rahmani et al. (2016)	n = 2 25%
Building Partnership & Social Dimensions	Kwofie et al. (2017); Dewulf and Kadefors (2012)	n = 2 25%
Performance and Success		n = 0 0%

3.6. Comparative studies

The comparative studies category may be an “other” category consisting of studies that did not quite fit into the previous categories. The emergence of comparative studies may be seen as an indicator of a maturity within this particular research field. The different approaches have been around for a sufficient time so that research effort on comparing the approach against each other has been conducted.

The characteristics of the nine studies are summarised in Table 12. As these articles are concerning evaluation or comparison of collaborative project delivery methods, the table lists the studies by delivery methods under scrutiny.

In addition, both Table 12 and Figure 12 show that studies that seek to compare different collaborative project delivery methods emerge sporadically. Unlike the result from the other categories, the comparative studies category results show no evident pattern in increase in research.

4. Discussion

In this section, we discuss our findings and implications for the field as according to the following six main categories – “Partnering”, “Alliancing”, “Integrated Project Delivery”, “Relational Contracting”, “Relational-based Procurement”, and “Comparative Studies”. Within the categories, we present the findings according to the five study purposes Conceptualization, Implementation and Experiences, Pros & Cons, Building Partnership & Social Dimensions, and Performance and Success.

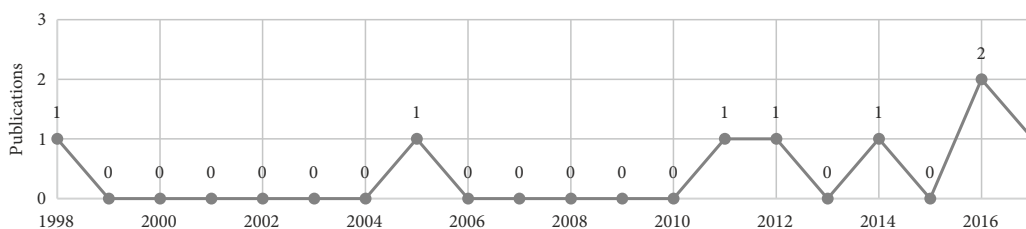


Figure 11. Relational-based procurement (RBP)

Table 12. Comparative studies

Comparing	Authors
Partnering/Alliancing	Manley (2002); Walker et al. (2002)
IPD/Relational Contracting	Chan et al. (2016)
Relationship-Based Procurement/Alliancing	Lahdenperä (2010)
Project Partnering/Project Alliancing/Integrated Project Delivery	Lahdenperä (2012)
RPB/Partnering	Doloi (2012)
Traditional/Integrated Project Delivery	Asmar et al. (2013); Bilbo et al. (2015)
Integrated Project Delivery/Alliancing	Heidemann and Gehbauer (2011)

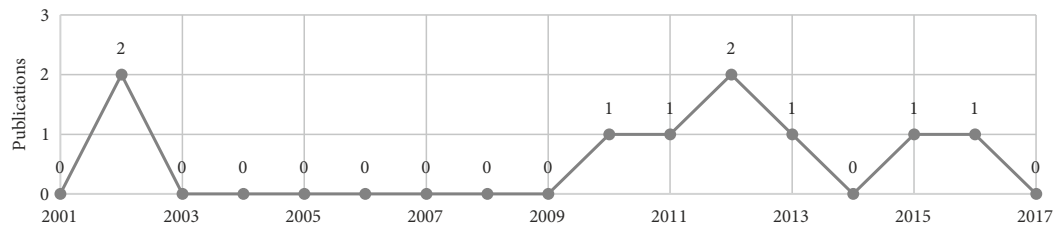


Figure 12. Comparative studies

Our scoping review identified 156 studies, a number indicating that research on collaborative project delivery methods is developing. Within the field there is a diverse and growing range of topics being researched. The categorisation of the research based on the study purpose proved to be difficult since several studies had multiple purposes. The solution was to mention the article just once even though it may touch upon other categories. For example, the “Pros & Cons” may overlap with both the “Conceptualisation” and the “Implementation & Experiences” category.

4.1. Partnering

The following consists of a discussion of the Partnering category, following the study purposes Conceptualisation, Implementation and Experiences, Pros & Cons, Building Partnership & Social Dimensions, and Performance and Success. We acknowledge that it can be discussed if some of the articles have been miscategorised.

