sciendo

Research Paper **Open Access**

Anita Ceric and Ivona Ivic*

Network analysis of interconnections between theoretical concepts associated with principal–agent theory concerning construction projects

DOI 10.2478/otmcj-2021-0025
Received: April 13, 2021; Accepted: May 3, 2021

Abstract: Communication risks and asymmetric information among project participants are often associated with poor performance in construction projects. Communication and coordination are prominent issues in recent research on construction management, with little actual theoretical foundation. The purpose of this study is to investigate the extent to which principal–agent (P–A) theory and its implications are used in construction management research. In the archives of the top seven construction management journals, 148 scientific papers mentioning P–A theory were found. The keywords were analysed to determine the connections between them. Network analysis (NA) of the interconnected keywords was used to illustrate the most common relations between P–A theory and construction management. The findings of this study indicate that the most important elements associated with P–A theory in construction management are contracts, governance, partnership, transaction costs, information systems, incentives, risk management, and trust. However, some keywords are often used without considering related theoretical concepts. This study introduces a new perspective on P–A theory research in the field of construction management.

Keywords: principal–agent theory, network analysis, construction projects, keywords search

1 Introduction

In the field of construction management, principal–agent (P–A) theory has received increased attention in recent years, as it offers a suitable representation of project management in construction. Researchers have contributed relevant studies to the literature. Sha (2019) explored the triangular relationship between the client, contractor and project manager; Lin and Wang (2019) used P–A theory to evaluate dynamic knowledge-sharing in construction project teams; Hosseinian et al. (2020) explored incentive contracts in a model with multiple agents; Cerić (2019) explained the relationship between P–A theory and blockchain to minimise communication risks.

In construction projects, there are many participants or stakeholders, with a wide variety of expertise and interests. Their interactions are undoubtedly subject to information asymmetry, which has implications in P–A theory. George Akerlof, Michael Spence and Joseph Stiglitz shared a Nobel Prize in Economics in 2001 for their work on information asymmetry conducted in the 1970s. Information asymmetry describes a condition in which one party is better informed than another, and the parties do not share the same interests (Jensen, 2000). Information asymmetry can cause communication risks in all project phases.

Information asymmetry can result from the self-interest of the participants or the unwillingness of stakeholders to share information. According to P–A theory, there are three types of information asymmetry: hidden characteristics, hidden information and hidden intention. These generate the following risks: adverse selection, moral hazard and hold-up (Jäger, 2008; Schieg, 2008). Adverse selection may occur if the principal does not know the exact qualifications of the agent before signing a contract. A moral hazard may occur if the principal is unsure that the agent will fully act on his/her behalf after a contract is signed. A hold-up can occur if the agent acts opportunistically after the principal has invested resources in the belief that the agent will act appropriately.

In early studies in the field of project management (Turner and Müller, 2004; Müller and Turner, 2005), the

***Corresponding author:** Ivona Ivic, Građevinski Fakultet, Sveučilište u Zagrebu Zagreb, Croatia; email: iivic@grad.hr

main P–A relationship was between the project owner and the project manager. Research has shown that the behaviour of project managers during the construction phase is especially important for project success, more than that of project owners and contractors (Cerić, 2016). Other participants engaged in construction including contractors, sub-contractors, designers and consultants can also be considered as agents. The most common assumption is that the project owner is the principal and the contractor is the agent. According to P–A theory, principals and agents are guided by self-interest and opportunism. Adverse behaviour is a characteristic of both parties, but the opportunism of agents has been explored in greater depth because it is expected that agents will try to maximise their benefits even at the expense of the principal (Schieg, 2008). As the number of involved parties grows and the number of non-contractual relationships between them increases, the mechanisms of formal control become less capable of suppressing opportunistic behaviour (Cerić, 2016).

This study analyses the incidence of P–A theory in construction management literature with the purpose of assessing new development on the subject. The literature analysis was conducted using the keywords listed by the authors. Keywords analysis was chosen because keywords accurately represent the theme of a paper. Focusing on the leading journals in the field, this study builds on a previous review by Cerić (2013) and investigates the connection between P–A theory and its areas of application with deeper historical roots in construction management. Seven leading journals in the construction management field were searched using 'principal–agent' as the keyword. 'Principal–agent' is most often followed by 'theory', but 'problem' and 'model' are also associated in the literature. Hereafter, only the word 'theory' is considered.

This paper is organised into four sections. The methodology of the literature review is explained in Section 2. In Section 3, the findings are highlighted, mainly through tables and network diagrams. A discussion is presented in Section 4. The conclusions and limitations of the study, and suggestions for future research in this area are presented in Section 5. This review is intended to enrich construction management research and present new perspectives on the interconnections between theoretical concepts associated with P–A theory concerning construction projects.

2 Methodology

The presented research was collected in three steps: selection of journals, keyword search and keyword analysis. The journals to be investigated were selected first. There are two sampling methods for publications used in literature reviews. Some researchers choose leading journals to conduct a literature search (Xia et al., 2018). Others use common computer search engines and established literature databases (Sabini et al., 2019). The aim of this study was to investigate the extent to which P–A theory is used in construction management research. A literature search was conducted focusing on the leading journals in the field of construction management. The main keyword for the search was 'principal–agent', and this keyword was used in the identification of papers relevant to P–A theory. All associated keywords in the relevant papers were identified and analysed for interconnections, which is the main contribution of this review. Keyword analysis is important because keywords represent the theme of a paper.

This literature review is based on Bröchner and Björk (2008). Through an opinion survey, their research identified seven leading journals in the field of construction management. The seven leading journals in construction management identified by Bröchner and Björk, and their publishers (2008, p. 742), are shown in Table 1. For the purposes of this literature review, each of their online archives was searched using the keyword 'principal–agent'.

To map the concepts related to P–A theory in construction management research and highlight the key relationships, this study provides a network analysis (NA) of the relevant keywords.

In addition to use in social research to determine relational data, NA is conducted in project planning, complex systems, electrical circuits, transportation systems, communication networks, epidemiology, bioinformatics, hypertext systems, text analysis, bibliometrics, organisational theory, genealogical research and event

Tab. 1: Top construction management journals according to authors (Bröchner and Björk, 2008)

Journal	Acronym	Publisher
Automation in Construction	*AIC*	Elsevier
Building Research and Information	*BRI*	Taylor and Francis
Construction Innovation	*CI*	Emerald
Construction Management and Economics	*CME*	Taylor and Francis
Engineering, Construction, and Architectural Management	*ECAM*	Emerald
International Journal of Project Management	*IJPM*	Elsevier
Journal of Construction Engineering and Management	*JCEM*	ASCE

analysis (Brandes and Erlebach, 2005). In element-level analysis (Brandes and Erlebach, 2005), the main questions are: 'Which is the most important element?' and 'How important is this element?' In this study, the element is a keyword, meaning a concept connected to P–A theory in the construction management literature.

Gephi software was used to conduct the NA. Gephi is an open-source software for graph and NA that uses a 3-D render engine to display networks in real time for faster statistical analysis (Bastian et al., 2009). In NA, relationship data are visually represented and statistically evaluated. A visual representation is created; all identified keywords are depicted as nodes, and the interconnections between them are shown as edges. In this case, weights are assigned to each edge to describe the importance of the specific relationship between keywords. In NA, edge weights can be represented as a function $\omega : E \rightarrow \mathrm{R}$ that assigns each edge $e \in E$ a weight $\omega(e)$ (Brandes and Erlebach, 2005). Depending on the context, edge weights can describe properties such as cost, capacity and strength of interaction, or in this case, the number of times that a specific connection appears in the analysed papers. All input data are available in the Appendix. This network is undirected because the interconnection between two keywords is a two-way relationship. Network visualisation enables the mapping of the keywords; statistical analysis enables the mapping of key relationships between keywords. Only some of the network properties were calculated, as the main objective was the network visualisation. These network properties include the following:

1. Density: an indicator of network connectivity describing the portion of potential connections in a network that are actual connections; it represents the extent to which dense cohesive nodes in a network are interconnected (Pryke, 2004).
2. Degree: the number of nodes connected to a given node (De Nooy et al. 2005). A node with a higher degree is more involved in information transaction (Park et al. 2011).
3. Centrality: a rough indicator describing the social power and influence of a node based on its well-connectedness in the network (Park et al. 2011).