The *conceptualisation* purpose consists of studies that develop or explore the concept of partnering. Partnering may be a specific strategy, but it can also describe a multifaceted practice. For example, Cheng et al. (2001) propose a partnering infrastructure and Cheng and Li (2004) build upon this paper by providing a practical model for partnering. Naoum (2003) introduces an overview of partnering practice. A slightly different take on the category is presented with a model evaluating the applicability of partnering used in a given situation (Lu & Yan, 2007). Another study proposes a buyer-supplier integration model based on clients’ collaborative purchasing practices (Eriksson & Pesämaa, 2013).

Other studies in this category describe specific elements that a partnering model may consist of, such as Eriksson (2010) who separates partnering into mandatory core procedures and collaborative tools. Another

view on partnering is to see it as a framework encompassing: participants, objectives, knowledge, skills, tools, and techniques applied to pursue the objectives (Børve et al., 2017). Gottlieb and Jensen (2012) link the partnering concept to institutional theory and governance, seeing partnering as a project governance mechanism, and a collective sense-making process.

When it comes to *implementation and experiences*, a report from 1994 stated that partnering had shown a promise for improved relationships with contractors and reduced litigation (Osama, 1994). Some years later, a case study from Puerto Rico describes lessons learned from the Tren Urbano project, a \$1.5 billion, 17.2-km heavy-rail project (Peña-Mora & Harpoth, 2001). Similarly, a case from the UK lowered costs, improved team approach and created less confrontation (Humphreys et al., 2003). Bayliss et al. (2004) report on a successful partnering venture in Hong Kong, focusing on tools that facilitated its success. In the empirical study done by Eriksson and Nilsson (2008), the client reduced the focus on price and facilitated a relationship based on trust and cooperation. Being slightly different than several other papers in this category, Beach et al. (2005) evaluated the progress UK construction industry made in its adoption of partnering. An important note about this category is that several case studies have been placed into other categories based on their stated study purpose.

Regarding *pros & cons* and reasons for adopting partnering Black et al. (2000) studied the contractors’, consultants’ and clients’ view on reasons for adopting partnering and what makes it a success. A second study sought to identify the problematic issues associated with project partnering based on contractors’ perceptions (Ng et al., 2002). Chan et al. (2003a) provide a review of 31 barriers to successful implementation of partnering (W. T. Chen & T.-T. Chen, 2007). Packham et al. (2003) found that

partnering did not offer many tangible benefits to small construction enterprises and often has a detrimental effect upon the contractor–subcontractor relationship. Chan et al. (2004) followed up on their 2003 paper with an examination of critical success factors, extracted by factor analysis on 41 variables. W. T. Chen and T.-T. Chen (2007), using factor analysis, identified 19 success factors divided into four clusters: collaborative team culture, long-term quality focus, consistent objectives, and resource sharing. Alderman and Ivory (2007) studied how changing commercial pressures, in the context of already fragile relationships, could lead to the abandonment of partnering, while Chan et al. (2008) provided insights into how partnering culture can be successfully developed with an Incentive Agreement. On a more strategic level, Crespim-Mazet and Portier (2010) suggest that the lack of diffusion and understanding of construction partnering may be due to the resistance of purchasers who feel threatened by the structural changes in their purchasing habits. According to Mollaoglu et al. (2015), of the top reported barriers to project partnering, the majority are cultural; and contrary to the literature according to them, none are legislative. On the other hand, factors such as “Faster construction time”, “Improvement of relationship amongst project participants” and “Improvement in communication amongst project participants” have been stated as significant benefits (Chan et al., 2003a). Furthermore, effective management of the partnering process can lead to positive outcomes, such as mutual trust, long-term commitment, creativity, shared vision, problem-solving ability, equity, cost-effectiveness, customer satisfaction and continuous improvement (Li et al., 2001).

In the subcategory of *building partnership & social dimensions*, the first paper examined the stability in the owner-contractor relationship (Drexler & Larson, 2000). A study the same year demonstrated how cognitive and social dimensions affect the use and impact of incentives (Bresnen & Marshall, 2000b). Furthermore, Bresnen and Marshall (2000a) explored the economic, organisational and technological factors that encourage or inhibit collaboration in practice. They found that people and relationships were considered the heart of collaboration, but that the lack of continuity in relationships frequently undermined attempts to secure the full benefits of collaboration. The nature and quality of relationships between client and contractor have also been studied (Bresnen & Marshall, 2002; Laan et al., 2011a). Cheung et al. (2003) examined the behavioural aspect of partnering; particularly trust as a success factor for partnering. Research also shows how procurement practice is influenced by goals of innovation and collaboration (Kadefors et al., 2007). Cheng (2016) proposes a novel approach with his research on developing an intention-based model according to the theory of planned behaviour. Cacamis and Asmar (2014) suggest the case that advancing the emotional intelligence (EI) of project participants can improve the partnering effort and ultimately result in increased project performance.

Regarding *performance and success*, a study from 1993 states that construction projects using partnering arrangement experienced significant cost and timesaving (Weston & Gibson, 1993). Other studies quantitatively assessed large samples, 280, 400 and 290 construction projects, respectively (Krebs & Epstein, 1996; Larson, 1995, 1997). Ali et al. (2010), Anderson and Polkinghorn (2011), Gransberg et al. (1999) also analysed the project performance of partnering projects quantitatively. Black et al. (2000) evaluated whether partnered projects in the Texas Department of Transportation performed better on average than non-partnered projects. Chen and Wu (2012) present the principles and algorithm of a project partnering assessment method and a case study to demonstrate the proposed methodology.

Being the category with most articles identified during the review, partnering appears at first sight to be well covered in literature. The articles origin from all over the world, but this project delivery method appears more often in Europe and Asia than in other places of the world. However, while being a project delivery method well covered in research, there are variations in how partnering is defined. Some definitions put weight on contractual terms, while others include multi-faceted practices. When describing multi-faceted practices, terms as trust – not to forget integration – appear. When the respective authors have problems with defining partnering, it may be because the terms trust and integration are hard to define.

If there is one research gap related to the partnering category that should be pointed at, it is that the identified literature does not have a clear description of how multi-faceted practices appears across the current definitions of partnering.

4.2. Alliancing

Amongst the publications with study purpose *conceptualisation*, Yeung et al. (2007) present a definition of alliancing in construction, clearly distinguishing amongst general prerequisites, hard (contractual) and soft (relationship-based) elements. Chen et al. (2012) explore cost management strategies and the supporting techniques used in project alliancing. Johnson et al. (2013) theorise how to utilise alliancing in federal construction effectively. Hosseinian and Carmichael (2013) derive the optimal gain share / pain share between risk-averse parties in alliancing projects. MacDonald et al. (2013) describe a value for money framework that can be used on alliance projects to improve the consideration of, and reporting of, value for money. While not primarily being about project alliancing, Vilasini et al. (2014) developed and evaluated a framework for process improvement in alliance projects. Lahdenperä (2017) aimed to define the means and mechanisms which influence the capacity of alliancing to produce value for money. Sakal (2005) discusses project alliancing as a relational contracting mechanism for dynamic projects.

To examine *implementation and experiences*, Walker (2002) studied – longitudinally – a successful building

construction project that used an alliancing approach. Walker et al. (2001) outline how the project agreement operating on the Australian National Museum project in Canberra, Australia facilitated a responsible and responsive workplace environment for construction workers. Besides, Keniger and Walker (2002) present a case study of the quality management system on the National Museum of Australia. In a third case study on the National Museum, Hauck et al. (2004) sought to determine to which extent it could be classified as a “collaborative project”. Hietajärvi et al. (2017a) wanted to understand what kinds of integration mechanisms are used and how they are developed during infrastructure alliance projects.

Furthermore, Hietajärvi et al. (2017b) identified key activities of opportunity management in an infrastructure alliance project. Che Ibrahim et al. (2017) explored features that could influence success in alliance contracting in the New Zealand construction industry. Fernandes et al. (2017) investigated whether it makes sense to use project alliancing in more everyday projects.

Love et al. (2010) examined the *pros & cons* with the alliance relationship development process for price competitive alliances, and how success factors impact different phases of this development process.