As this is a weighted network, the weighted degree must be represented. The evaluated types of centrality are 'betweenness centrality' and 'closeness centrality' (Freeman, 1979). Betweenness centrality signifies the extent to which a node lies between other node pairs. Closeness centrality indicates the ability of a node to access information through other nodes.

3 Findings

The results of the first two steps of this review are presented in Table 2, which shows the incidence of the keyword 'principal–agent' in the seven leading construction management journals. Overall, 148 papers containing the main keyword were found; the main keyword appeared in four paper titles, 22 abstracts and in no more than 14 keyword lists, which were essential in the literature search. The main keyword appeared in *IJPM* the most (70 papers), followed by *JCEM* (25 papers), *CME* (23 papers), *ECAM* (17 papers), *CI* (7 papers), *BRI* (5 papers) and *AIC* (1 paper).

The 148 papers cited in the top seven construction management journals are presented in Table 3. Most of the papers were published in the 2000s, mostly between 2005 and 2020. The peak was in 2019; 14 papers with the keyword 'principal–agent' were published. In recent years, the numbers have been similar: 13 papers in 2014, 11 in 2015, 13 in 2016 and 12 in 2017 and 2018. Most of the research has been recent. However, the first papers appeared in 1991 (Ward et al., 1991; Ward and Chapman, 1991).

The associated keywords from 148 selected papers were classified and analysed to determine their connection

Tab. 2: Incidence of keyword 'principal–agent' in selected journals

Keyword/Journal	*AIC*	*BRI*	*CI*	*CME*	*ECAM*	*IJPM*	*JCEM*
Papers	1	5	7	23	17	70	25
Titles	0	0	0	0	0	3	1
Abstracts	0	1	0	4	4	8	5
Keywords	0	1	0	2	2	6	3

P–A, principal–agent.

Tab. 3: Papers cited

Acronym	Papers cited
AIC	Xu et al. (2019)
BRI	Lützkendorf and Speer (2005), Ürge-Vorsatz et al. (2007), Sha (2013), Zhang et al. (2016), Ströbele and Lützkendorf (2019)
CI	Davidson (2009), Vennström and Eriksson (2010), Van Duren et al. (2015), Saini et al. (2018), Saini et al. (2019), Van den Berg et al. (2020), Van Oorschot et al. (2020)
CME	Boukendour (2007), Bowen et al. (2007), Ward and Chapman (2008), Yung and Lai (2008), Hossain (2009a), Tuuli et al. (2010), Sha (2011), Bowen et al. (2012), Ling and Tran (2012), Rose and Manley (2012), Chang (2013a), Espinoza and Morris (2013), Javed et al. (2014), Fu et al. (2015), De Valence and Runeson (2015), Winch (2015), Snippert et al. (2015), De Biasio and Murray (2017), Liu et al. (2017), Odoemena and Horita (2018), Gao and Liu (2019), Sha (2019), Zhang et al. (2020b)
ECAM	Hsieh and Forster (2006), Eriksson and Laan (2007), Badenfelt (2008), Bemelmans et al. (2012), Hughes et al. (2012), Hosseinian and Carmichael (2014), Li et al. (2014), Chong and Oon (2016), Adam et al. (2017), Mei et al. (2017), Chen et al. (2019), Han et al. (2019), Hasan and Jha (2019), Laryea (2019), Lee (2019), Wang and Shi (2019), Zhang et al. (2020a)
IJPM	Ward et al. (1991), Ward and Chapman (1991), Williams (1993), Ogunlana (1996), Farrell (2003), Turner and Müller (2003), Müller and Turner (2005), Yu et al. (2005), Jensen et al. (2006), Koch and Buser (2006), Smyth and Morris (2007), Turner et al. (2008), Hossain (2009b), Hossain and Wu (2009), Huang and Chang (2009), Pinto et al. (2009), Corvellec and Macheridis (2010), Hölzle (2010), Mahaney and Lederer (2010), Müller and Turner (2010), Bakker et al. (2011), Kapsali (2011), Koppenjan et al. (2011), Eriksson (2012), Hsu et al. (2012), Ika et al. (2012), Bond-Bernard et al. (2013), Braun et al. (2013), Chang (2013b), Chang (2013c), Flyvbjerg (2013), Ahola et al. (2014), Biesenthal and Wilden (2014), Carbonara et al. (2014), Floricel et al. (2014), Guo et al. (2014), Liu et al. (2014), Pinto (2014), Toivonen and Toivonen (2014), Chang (2015), Shen et al. (2015), Wang and Liu (2015), Xiang et al. (2015), Zwikael and Smyrk (2015), Badewi (2016), Conforto et al. (2016), Joslin and Müller (2016), Laursen and Svejvig (2016), Liu et al. (2016), Müller et al. (2016), Näsänen and Vanharanta (2016), Samset and Volden (2016), Cao et al. (2017), Musawir et al. (2017), Niknazar and Bourgault (2017), Teo and Bridge (2017), Zheng et al. (2017), Bryde et al. (2018), Cui et al. (2018), Pilkienė et al. (2018), Pollack et al. (2018), Sirisomboonsuk et al. (2018), Sydow and Braun (2018), Vuorinen and Martinsuo (2018), Wang et al. (2018), Daniel and Daniel (2019), Volden (2019), Hedborg et al. (2020), Musawir et al. (2020), Picciotto (2020)
JCEM	Cheah et al. (2004), Ho (2006), Puddicombe (2009), Zhang (2009), Xiang et al. (2012), Hosseinian and Carmichael (2013), Chang (2014), Chang and Chou (2014), Chen et al. (2014), Le et al. (2014), Van Buiten and Hartmann (2015), Chang and Chen (2016), Szentes and Eriksson (2016), Xiong and Zhang (2016), Chang et al. (2017), Shen et al. (2017), Wen et al. (2017), Shrestha et al. (2018), Tembo-Silungwe and Khatleli (2018), Solheim-Kile and Wald (2019), Yao et al. (2019), Hosseinian et al. (2020), Li et al. (2020), Yao et al. (2020), Zhu et al. (2020)

to the main keyword 'principal–agent'; they reflect the themes of the papers.

The analysis identified 717 keywords, which amounts to less than five keywords per paper. Several papers shared a large number of identical keywords. Owing to space limitations, only the most important are presented here. Keywords such as 'construction' and 'construction industry', 'construction management' and 'project management' were excluded from further analysis. General keywords such as 'environment' and 'sustainability', and indefinite keywords such as 'control', 'conflict', 'flexibility' and 'performance' were also excluded. Names of countries and organisations were excluded, as were technical terms such as 'Monte Carlo method' and 'regression analysis'. The main keyword 'principal–agent' was also excluded because the 14 papers in which it explicitly occurred were already considered. The incidence of the 36 remaining associated keywords in the seven selected journals is shown in Table 4. They appear 209 times – 70 times in *IJPM*, 54 times in *JCEM*, 43 times in *CME*, 24 times in *ECAM*, nine times in *CI*, seven times in *BRI* and twice in *AIC*.

Visual representations of keywords from Table 4 and their interconnections are shown in Figure 1. Four nodes have been omitted from the visual representation because they do not have connections with other keywords: 'change management', 'corruption', 'social theories' and 'temporary organisations'. They have a connection with P–A theory somewhere in the article text, but not in the keywords section. Detailed visualisation data are presented in the Appendix. The visualisation of the network was created using the Force Atlas layout. Nodes are modelled with a larger diameter to indicate a larger weight, and a darker colour if they are more central (by betweenness centrality). The specific node characteristics are listed in Table 5. Edges are modelled to be wider and darker according to their weights.