Davis and Love (2011) studied the relationship development process as a significant contributor to *building partnership and social dimensions*. Furthermore, Laan et al. (2011a) provide insights into how a project alliance contract develops cooperative relationships between client and contractor organisations. Using another approach, Yitmen (2013) examined how organisational cultural intelligence potentially affects the strategic alliancing ability to contract firms operating abroad. Another research topic is the no-blame culture and how the alliancing influences it (Lloyd-Walker et al., 2014). The last study with this study purpose investigated how specific characteristics of temporary organisations influences identity formation (Hietajärvi & Aaltonen, 2018).

Regarding *performance and success*, the first study in this category developed an assessment tool for team integration in alliance projects by using key indicators (KIs) for measuring team integration practice (Che Ibrahim et al., 2013). Che Ibrahim et al. (2015) developed an Alliance Team Integration Performance Index (ATIPI) that measures team integration performance in alliance projects. Che Ibrahim et al. (2014) enhance the existing ATIPI model with quantitative measures for each key indicator. Chen et al. (2015) tested the impact of uncertainty, frequency, and various dimensions of contracting parties’ asset specificity on three transaction cost elements (set-up, monitoring, and enforcement costs). A meta-analysis in this category reports on three studies of completed construction project alliance performances in 2008, 2010 and 2012 (Walker et al., 2015).

Alliancing appears to be a clearly defined project delivery method, at least in the Australian context. Here it could be noted that many of the articles in this category stems from Australia. An overweight of the articles have

the study purposes conceptualization, implementation and pros & cons, while an underweight have building partnership & social dimensions and performance & success. The two last study purposes seem to be important in alliances, so the amount of research articles on these could be extended.

4.3. Integrated Project Delivery

While Matthews and Howell (2005) *conceptualise* IPD as a relational contracting mechanism, Kraatz et al. (2014) provide strategic and practical outcomes to guide the uptake of IPD in Australia. Sarkar and colleagues attempted to develop a framework for integrated lean project delivery methods in India (Sarkar, 2015; Sarkar & Mangrola, 2016). Zhang et al. (2016) provide a new method to select project parties for IPD-projects. Ma et al. (2018) suggests a collaboration platform for IPD projects to improve the efficiency of IPD collaboration. Osman et al. (2015) developed a readiness assessment model to implement in IPD construction projects, followed up with a study to assess how ready the Malaysian construction industry is for IPD (Osman et al., 2017).

Bygballe et al. (2015) examine *implementation and experiences* when studying the interplay between formal and informal contracting in five integrated project delivery projects. Esther Paik et al. (2017) examined the construction industry’s use of integrated project delivery as an innovative method of planning, designing, and building construction projects via inter-organisational teams. Rowlinson (2017) present the process changes required by building information modelling (BIM) and integrated project delivery.

When it comes to *pros & cons*, El-adaway (2010) presents a list of ten managerial and contractual issues to promote integrated project delivery through strategic partnering. Ghassemi and Becerik-Gerber (2011) investigated how successful IPD projects overcame legal, cultural, financial, and technological barriers. Nejati et al. (2014) studied whether it is possible to use IPD for collaborative mass housing building projects. Nida et al. (2015) stated that significant barriers are rooted in the way public owners perceive IPD. Nanda et al. (2017) investigated what key stakeholders considered to be the pros & cons for improvement in using lean thinking and tools in an IPD process.

Zhang et al. (2012) studied the flexibility of integrated project teams, and how to *build partnership and social dimensions*. The study was followed up with a summarising of factors that influence collaboration in IPD teams (Zhang et al., 2013). Sun et al. (2015) identified how communication behaviours in inter-organisational teams affect innovation. Paolillo et al. (2016) explored the procedural and social elements of a large commercial construction project utilising people-centred innovation (PCI). Pishdad-Bozorgi and Beliveau (2016b) analysed the relationship between trust and IPD and offers analysis on how trust-building attributes are supported and leveraged by

IPD (Pishdad-Bozorgi & Beliveau, 2016a). The main author followed up with case studies to explore IPD from the standpoint of trust (Pishdad-Bozorgi, 2017). Lastly, Kokkonen and Vaagaasar (2018) investigated how management produces positive effects for collaboration in multi-partner, temporary collaborations.

Hanna (2016) collected quantitative data and evaluated *performance and success* of IPD in building construction projects across a wide range of performance metrics. Mesa et al. (2016) showed with a sensitivity analysis that project outcomes were sensitive to communication, alignment of interests and objectives, teamwork, trust, and gain/pain sharing. Asmar et al. (2016) presents the development, validation, and implementation of comprehensive project performance metrics. Xie and Liu (2017) study the relationship between contract provisions and financial incentives in IPD projects.

When it comes to IPD, the review revealed many articles with a descriptive presentation of implementation and experience. The articles apply different definitions of IPD – represented by sub-terms as IPD Lite, Lean IPD etc. The pure IPD articles are often written by authors from – or associated with – American Universities. Therefore, the project delivery methods actually presented share many, but not necessarily all, characteristics. Several of the IPD articles have study purpose related to partnership and social dimensions. Fewer of them study if IPD results in performance and success. The articles describe what is done, but do not provide empirical data on the results of IPD.

4.4. Relational contracting

Rahman and Kumaraswamy (2002) provide a *conceptual* overview of relational contracting. The same authors offer more insight into the particularities of the concept in their 2004 follow-up paper (Rahman & Kumaraswamy, 2004). Rahman et al. (2007) identified contractual and non-contractual incentives for designing appropriate RC project teams. Yeung et al. (2012) state that five core elements are always included in the conceptualisation of RC, namely “commitment”, “trust”, “cooperation and communication”, “common goals and objective”, and “win–win philosophy”.

Kumaraswamy et al. (2005) – reporting from *pros & cons* – provided a list of factors facilitating RC, as well as factors deterring RC. Cheung et al. (2006) studied the application of relational contracts and found eight critical factors. Based on *implementation and experiences*, Ling et al. (2006) found that RC could be facilitated by having top management support, alignment of project objectives, relationship building, and appropriate contractual incentives.

Claims and disputes represent a problem for the construction industry. Yates and colleagues give an overview and describe how such issues are prevalent on projects that use relational contracts. Furthermore, they provide measures to avoid this (Yates & Duran, 2006; Yates & Epstein, 2006). It is observed that trust can offer incentives to RC in construction (Rahman & Kumaraswamy, 2008).

Rahman and Kumaraswamy (2012) state that RC implies collaborative efforts from the stakeholders, and maintenance of the relationships during project execution.

Experiences from specific case studies are documented, for example from the first project to be procured via relationship contracting in South Australia (Zou & Zillante, 2012). El-adaway (2012) studied how risk-retention groups provided insurance coverage against third party claims under relational contracts, and why this approach succeeded. Zhang and Li (2015) provide a theoretical framework for understanding risk perception and financial incentives in RC from the social and individual perspectives.

With regards to *building partnerships and social dimensions*, Gil and Marion (2012) examined the effect of past and future relationships between contractors and subcontractors in the highway construction market. Ling et al. (2015) developed mathematical models to predict the interpersonal relationships between clients, contractors, and consultants at the end of public projects. A study from Australia suggests that clients and consultants play an important role in setting the tone in interpersonal relationships (Ling et al., 2015).

As for *performance and success*, Ning and Ling (2015) investigated whether project complicatedness influenced the adoption of RC in public construction projects. Not many studies sought to uncover whether specific characteristics of RC could be linked to project success, but Ling et al. (2014) state that RC could boost project performance.

The lack of articles concerning “building partnerships and social dimensions” and “Performance and success” may be prescribed to the fact that the literature seems to regard Relational Contracting as a set of “*principles [that] embrace and underpin various approaches (...)*” (Rahman & Kumaraswamy, 2002). Thus, a possible explanation to this gap in the research on performance of projects using relational contracting is because performance-studies are using labels that imply real-life project delivery methods such as Alliancing and Integrated Project Delivery. The label and the concept of Relational Contracting are of more academic interest than practical interest. Practitioners might view Relational Contracting as an obscure term only used by academics sitting in their ivory tower. Thus, researchers doing case studies are inclined to use the same labels as practitioners use when reporting on their findings.

4.5. Relational-based procurement

Love et al. (1998a) suggest – on a *conceptual* level – that concurrent engineering in construction improves the way in which projects are procured. Rahman and Kumaraswamy (2005) examined the importance of a single set of different factors for selecting consultants, contractors, subcontractors, suppliers, and clients for collaborative working arrangements. Kantola and Saari (2016) aimed to reveal the most functioning project delivery systems for nearly zero-energy building projects.