The graph density was calculated to evaluate the overall keyword connectivity. A density of 0.188 indicates

Tab. 4: Incidence of associated keywords in selected journals

Keyword/Journal	*AIC*	*BRI*	*CI*	*CME*	*ECAM*	*IJPM*	*JCEM*	Sum
Adverse selection		1						1
Agency theory				1		4	2	7
Change management				1		1		2
Cooperation/collaboration	1			1	1	1	2	6
Communication				1		3	1	5
Contracts				7	5	2	12	26
Corruption				2			1	3
Financial management				1			2	3
Governance		2		2		14	1	19
Hold-up				1		1		2
Incentives				2	4	3	6	15
Information asymmetry	1	1				1	2	5
Information systems		1	1		2	3	2	9
Institutional theory						1		1
Moral hazard						1		1
Opportunism			1	3		1		5
Organisation theory				1				1
Partnership				5	3	3	9	20
Procurement			2	1	1	1	1	6
Professional ethics/professionalism		1				1		2
Reputation							1	1
Risk management				2	2	10	6	20
Social capital							1	1
Social networks				3		2	1	6
Social theories						1		1
Stewardship theory				1		2		3
Strategic planning					2	1	1	4
Supply chain management			3		2	2		7
Temporary organisations						2		2
Transaction costs				3	1	5	1	10
Trust				1	1	1	3	6
Uncertainty		1		2		4		7

weak interconnectedness; a small portion of potential connections are connected. A total of 33 nodes were analysed; the average degree was 6 and the average weighted degree was 10.24.

The importance of each node was evaluated by considering the degree and weighted degree. The ten nodes with the largest degree were 'contracts' (18), 'P–A theory' (16), 'partnership' (14), 'incentives' (13), 'governance' (12), 'risk management' (11), 'trust' (11), 'transaction costs' (10), 'information systems' (9) and 'procurement' (9). Considering the weighted degree, 'contracts' have the most information transactions in the analysed network (46 connections), followed by 'P–A theory' (28), 'partnership' (28), 'incentives' (27), 'governance' (24), 'risk management' (24), 'transaction costs' (23), 'trust' (14), 'agency theory' (12) and 'procurement' (11).

The centrality of the node was evaluated through closeness and betweenness centrality. Centrality measures the social power and influence of a node. Much information flows between most keywords, but their ability to access information through other nodes is not strong, indicated by a closeness centrality of approximately 0.5 for 29 analysed keywords.

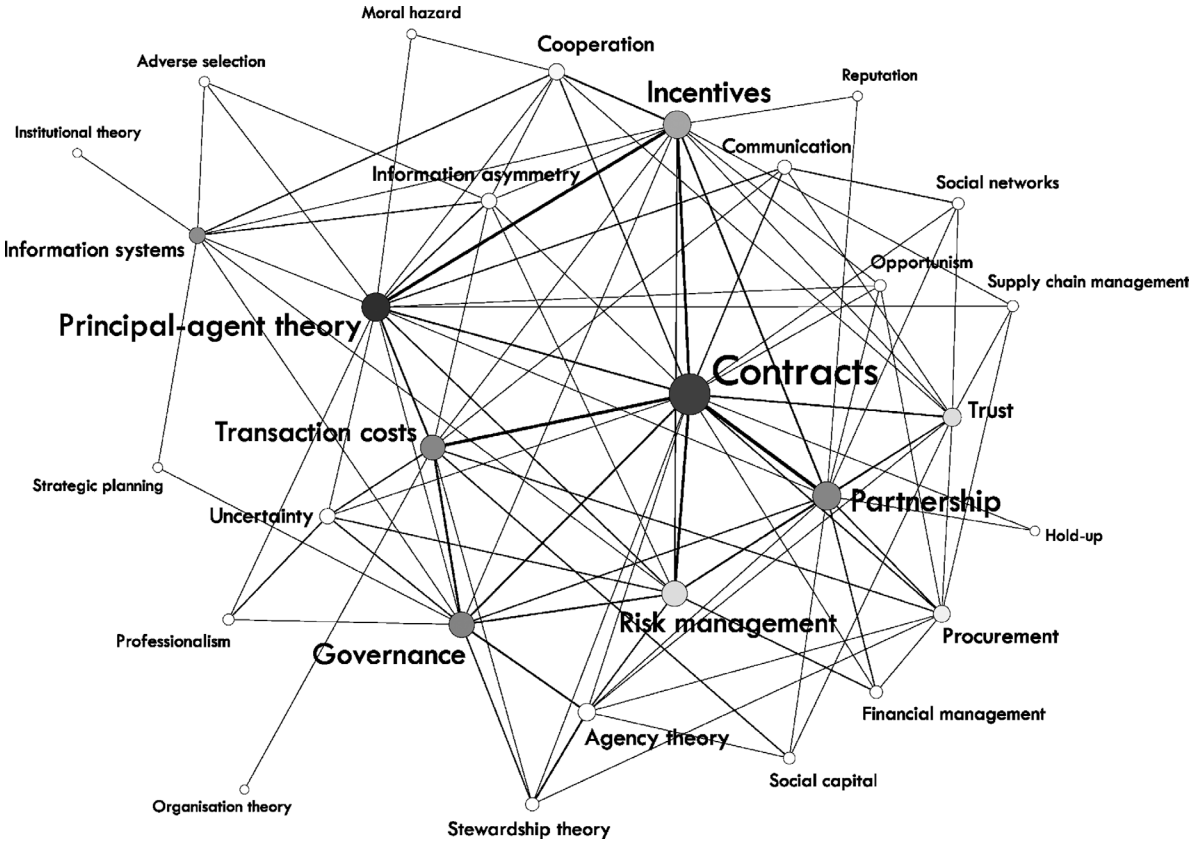

Fig. 1: Network visualisation of interconnected keywords in Gephi.

According to betweenness centrality, 'P–A theory' (68.26) and 'contracts' (61.63) are by far the most important elements in the network, followed by 'governance' (40.0), 'partnership' (39.53), 'transaction costs' (39.07), 'information systems' (37.42), 'incentives' (30.26), 'risk management' (15.92) and 'trust' (15.62). The other nodes have little or no centrality. Thus, the majority of information flowing in the network is controlled through the keywords 'P–A theory' and 'contracts'. The removal of these nodes from the network may fragment the network (Home Office, 2016). The centrality of 'P–A theory' was expected because it was the central keyword in the literature search. The centrality of 'contracts' can be explained by its importance in the construction industry. Since the keyword 'contracts' has a much greater weighted degree, it can be concluded that this is the most important keyword in the network.

Sometimes the analysed keywords were mentioned by themselves in the keywords of a paper. This is especially true for 'governance', which was researched 'on its own' in nine papers (see Appendix). The isolation and a low graph density clearly indicate a low connectivity with the theoretical concepts of P–A theory in construction management research.

4 Discussion

The literature indicates that the main research interests associated with P–A theory in construction management are contracts, partnership, incentives, governance, risk management, transaction costs, trust and procurement. A main finding of this study is that the most important (central) elements associated with P–A theory in construction management are contracts, governance, partnership, transaction costs, information systems, incentives, risk management and trust.

These associated keywords are the focus of recent research. Nevertheless, some of the keywords are often researched without considering related theoretical concepts. For example, 'governance' is only loosely connected with related concepts in a significant number of the retrieved papers.