Mollaoglu-Korkmaz et al. (2011) studied how project delivery methods influence an owner's ability to achieve sustainability goals, based on how they were *implemented and the experiences* from that.

Ey et al. (2014) investigated current practices of collaborative procurement in Australia, focusing *less on the pros and more on the cons*. Rahmani et al. (2016) studied Relationship-based procurement (RBP) approaches in the Australian construction industry and the future direction of collaborative project procurement arrangements.

Dewulf and Kadefors (2012) investigated how the formalised context influenced partnership building and social dimensions. The objective of Kwofie et al. (2017) was to delineate the nature of collaborative practices in the South African construction Industry.

The final sample does not contain any studies directly linking *performance and success* with Relational-based procurement. One aspect worth mentioning is that no articles about Best Value Procurement (BVP) or Competitive Dialogue (CD) were identified. An explanation for this is that neither Best Value Procurement (BVP) nor Competitive Dialogue (CD) was used as a search term. Another reason is that Best Value Procurement (BVP) and Competitive Dialogue (CD) are relatively "new" terms, so related research is maybe published primarily in conference proceedings (and thus excluded from the final sample).

A limitation of the relational-based procurement category is the use of "procurement". As stated in the theoretical framework, a project delivery method includes more than the procurement strategy. Procurement involves the selection of the most appropriate actor(s) for delivering the design and construction of the project. It is of limited value to study collaboration if the design, construction, operations and maintenance activities are not involved. There are relatively few hits within the category relational-based procurement, and a clear gap in research regarding performance and success.

4.6. Comparative studies

Manley (2002) provides an overview of the extent to which road agencies nationally and internationally have adopted partnering and alliancing on road projects. Walker et al. (2002) clarify the nature of project alliancing, and how to differentiate between Alliancing and Partnering. Lahdenperä (2010) conceptualise a novel type of two-stage target-cost contracting system, which combines early contractor selection and price containment. Heidemann and Gehbauer (2011) show that with a lean approach, project results will be positively influenced by a cooperative project delivery. Doloi (2012) investigated the underlying attributes and factors critical to the success of relationship agreements compared to traditional practices. Asmar et al. (2013) studied the performance differences between IPD and more established delivery systems. Bilbo et al. (2015) sought to identify the impact(s) of using IPD and Construction Management at Risk as project delivery methods on the construction of healthcare buildings. Lahdenperä

(2012) clarifies the similarities and differences between Partnering, Alliancing, Integrated project delivery, and Relational contracting by examining their key features one by one and concerning each other.

A core issue of comparative studies is the challenge of comparing different project delivery methods that are applied to unique projects in a unique context. As seen above, the studies address this by various means. One, for instance, identified metrics such as quality, schedule, and project changes that were comparable across contexts. Others focused on common drivers such as cost efficiency, trust and communication using a questionnaire. However, due to all the variables discussed, care should be taken when interpreting these findings as one cannot easily verify by using control groups. A control group in this instance would be a nearly identical project in a nearly identical context. To sum up, the number of comparative studies of collaborative project delivery methods is limited. It appears to be difficult to compare beyond a description of the methods. To compare whether one method is better suited to build partnership & social dimensions or to a larger extent leads to performance and success is difficult, because projects and their contexts differ. This possibly explains the low number of comparative studies.

4.7. Knowledge gaps

Comparing and contrasting the characteristics of the different concepts is a challenging endeavour, but this article provides some clarification on the concept of collaborative project delivery methods, most evidently by identifying several knowledge gaps in the current body of literature. New PDM's are, at the core, implemented to ensure success in ways traditional PDM's are lacking.

Partnering is the category which is most well covered in literature. However, there are still variations the concept is defined and reported, and the literature does not describe how multi-faceted practices appear across the current definitions of partnering. Alliancing has been around for a long time, but still has a knowledge gap regarding how to building partnership and why this increases the likelihood of greater performance and project success. The emerging category of IPD is not as well-researched and seems to need more case studies on real projects. Being the "youngest" project delivery method, the category still lacks comprehensive reviews of performance and success.