Construction procurement is defined by contracts. Many participants may be involved in the delivery of a project. There may be several contracts, sometimes in different forms. The main aim of contracting is to properly allocate risk between the project owner and the contractor. This is applicable to any P–A relationship in the project. For proper risk allocation, the sharing of project outcomes

Tab. 5: Node characteristics, data from Gephi

Node	Degree	Weighted degree	Closeness centrality	Betweenness centrality
Adverse selection	3	3.0	0.44	0.0
Agency theory	8	13.0	0.54	5.3
Change management	0	0.0	0.0	0.0
Cooperation	7	11.0	0.56	9.04
Communication	5	8.0	0.52	2.78
Contracts	18	46.0	0.72	61.63
Corruption	0	0.0	0.0	0.0
Financial management	4	6.0	0.48	0.28
Governance	12	24.0	0.64	40.0
Hold-up	2	2.0	0.44	0.0
Incentives	13	27.0	0.65	30.26
Information asymmetry	8	10.0	0.58	8.06
Information systems	9	11.0	0.54	37.42
Institutional theory	1	1.0	0.35	0.0
Moral hazard	2	2.0	0.43	0.0
Opportunism	5	5.0	0.52	0.9
Organisation theory	1	1.0	0.38	0.0
Partnership	14	28.0	0.64	39.53
P–A theory	16	28.0	0.7	68.26
Procurement	9	12.0	0.52	10.82
Professionalism	3	4.0	0.45	0.0
Reputation	2	2.0	0.44	0.0
Risk management	11	24.0	0.61	15.92
Social capital	4	5.0	0.47	1.23
Social networks	4	5.0	0.47	0.38
Social theories	0	0.0	0.0	0.0
Stewardship theory	4	7.0	0.49	0.56
Strategic planning	2	2.0	0.42	0.0
Supply chain management	4	4.0	0.5	1.18
Temporary organisations	0	0.0	0.0	0.0
Transaction costs	10	23.0	0.6	39.07
Trust	11	14.0	0.56	15.62
Uncertainty	6	10.0	0.54	2.76

P–A, principal–agent.

is facilitated by incentives, which are an important vehicle to align contractor interests with owner interests. Optimal incentive contracts have been a research focus in recent years (Hosseinian and Carmichael, 2013). Choosing the best incentive strategy is critical in construction procurement (Chang, 2014).

Nevertheless, contracts are not sufficient to prevent negative opportunistic behaviour by participants. The main problem is that in any project, a large number of participants suggest a large number of non-contractual relationships between them (Cerić, 2016). Thus, in addition to formal methods of control (written contracts), researchers are now exploring how relational contracting can minimise project risks and transaction costs. Partnership is common in construction projects because it enhances trust between partnering organisations, which reduces risk. Trust is an important part of relational contracting; an individual or organisation trusts another individual or organisation to do what they have promised (Benítez-Ávila et al., 2018). Trust is also known as

a governance mechanism or an informal control mechanism. Thus, project governance is associated with the project structure and formal contracts, and also with relational contracting, focusing on P–A theory and communication risks (Ahola et al., 2014). Information systems such as BIM and blockchain can influence the development of trust and cooperation among project participants. Thus, they are another focus of recent research on minimising communication risks (Cerić, 2019).

Transaction cost theory is a part of New Institutional Economics, a theoretical framework that supports P–A theory. It emphasises the economic importance of creating or selecting governance structures for individual transactions to reduce contractual hazards (De Schepper et al., 2015). Transaction cost theory is based on the idea that major transaction costs can arise from asymmetric information and opportunistic behaviour. Bromiley and Cummings (1995) claim that trust reduces transaction cost and suggest that the inclusion of trust would expand and extend the research framework of transaction cost economics.

Other interesting keywords were also found; however, the discussion has focused on the most frequent and central keywords because they represent the bulk of current research.

5 Conclusion

Construction projects are delivered through a multitude of participants or stakeholders; between them, there are different contractual and non-contractual relationships. The complex relationships between project participants along with individual self-interest provide a fertile ground for opportunistic behaviour and common communication risks. P–A theory and related concepts can complement our understanding of construction management.

The purpose of this paper was to assess new developments in construction management by analysing the incidence of P–A theory in construction management literature. A literature analysis was conducted using keywords listed by the authors. The analysis identified eight research concepts currently of the greatest interest (contracts, partnership, incentives, governance, risk management, transaction costs, trust and procurement) and centrality (contracts, governance, partnership, transaction costs, information systems, incentives, risk management and trust) in construction management papers.

Considering the framework of New Institutional Economics, this review does not cover all related theoretical concepts. The overlap of theories within the framework of New Institutional Economics, P–A theory, and transaction cost theory is worthy of future study.

Although this review was intended to provide a comprehensive image of P–A theory trends in the construction management literature, it has limitations in terms of journal selection. The archives of the selected journals span different years. The *BRI* archive goes back to 1973; *CME*, *JCEM*, and *IJPM* go back to 1983; *AIC* goes back to 1992, *ECAM* goes back to 1994 and *CI* goes back to 2001. Thus, journals with older archives are represented to a greater extent in this review. The bulk of the cited literature was published within the past two decades. Thus, the historical reach of the archives does not appear to be a factor.

The selected journals were identified by Bröchner and Björk (2008). Since 2008, many new journals have appeared, and are gradually becoming more important. As a result of the sampling decision, certain relevant publications may not have been included in this review, although the seven journals selected for investigation are the best. The literature review should be extended to a wider selection of journals to provide further understanding of the field.

Opportunistic behaviour, self-interest, corruption, communication risks, trust and other issues within the focus of P–A theory are widespread throughout the construction industry. It is hoped that this review offers a new perspective to construction management researchers, and that they can find new areas of interest within the list of associated keywords and interconnections identified by NA.

References

Adam, A., Josephson, P. E. B., & Lindahl, G. (2017). Aggregation of factors causing cost overruns and time delays in large public construction projects: Trends and implications. *Engineering, Construction and Architectural Management, 24*(3), pp. 393-406.

Ahola, T., Ruuska, I., Artto, K., & Kujala, J. (2014). What is project governance and what are its origins? *International Journal of Project Management, 32*(8), pp. 1321-1332.

Badenfelt, U. (2008). The selection of sharing ratios in target cost contracts. *Engineering, Construction and Architectural Management, 15*(1), pp. 54-65.

Badewi, A. (2016). The impact of project management (PM) and benefits management (BM) practices on project success: Towards developing a project benefits governance framework. *International Journal of Project Management, 34*(4), pp. 761-778.

Bakker, R. M., Cambré, B., Korlaar, L., & Raab, L. (2011). Managing the project learning paradox: a set-theoretic approach toward project knowledge transfer. *International Journal of Project Management, 29*(5), pp. 494-503.

Bastian, M., Heymann, S., & Jacomy, M. (2009). Gephi: An open source software for exploring and manipulating networks. In: *3rd International AAAI Conference on Weblogs and Social Media*, May 17-20, 2009, San Jose, California, Association for the Advancement of Artificial Intelligence, pp. 361-362.

Bemelmans, J., Voordijk, H., & Vos, B. (2012). Supplier-contractor collaboration in the construction industry: A taxonomic approach to the literature of the 2000-2009 decade. *Engineering, Construction and Architectural Management, 19*(4), pp. 342-368.

Benítez-Ávila, C., Hartmann, A., Dewulf, G., & Henseler J. (2018). Interplay of relational and contractual governance in public-private partnerships: The mediating role of relational norms, trust and partners' contribution. *International Journal of Project Management*, 36(3), pp. 429-443.

Biesenthal, C., & Wilden, R. (2014). Multi-level project governance: Trends and opportunities. *International Journal of Project Management, 32*(8), pp. 1291-1308.

Bond-Bernard, T. J., Steyn, H., & Fabris-Rotelli, I. (2013). The impact of a call centre on communication in a programme and its projects. *International Journal of Project Management, 31*(7), pp. 1006-1016.

Boukendour, S. (2007). Preventing post-contractual opportunism by an option to switch from one contract to another. *Construction Management and Economics, 25*(27), pp. 723-727.

Bowen, P. A., Akintoye, A., Pearle, R., & Edwards, P. J. (2007). Ethical behaviour in the South African construction industry. *Construction Management and Economics, 25*(6), pp. 631-648.

Bowen, P. A., Edwards, P. J., & Cattell, P. (2012). Corruption in the South African construction industry: A Thematic analysis of verbatim comments from survey participants. *Construction Management and Economics, 30*(10), pp. 885-901.

Brandes, U., & Erlebach, T. (eds.) (2005). *Network analysis: Methodological foundations*. Springer-Verlag, Berlin.

Braun, T., Ferreira, A. I., & Sydow, J. (2013). Citizenship behaviour and effectiveness in temporary organizations. *International Journal of Project Management, 31*(6), pp. 862-876.

Bröchner, J., & Björk, B.-C. (2008). Where to submit? Journal choice by construction management authors. *Construction Management and Economics, 26*(7), pp. 739-749.

Bromiley, P., & Cummings, L. L. (1995). Transactions costs in organizations with trust. In: Bies, R., Sheppardand, B., & Lewicki, R. (eds.), *Research on Negotiations in Organizations*, 5. JAI Press, Greenwich, CT, pp. 219-247.

Bryde, D., Unterhitzenberger, C., & Joby, R. (2018). Conditions of success for earned value analysis in projects. *International Journal of Project Management, 36*(3), pp. 474-484.

Cao, D., Li, H., Wang, G., & Huang, T. (2017). Identifying and contextualising the motivations for BIM implementation in construction projects: An empirical study in China. *International Journal of Project Management, 35*(4), pp. 658-669.

Carbonara, N., Costantino, N., & Pellegrino, R. (2014). Concession period for PPPs: A win-win model for a fair risk sharing. *International Journal of Project Management, 32*(7), pp. 1223-1232.

Cerić, A. (2013). Application of the principal-agent theory to construction management: Literature review. In: Smith, S. D., & Ahiaga-Dagbui, D. D. (eds.), *Proceedings 29th Annual ARCOM Conference,* Association of Researchers in Construction Management, Reading, pp. 1071-1081.

Cerić, A. (2016). *Trust in Construction Projects*. Routledge, Oxon.

Cerić, A. (2019). Blockchain strategy for minimizing information asymmetry in construction projects. In: Završki, I., Cerić, A., Vukomanović, M., Huemann, M., & Ronggui, D. (eds.), *14th International Conference: Organization, Technology and Management in Construction*. Croatian Association for Construction Management, University of Zagreb, Faculty of Civil Engineering, Zagreb, pp. 494-506.

Chang, C. Y., & Chen, S. (2016). Transitional public-private partnership model in China: Contracting with little recourse to contracts. *Journal of Construction Engineering and Management, 142*(10), pp. 05016011-1-11.

Chang, C.-Y., & Chou, H.-Y. (2014). Transaction-cost approach to the comparative analysis of user-pay and government-pay public-private partnership systems. *Journal of Construction Engineering and Management, 140*(9), pp. 04014039-1-13.

Chang, C. Y. (2013a). When might a project company break up? The perspective of risk-bearing capacity. *Construction Management and Economics, 31*(12), pp. 1186-1198.

Chang, C. Y. (2013b). A critical analysis of recent advances in the techniques for the evaluation of renewable energy projects. *International Journal of Project Management, 31*(7), pp. 1057-1067.

Chang, C. Y. (2013c). Understanding the hold-up problem in management of megaprojects: The case of the Channel Tunnel rail link project. *International Journal of Project Management, 31*(4), pp. 628-637.

Chang, C. Y. (2014). Principal-agent model of risk allocation in construction contracts and its critique. *Journal of Construction Engineering and Management, 140*(1), pp. 04013032-1-9.

Chang, C.-Y. (2015). Risk-bearing capacity as a new dimension to the analysis of project governance. *International Journal of Project Management, 33*(6), pp. 1195-1205.

Chang, C. Y., Pan, W., & Howard, R. (2017). Impact of building information modeling implementation on the acceptance of integrated delivery systems: Structural equation modeling analysis. *Journal of Construction Engineering and Management, 143*(8), pp. 04017044-1-10.

Cheah, C. Y. J., Garvin, M. J., & Miller, J. B. (2004). Empirical study of strategic performance of global construction firms. *Journal of Construction Engineering and Management, 130*(6), pp. 808-817.

Chen, Y., Yin, Y., Browne, G. J., & Li, D. (2019). Adoption of building information modeling in Chinese construction industry: The technology-organization-environment framework. *Engineering, Construction and Architectural Management, 26*(9), pp. 1878-1898.

Chen, Y. Q., Zhang, Y. B., & Zhang, S. J. (2014). Impacts of different types of owner-contractor conflict on cost performance in construction projects. *Journal of Construction Engineering and Management, 140*(6), pp. 04014017-1-8.

Chong, H.-Y., & Oon, C. K. (2016). A practical approach in clarifying legal drafting: Delphi and case study in Malaysia. *Engineering, Construction and Architectural Management, 23*(5), pp. 610-621.

Conforto, E. C., Amaral, D. C., da Silva, S. L., Di Felippo, A., & Kamikawachi, D. S. L. (2016). The agility construct on project management theory. *International Journal of Project Management, 34*(4), pp. 660-674.

Corvellec, H., & Macheridis, N. (2010). The moral responsibility of project selectors. *International Journal of Project Management, 28*(3), pp. 212-219.

Cui, C., Liu, Y., Hope, A., & Wang, J. (2018). Review of studies on the public–private partnerships (PPP) for infrastructure projects. *International Journal of Project Management, 36*(5), pp. 773-794.

Daniel, E., & Daniel, P. A. (2019). Megaprojects as complex adaptive systems: The Hinkley point C case. *International Journal of Project Management, 37*(8), pp. 1017-1033.

Davidson, C. (2009). The challenge of organizational design for manufactured construction. *Construction Innovation: Information, Process, Management, 9*(1), pp. 42-57.

De Biasio, A., & Murray, A. (2017). The social network of the UK PPP secondary equity market–returns and competition in an emerging market. *Construction Management and Economics, 35*(8-9), pp. 468-481.

De Nooy, W., Mrvar, A., & Batageli, V. (2005). *Exploratory Social Network Analysis with Pajek*. Cambridge University Press, Cambridge, UK.

De Schepper, S., Haezendonck, E., & Dooms, M. (2015). Understanding pre-contractual transaction costs for Public–Private Partnership infrastructure projects. *International Journal of Project Management*, 33(4), pp. 932-946.

De Valence, G., & Runeson, G. (2015). Graham Ive and the methodology of construction economics. *Construction Management and Economics, 33*(2), pp. 126-33.

Eriksson, E., & Laan, A. (2007). Procurement effects on trust and control in client-contractor relationships. *Engineering, Construction and Architectural Management, 14*(4), pp. 387-399.

Eriksson, P. E. (2012). Exploration and exploitation in project-based organizations: Development and diffusion of knowledge at different organizational levels in construction companies. *International Journal of Project Management, 31*(3), pp. 333-341.

Espinoza, D., & Morris, J. W. F. (2013). Decoupled NPV: a simple, improved method to value infrastructure investments. *Construction Management and Economics, 31*(5), pp. 471-496.

Farrell, L. M. (2003). Principal-agency risk in project finance. *International Journal of Project Management, 21*(8), pp. 547-561.

Floricel, S., Bonneau, C., Aubry, M., & Sergi, V. (2014). Extending project management research: Insights from social theories. *International Journal of Project Management, 32*(7), pp. 1091-1107.

Flyvbjerg, B. (2013). Quality control and due diligence in project management: Getting decisions right by taking the outside view. *International Journal of Project Management, 31*(5), pp. 760-774.

Freeman, L. C. (1979). Centrality in social networks. *Social Networks, 1*, pp. 215-239.

Fu, Y., Chen, Y., Zhang, S., & Wang, W. (2015). Promoting cooperation in construction projects: An integrated approach of contractual incentive and trust. *Construction Management and Economics, 33*(8), pp. 653-670.

Gao, R., & Liu, J. (2019). Selection of government supervision mode of PPP projects during the operation stage. *Construction Management and Economics, 37*(10), pp. 584-603.

Guo, F., Chang-Richards, Y., Wilkinson, S., & Li, T. C. (2014). Effects of project governance structures on the management of risks in major infrastructure projects: A comparative analysis. *International Journal of Project Management, 32*(5), pp. 815-826.

Han, J., Rapoport, A., & Fong, P.S.W. (2019). Incentive structures in multi-partner project teams. *Engineering, Construction and Architectural Management*, *27*(1), pp. 49-65.

Hasan, A., & Jha, K. N. (2019). Client and contractor roles in schedule incentive/disincentive projects: An empirical study from India. *Engineering, Construction and Architectural Management, 26*(3), pp. 386-407.