Even though there is increasing number of articles on the subject, few studies are done on how the project delivery method affected project performance. Therefore, the knowledge is scares on how the characteristic that sets the different project delivery methods apart actually affect performance. The articles may state *why* the method was chosen, and the *rationale* behind the selection. For example, by providing a walkthrough on *why* aligning the interest of the owner with that of the supply-chain should generate better project, without describing the cause-effect relationship between aligning interests and performance of the particular project. Studies related to Performance

and Success tend to use the same label, categorising their research as that practitioners use, i.e. Alliancing or IPD. This is most evident in the discussion surrounding relational contracting i.e. it is a concept gathering academic and theoretical interest but lacks empirical evidence.

Only four out of 156 articles mention performance metrics (quantitative) in their key findings. All four were quantitative in nature. The review identified specific frameworks for measuring the performance of collaborative project delivery methods. However, it seems that these frameworks are not utilised by the research community i.e. by for example test them empirically on projects, conducting comparative case studies etc. It can be argued that several articles studied “effects”, or “how (...) affected”. Yet, these studies are often of qualitative nature and conclude that “*The key to success of (...) is establishing a clearly defined contract which equitably aligns efforts and rewards (...)*”, or similar. One article developed a performance metric, two articles present (same author) one and the last article proposes a need for standard performance indicators.

Soft elements are an important aspect of collaborative PDM. However, few articles study soft elements such as culture explicitly. Even more, soft element such as trust is often regarded as an effect, outcome, or a success factor. On the other hand, a soft element such as collaboration is viewed as a needed prerequisite – but it can also be a desired outcome. Even scarcer are studies that seek to link soft elements and performance, or articles examining the cause effect between hard and soft elements. Although 28 articles highlight “trust” in their conclusion, the number was surprisingly low. Furthermore, trust is often mentioned as a prerequisite needed or as a critical success-factor for building relationships. Trust has become a buzzword surrounding collaborative project delivery methods. The word has emerged to become an abstract concept surrounded by mysticism – as trust is viewed by many scholars and practitioners as being the elusive and highly sought-after ingredient in a successful collaborative PDM.

The core collaborative *project delivery methods* in construction project are Partnering, Alliancing, and IPD. Relation-based procurement is limited to the strategy of procuring for collaboration, while Relation-based Contracting is mostly of academic interest (philosophy/ principles). An explanation may be that the empirical-based research on collaborative PDMs are often descriptive in nature, focusing on describing phenomena’s, situations, and events as they occur. Thus, case studies seem to use industry labels such as Alliancing, and IPD which implies that national and regional context matters. Therefore, constraints such as government, national legislations, standards and local practices all contribute and affect significantly on how and what type of research that are reported. Relation-based procurement, as per definition, is limited to the client strategy for contracting a suitable party to carry out projects. In the light of project delivery methods, the term relational-based *procurement* proposes

structural limitations as to how to study collaboration if construction *process* (the design, construction, operations and maintenance activities) are not involved.

Conclusions

This paper contributes to the current state of research on collaborative project delivery methods. Firstly, it provides an overview of categories of collaborative project delivery methods identified in the realm of academic journals. Secondly, knowledge gaps in the research literature have been identified by creating a summary of the body of evidence according to the study purpose of the identified articles.

The results offer a structural take on collaborative project delivery methods by examining the categories Partnering, Integrated project delivery, Alliancing, Relational contracting, and Relationship-based procurement according to the study purposes Conceptualisation, Implementation and Experiences, Pros & Cons, Building Partnership & Social Dimensions, and Performance and Success. This study has not assessed the quality, nor does it give a ranking of the body of literature. The findings can help the scholars and practitioners in the construction sector advance their knowledge on collaborative PDMs, as well as provide direction for future research.

What research has been carried out on collaborative project delivery methods?

Our study suggests that a comprehensive endeavour has been carried out within the field of collaborative PDM. However, a substantial part of the sample is centred on a limited number of authors such as Walker, Kumaraswamy, Rahman, Shan, etc. Further, around 50% of the sample is published in four journals: “Journal of Management in Engineering”, “International Journal of Project Management”, “Journal of Construction Engineering and Management” and “Construction Management and Economics”. A remark is the connection between geographical distribution and thematic category. The study reveals that the prominence of research on specific project delivery methods seems to be aligned with the methods used by the industry in the geographical area. USA, for example, is the prominent promoter of IPD research and Australia has the same role with regards to research on Alliancing. The increase in research articles, especially related to IPD and Alliancing may also be related to the steady increase in real-life projects available to conduct research on. As for research in construction, research is very dependent on the industry.