Hedborg, S., Eriksson, P. E., & Gustavsson, T. K. (2020). Organisational routines in multi-project contexts: Coordinating in an urban development project ecology. *International Journal of Project Management*, *38*(7), pp. 394-404.

Ho, P. (2006). Model for financial renegotiation in public-private partnership projects and its policy implications: Game theoretic view. *Journal of Construction Engineering and Management, 132*(7), pp. 678-688.

Hölzle, K. (2010). Designing and implementing a career path for project managers. *International Journal of Project Management, 28*(8), pp. 779-786.

Home Office (2016). *Social Network Analysis: 'How to guide'*. Crown, UK, Home Office.

Hossain, L., & Wu, A. (2009). Communications network centrality correlates to organisational coordination. *International Journal of Project Management, 27*(8), pp. 795-811.

Hossain, L. (2009a). Communications and coordination in construction projects. *Construction Management and Economics, 27*(1), pp. 25-39.

Hossain, L. (2009b). Effect of organisational position and network centrality on project coordination. *International Journal of Project Management, 27*(7), pp. 680-689.

Hosseinian, S. M., & Carmichael, D. G. (2013). Optimal incentive contract with risk-neutral contractor. *Journal of Construction Engineering and Management, 139*(8), pp. 899-909.

Hosseinian, S. M., & Carmichael, D. G. (2014). An optimal target cost contract with a risk neutral owner. *Engineering, Construction and Architectural Management, 21*(5), pp. 586-604.

Hosseinian, S. M., Farahpour, E., & Carmichael, D. G. (2020). Optimum outcome-sharing construction contracts with multiagent and multioutcome arrangements. *Journal of Construction Engineering and Management, 146*(7), pp. 04020067-1-12.

Hsieh, H. Y., & Forster, J. (2006). Residential construction quality and production levels in Taiwan. *Engineering, Construction and Architectural Management, 13*(5), pp. 502-520.

Hsu, J. S. C., Shih, S. P., Chiang, J. C., & Liu, J. Y. C. (2012). The impact of transactive memory systems on is development teams' coordination, communication, and performance. *International Journal of Project Management, 30*(3), pp. 329-340.

Huang, Y. L., & Chang, S. H. (2009). Design Professionals' legal risks increased under nature's attack: Chichi earthquake experience. *International Journal of Project Management, 27*(6), pp. 544-551.

Hughes, D., Williams, T., & Ren, Z. (2012). Is incentivisation significant in ensuring successful partnered projects. *Engineering, Construction and Architectural Management, 19*(3), pp. 306-319.

Ika, L. A., Diallo, A., & Thuillier, D. (2012). Critical success factors for world bank projects: an empirical investigation. *International Journal of Project Management, 30*(1), pp. 105-116.

Jäger, C (2008). *The Principal-Agent Theory within the Context of Economic Sciences*. Herstellung und Verlag, Books on Demand GmbH, Norderstadt.

Javed, A. A., Lam, P. T. I., & Chan, A. P. C. (2014). Change negotiation in public-private partnership projects through output specifications: An experimental approach based on game theory. *Construction Management and Economics, 32*(4), pp. 323-348.

Jensen, C., Johansson, S., & Löfström, M. (2006). Project relationships – A model for analyzing interactional uncertainty. *International Journal of Project Management, 24*(1), pp. 4-12.

Jensen, M. C. (2000). *The Theory of the Firm: Governance, Residual Claims, and Organizational Forms*. Harvard University Press, Cambridge, MA.

Joslin, R., & Müller, R. (2016). The relationship between project governance and project success. *International Journal of Project Management, 34*(4), pp. 613-626.

Kapsali, M. (2011). Systems thinking in innovation project management: a match that works. *International Journal of Project Management, 29*(4), pp. 396-407.

Koch, C., & Buser, M. (2006). Emerging metagovernance as an institutional framework for public private partnership networks in Denmark. *International Journal of Project Management, 24*(7), pp. 548-556.

Koppenjan, J., Veeneman, W., Van der Voort, H., Ten Heuvelhof, E., & Leijten, M. (2011). Competing management approaches in large engineering projects: The Dutch Randstad Rail project. *International Journal of Project Management, 29*(6), pp. 740-750.

Laryea, S. (2019). Procurement strategy and outcomes of a new universities project in South Africa. *Engineering, Construction and Architectural Management*, *26*(9), pp. 2060-2083.

Laursen, M., & Svejvig, P. (2016). Taking stock of project value creation: A structured literature review with future directions for research and practice. *International Journal of Project Management, 34*(4), pp. 736-747.

Le, Y., Shan, M., Chan, A. P. C., & Hu, Y. (2014). Investigating the causal relationships between causes of and vulnerabilities to corruption in the Chinese public construction sector. *Journal of Construction Engineering and Management, 140*(9), pp. 05014007-1-12.

Lee, C. (2019). Financing method for real estate and infrastructure development using Markowitz's portfolio selection model and the Monte Carlo simulation. *Engineering, Construction and Architectural Management*, *26*(9), pp. 2008-2022.

Li, H., Arditi, D., & Wang, Z. (2014). Transaction costs incurred by construction owners. *Engineering, Construction and Architectural Management, 21*(4), pp. 444-458.

Li, H., Lv, L., Zuo, J., Su, L., Wang, L., & Yuan, C. (2020). Dynamic reputation incentive mechanism for urban water environment treatment PPP projects. *Journal of Construction Engineering and Management, 146*(8), pp. 04020088-1-14.

Lin, L. N., & Wang, H. (2019). Dynamic incentive model of knowledge sharing in construction project team based on differential game. *Journal of the Operational Research Society, 70*(12), pp. 2084-2096.

Ling, F. Y. Y., & Tran, P. Q. (2012). Effects of interpersonal relations on public sector construction contracts in Vietnam. *Construction Management and Economics, 30*(12), pp. 1087-1101.

Liu, J., Gao, R., Cheah, C. Y. J., & Luo, J. (2016). Incentive mechanism for inhibiting investors' opportunistic behavior in PPP projects. *International Journal of Project Management, 34*(7), pp. 1102-1111.

Liu, J., Gao, R., Cheah, C. Y. J., & Luo, J. (2017). Evolutionary game of investors' opportunistic behaviour during the operational period in PPP projects. *Construction Management and Economics, 35*(3), pp. 137-153.

Liu, L., Borman, M., & Gao, J. (2014). Delivering complex engineering projects: Reexamining organizational control theory. *International Journal of Project Management, 32*(5), pp. 791-802.

Lützkendorf, T., & Speer, T. M. (2005). Alleviating asymmetric information in property markets: building performance and product quality as signals for consumers. *Building Research and Information, 33*(2), pp. 182-195.

Mahaney, R. C., & Lederer, A. L. (2010). The role of monitoring and shirking in information systems project management. *International Journal of Project Management, 28*(1), pp. 14-25.

Mei, T., Wang, Q., Xiao, Y., & Yang, M. (2017). Rent-seeking behavior of BIM-and IPD-based construction project in China. *Engineering, Construction and Architectural Management, 24*(3), pp. 514-536.

Müller, R., & Turner, J. R. (2005). The Impact of principal-agent relationship and contract type on communication between project owner and manager. *International Journal of Project Management, 23*(5), pp. 398-403.

Müller, R., & Turner, J. R. (2010). Leadership competency profiles of successful project managers. *International Journal of Project Management, 28*(5), pp. 437-448.

Müller, R., Zhai, L., Wang, A., & Shao, J. (2016). A framework for governance of projects: Governmentality, governance structure and projectification. *International Journal of Project Management, 34*(6), pp. 957-969.

Musawir, A. ul, Abd-Karim, S. B., & Mohd-Danuri, M. S. (2020). Project governance and its role in enabling organizational strategy implementation: A systematic literature review. *International Journal of Project Management, 38*(1), pp. 1-16.

Musawir, A. ul, Serra, C. E. M., Zwikael, O., & Ali, I. (2017). Project governance, benefit management, and project success: Towards a framework for supporting organizational strategy implementation. *International Journal of Project Management, 35*(8), pp. 1658-1672.

Näsänen, J., & Vanharanta, O. (2016). Program group's discursive construction of context: A means to legitimize buck-passing. *International Journal of Project Management, 34*(8), pp. 1672-1686.

Niknazar, P., & Bourgault, M. (2017). Theories for classification vs. classification as theory: Implications of classification and typology for the development of project management theories. *International Journal of Project Management, 35*(2), pp. 191-203.

Odoemena, A. T., & Horita, M. (2018). A strategic analysis of contract termination in public–private partnerships: Implications from cases in sub-Saharan Africa. *Construction Management and Economics, 36*(2), pp. 96-108.

Ogunlana, S. O. (1996). Construction delays in a fast-growing economy: Comparing Thailand with other economies. *International Journal of Project Management, 14*(1), pp. 37-45.

Park, H., Han, S. H., Rojas, E. M., Son, J., & Jung, W. (2011). Social network analysis of collaborative ventures for overseas construction projects. *Journal of Construction Engineering and Management, 137*(5), pp. 344-355.

Picciotto, R. (2020). Towards a 'New Project Management' movement? An international development perspective. *International Journal of Project Management, 38*(8), pp. 474-485.

Pilkienė, M., Alonderienė, R., Chmieliauskas, A., Šimkonis, S., & Müller, R. (2018). The governance of horizontal leadership in projects. *International Journal of Project Management, 36*(7), pp. 913-924.

Pinto, J. K. (2014). Project management, governance, and the normalization of deviance. *International Journal of Project Management, 32*(3), pp. 376-387.

Pinto, J. K., Slevin, D. P., & English, B. (2009). Trust in projects: an empirical assessment of owner/contractor relationships. *International Journal of Project Management*, 27(6), pp. 638-648.

Pollack, J., Biesenthal, C., Sankaran, S., & Clegg, S. (2018). Classics in megaproject management: A structured analysis of three major works. *International Journal of Project Management, 36*(2), pp. 372-384.

Pryke, S. D. (2004). Analysing construction project coalitions: Exploring the application of social network analysis. *Construction Management and Economics, 22*(8), pp. 787-797.

Puddicombe, M. S. (2009). Why contracts: evidence. *Journal of Construction Engineering and Management, 135*(8), pp. 675-682.

Rose, T. M., & Manley, K. (2012). Adoption of innovative products on Australian road infrastructure projects. *Construction Management and Economics, 30*(4), pp. 277-298.

Sabini, L., Muzio, D., & Alderman, N. (2019). 25 years of 'sustainable projects'. What we know and what the literature says. *International Journal of Project Management, 37*(6), pp. 820-838.

Saini, M., Arif, M., & Kulonda, D. J. (2018). Critical factors for transferring and sharing tacit knowledge within lean and agile construction processes. *Construction Innovation, 18*(1), pp. 64-89.

Saini, M., Arif, M., & Kulonda, D. J. (2019). Challenges to transferring and sharing of tacit knowledge within a construction supply chain. *Construction Innovation, 19*(1), pp. 15-33.

Samset, K., & Volden, G. H. (2016). Front-end definition of projects: Ten paradoxes and some reflections regarding project management and project governance. *International Journal of Project Management, 34*(2), pp. 297-313.

Schieg, M. (2008). Strategies for avoiding asymmetric information in construction project management. *Journal of Business Economics and Management, 9*(1), pp. 47-51.

Sha, K. (2011). Vertical governance of construction projects: An information cost perspective. *Construction Management and Economics, 29*(11), pp. 1137-1147.

Sha, K. (2013). Professionalism in China's building sector: An economic governance perspective. *Building Research and Information, 41*(6), pp. 742-751.

Sha, K. (2019). Incentive strategies for construction project manager: A common agency perspective. *Construction Management and Economics, 37*(8), pp. 461-471.

Shen, W., Tang, W., Wang, S., Duffield, C. F., Hui, F. K. P., & You, R. (2017). Enhancing trust-based interface management in international engineering-procurement-construction projects. *Journal of Construction Engineering and Management, 143*(9), pp. 04017061-1-12.

Shen, Y., Tuuli, M. M., Xia, B., Koh, T. Y., & Rowlinson, S. (2015). Toward a model for forming psychological safety climate in construction project management. *International Journal of Project Management, 33*(1), pp. 223-235.

Shrestha, A., Chan, T. K., Aibinu, A. A., Chen, C., & Martek, I. (2018). Risk allocation inefficiencies in Chinese PPP water projects. *Journal of Construction Engineering and Management, 144*(4), pp. 04018013-1-10.

Sirisomboonsuk, P., Gu, V. C., Cao, R. Q., & Burns, J. R. (2018). Relationships between project governance and information technology governance and their impact on project performance. *International Journal of Project Management, 36*(2), pp. 287-300.

Smyth, H. J., & Morris, P. W. G. (2007). An epistemological evaluation of research into projects and their management: methodological issues. *International Journal of Project Management, 25*(4), pp. 423-436.

Snippert, T., Witteveen, W., Boes, H., & Voordijk, H. (2015). Barriers to realizing a stewardship relation between client and vendor: The best value approach. *Construction Management and Economics, 33*(7), pp. 569-586.

Solheim-Kile, E., & Wald, A. (2019). Extending the transactional view on public-private partnership projects: Role of relational and motivational aspects in goal alignment. *Journal of Construction Engineering and Management, 145*(5), pp. 04019030-1-12.

Ströbele, B., & Lützkendorf, T. (2019). Communicating environmental information: Rethinking options for construction products. *Building Research and Information, 47*(6), pp. 681-696.

Sydow, J., & Braun, T. (2018). Projects as temporary organizations: An agenda for further theorizing the interorganizational dimension. *International Journal of Project Management, 36*(1), pp. 4-11.

Szentes, H., & Eriksson, P. E. (2016). Paradoxical organizational tensions between control and flexibility when managing large infrastructure projects. *Journal of Construction Engineering and Management, 142*(4), pp. 05015017-1-10.

Tembo-Silungwe, C. K., & Khatleli, N. (2018). Identification of enablers and constraints of risk allocation using structuration theory in the construction industry. *Journal of Construction Engineering and Management, 144*(5), pp. 04018021-1-11.

Teo, P., & Bridge, A. J. (2017). Crafting an efficient bundle of property rights to determine the suitability of a Public-Private Partnership: A new theoretical framework. *International Journal of Project Management, 35*(3), pp. 269-279.

Toivonen, A., & Toivonen, P. U. (2014). The transformative effect of top management governance choices on project team identity and relationship with the organization – An agency and stewardship approach. *International Journal of Project Management, 32*(8), pp. 1358-1370.

Turner, J. R., & Müller, R. (2003). On the nature of the project as a temporary organization. *International Journal of Project Management, 21*(1), pp. 1-8.

Turner, J. R., & Müller, R. (2004). Communication and cooperation on projects between the project owner as principal and the project manager as agent. *European Management Journal, 22*(3)., pp. 327-336.

Turner, J. R., Huemann, M., & Keegan, A. (2008). Human resource management in the project-oriented organization: employee well-being and ethical treatment. *International Journal of Project Management, 26*(5), pp. 577-585.

Tuuli, M. M., Rowlinson, S., & Koh, T. Y. (2010). Dynamics of control in construction project teams. *Construction Management and Economics, 28*(2), pp. 189-202.

Ürge-Vorsatz, D., Harvey, L. D. D., Mirasgedis, S., &., & Levine, M. D. (2007). Mitigating CO_2 emissions from energy use in the world's buildings. *Building Research and Information, 35*(4), pp. 379-398.

Van Buiten, M., & Hartmann, A. (2015). Asset management perspective on the duration of public-private partnership contracts: Cost-control trade-off? *Journal of Construction Engineering and Management, 141*(3), pp. 04014080-1-9.

Van den Berg, M., Voordijk, H., & Adriaanse, A. (2020). Information processing for end-of-life coordination: a multiple-case study. *Construction Innovation*, *20*(4), pp. 647-671.