Knowledge gaps – implications

This scoping review identifies needs for more research on collaborative project delivery methods. Table 13 summarises explicitly which PDMs that are studied with which study purpose, and implicitly which topics that require more research.

Table 13. Summary of research on collaborative PDM according to study purpose analysis

Category	Partnering	Alliancing	Integrated Project Delivery	Relational contracting	Relational-based procurement	Total	%
Conceptualisation	16 (39.0%)	8 (19.5%)	8 (19.5%)	6 (14.6%)	3 (7.3%)	41	28.1%
Implementation and Experiences	8 (32.0%)	8 (32.0%)	3 (12.0%)	5 (20.0%)	1 (4.0%)	25	17.1%
Pros & Cons	15 (50.0%)	1 (3.3%)	5 (16.7%)	8 (26.7%)	2 (6.7%)	30	20.6%
Building Partnership & Social Dimensions	14 (45.2%)	5 (16.1%)	8 (25.8%)	2 (6.5%)	2 (6.5%)	31	21.2%
Performance and Success	9 (47.4%)	5 (26.3%)	4 (21.1%)	1 (5.3%)	0 (0.0%)	19	13.0%
Total	62	27	28	22	8	146	100%

As the preceding discussion demonstrates, there is some overlap between the PDMs. However, there are knowledge gaps related to each of the PDMs. A clear description of how multi-faceted practices appear across the current definitions of partnering seems to be missing. Alliancing appears to be clearly defined in the Australian context. Social dimensions and performance seem to be important in alliances, so the number of research articles on these could be extended. IPD has an overweight of articles being descriptive in nature, especially regarding implementation and experience. Few studies systematically analyse performance and success. The articles describe what is done, but do not provide empirical data on the results of IPD. Relational contracting lacks articles concerning “building partnerships and social dimensions” and “Performance and success”. Relational-based procurement is limited to “procurement”, and the project delivery method includes more than procurement. Therefore, it is of limited value to study collaboration if the design, construction, operations, and maintenance activities are not involved. There are few comparative studies of project delivery methods, especially when it comes to project performance and success. There are more variables than PDM that impact, and it is difficult to find projects where all variables except for the PDM are similar.

There seems to be no unified theoretical framework for collaborative PDMs, despite an increasing amount of literature. A related issue is that no unified terminology exists, either. The fluctuation in terms, practicalities such as national contractual legislation and standards and cultural differences may be significant barriers. Various regions and professional environments use a variety of terms. This happens on a macro-level (i.e. partnering, alliancing, IPD), but is observed on the micro-level as well. For example, a wide variety of terms are used to describe similar fundamental elements concerning partnership & social dimensions (i.e. the need for commitment, the need for shared objectives, etc.).

Literature does not – to a large extent – consider how context impacts the PDMs. To exemplify, research from Scandinavia may take for granted the high levels of trust that characterises the Scandinavian construction industry. This trust may impact the PDM, but if taken for granted it will affect how research is reported and which research

aspects are emphasized. The literature must consider context and not only the relationship between the principal (the client) and the agent (the contractors).

Analyses of the cause-effect relationships are difficult but needed. A collaborative project delivery method includes contractual elements that promote collaboration, and it looks like a common perception that the more contractual elements, the better. However, the elements’ respective contribution to collaboration is unclear. As such, there is a need for more research on the cause-effect relationship regarding certain on the topic of PDMs elements. This is especially true for papers addressing soft elements and culture. Studies describe the need for trust etc., but not necessarily how to actually promote it.

Additionally, the research on PDMs lacks empirical data on performance. The empirical studies on collaborative PDMs are often descriptive by nature. More specifically, there is a need for prescriptive studies of the link between contractual elements and organizational outcomes (building partnership & social dimensions) and project outcomes (project performance and success). There is also a need for studies on what more than the described contractual elements are needed to promote collaboration in construction projects.

Data availability statement

Data generated and analysed during the study are available from the corresponding author by request.

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