Van Duren, J., Dorée, A., & Voordijk, H. (2015). Perceptions of success in performance-based procurement: Differences between clients and contractors. *Construction Innovation, 15*(1), pp. 107-128.

Van Oorschot, J. A. W. H., Halman, J. I. M., & Hofman, E. (2020). Getting innovations adopted in the housing sector. *Construction Innovation, 20*(2), pp. 285-318.

Vennström, A., & Eriksson, P. E. (2010). Client perceived barriers to change of the construction process. *Construction Innovation: Information, Process, Management, 10*(2), pp. 126-137.

Volden, G. H. (2019). Assessing public projects' value for money: An empirical study of the usefulness of cost–benefit analyses in decision-making. *International Journal of Project Management, 37*(4), pp. 549-564.

Vuorinen, L., & Martinsuo, M. (2018). Program integration in multi-project change programs: agency in integration practice. *International Journal of Project Management, 36*(4), pp. 583-599.

Wang, Q., & Shi, Q. (2019). The incentive mechanism of knowledge sharing in the industrial construction supply chain based on a supervisory mechanism. *Engineering, Construction and Architectural Management, 26*(6), pp. 989-1003.

Wang, Y., & Liu, J. (2015). Evaluation of the excess revenue sharing ratio in PPP projects using principal-agent models. *International Journal of Project Management, 33*(6), pp. 1317-1324.

Wang, Y., Cui, P., & Liu, J. (2018). Analysis of the risk-sharing ratio in PPP projects based on government minimum revenue guarantees. *International Journal of Project Management, 36*(6), pp. 899-909.

Ward, S. C., & Chapman, C. B. (1991). Extending the use of risk analysis in project management. *International Journal of Project Management, 9*(2), pp. 117-123.

Ward, S. C., & Chapman, C. B. (2008). Stakeholders and uncertainty management in projects. *Construction Management and Economics, 26*(6), pp. 563-577.

Ward, S. C., Chapman, C. B., & Curtis, B. (1991). On the allocation of risk in construction projects. *International Journal of Project Management, 9*(3), pp. 140-147.

Wen, Q., Qiang, M., & An, N. (2017). Collaborating with construction management consultants in project execution: Responsibility delegation and capability integration. *Journal of Construction Engineering and Management, 143*(7), pp. 04017021-1-14.

Williams, T. M. (1993). Risk-management infrastructures. *International Journal of Project Management, 11*(1), pp. 5-10.

Winch, G. M. (2015). Project organizing as a problem in information. *Construction Management and Economics, 33*(2), pp. 106-116.

Xia, N., Zou, P. X. W., Griffin, M. A., Wang, X., & Zhong, R. (2018). Towards integrating construction risk management and stakeholder management: A systematic literature review and future research agendas. *International Journal of Project Management, 36*(5), pp. 701-715.

Xiang, P., Huo, X., & Shen, L. (2015). Research on the phenomenon of asymmetric information in construction projects – The case of China. *International Journal of Project Management, 33*(3), pp. 589-598.

Xiang, P. C., Zhou, J., Zhou, X. Y., & Ye, K. H. (2012). Construction project risk management based on the view of asymmetric information. *Journal of Construction Engineering and Management, 138*(11), pp. 1303-1311.

Xiong, W., & Zhang, X. (2016). The real option value of renegotiation in public-private partnerships. *Journal of Construction Engineering and Management, 142*(8), pp. 04016021-1-11.

Xu, Q., Chong, H. Y., & Liao, P. C. (2019). Collaborative information integration for construction safety monitoring. *Automation in Construction, 102*, pp. 120-134.

Yao, H., Chen, Y., Chen, Y., & Zhu, X. (2019). Mediating role of risk perception of trust and contract enforcement in the construction industry. *Journal of Construction Engineering and Management, 145*(2), pp. 04018130-1-13.

Yao, M., Wang, F., Chen, Z., & Ye, H. (2020). Optimal incentive contract with asymmetric cost information. *Journal of Construction Engineering and Management, 146*(6), pp. 04020054-1-13.

Yu, A. G., Flett, P. D., & Bowers, J. A. (2005). Developing a value-centred proposal for assessing project success. *International Journal of Project Management, 23*(6), pp. 428-436.

Yung, P., & Lai, L. W. C. (2008). Supervising for quality: An empirical examination of institutional arrangements in China's construction industry. *Construction Management and Economics, 26*(8), pp. 723-737.

Zhang, H., Yu, L., & Zhang, W. (2020). Dynamic performance incentive model with supervision mechanism for PPP projects. *Engineering, Construction and Architectural Management*, *27*(9), pp. 2643-2659.

Zhang, J., Chen, F., & Yuan, X.-X. (2020). Comparison of cost and schedule performance of large public projects under P3 and traditional delivery models: A Canadian study. *Construction Management and Economics*, *38*(8), pp. 739-755.

Zhang, J., Zhou, N., Hinge, A., Feng, W., & Zhang, S. (2016). Governance strategies to achieve zero-energy buildings in China. *Building Research and Information, 44*(5-6), pp. 604-618.

Zhang, X. (2009). Win-win concession period determination methodology. *Journal of Construction Engineering and Management, 135*(6), pp. 550-558.

Zheng, L., Lu, W., Chen, K., Chau, K. W., & Niu, Y. (2017). Benefit sharing for BIM implementation: Tackling the moral hazard dilemma in inter-firm cooperation. *International Journal of Project Management, 35*(3), pp. 393-405.

Zhu, L., Cheung, S. O., Gao, X., Li, Q., & Liu, G. (2020). Success DNA of a record-breaking megaproject. *Journal of Construction Engineering and Management, 146*(8), pp. 05020009-1-14.

Zwikael, O., & Smyrk, J. (2015). Project governance: Balancing control and trust in dealing with risk. *International Journal of Project Management, 33*(4), pp. 852-862.

Appendix: Interconnections between keywords associated with P–A theory

Keywords	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	Sum
1. Adverse selection												1	1						1															3
2. Agency theory		1				1			3									1		1			2	1			3					1		14
3. Change management			2																															2
4. Cooperation/ collaboration						2					3	1	2		1				1													1		11
5. Communication					1	2													2						2						1	1		9
6. Contracts		1		2	2	4		1	3	1	5	1				1		7	3	2			5		1		1				6	3	1	50
7. Corruption							2																											2
8. Financial management						1												2		1			2											6
9. Governance		3				3			9		1		1					2	1		1		3				2	1			4		2	33
10. Hold-up						1												1																2
11. Incentives				3		5			1		3	1	1			1		3	6			1	2						1		1	1		30
12. Information asymmetry	1			1		1					1		2						2				1								1			10
13. Information systems	1			2					1		1	2	2	1					1				1					1						13
14. Institutional theory													1																					1
15. Moral hazard				1															1															2
16. Opportunism						1					1					1		1	1	1														6
17. Organisation theory																	1														1			2
18. Partnership		1				7		2	2	1	3					1		2	1	2		1	3	1	1							2		30
19. Principal–agent theory	1			1	2	3			1		6	2	1		1	1		1	2		1		2						1		3		1	30
20. Procurement		1				2		1								1		2		1							1		1		2	1		13
21. Professional ethics/Profes-sionalism									1										1														2	4

(*Continued*)

Appendix: Continued.

Keywords	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	Sum
22. Reputation											1							1																2
23. Risk management		2				5		2	3		2	1	1					3	2				4									1	2	28
24. Social capital		1																1												2	1		5
25. Social networks					2	1												1							3						1		8
26. Social theories																										1								1
27. Stewardship theory		3				1			2											1														7
28. Strategic planning									1				1															2						4
29. Supply chain management											1								1	1									4			1		8
30. Temporary organisations																														2				2
31. Transation costs					1	6			4	1	1					1		3	2				2										2	23
32. Trust		1		1	1	3					1							2		1			1	1	1				1				14
33. Uncertainty						1			2										1		2		2								2		2	12

P–A, principal–agent.