

# APPLICATION OF THE PRINCIPAL-AGENT THEORY TO CONSTRUCTION MANAGEMENT: LITERATURE REVIEW

Anita Ceric<sup>1</sup>

*Department of Construction Management and Economics, Faculty of Civil Engineering, University of Zagreb*

There is a growing literature concerning the application of the principal-agent theory to construction management. As this literature review demonstrates, it has received particular attention in the first decade of the third millennium. The theory focuses on information asymmetry, in which one of the two parties is better informed than the other, and in which they do not share the same interests. Opportunistic behaviour can be expected in such relationships. The concept of asymmetric information is of great value to modern economic theory, and it is thus likely to play a major role in the study of construction management. This review focuses on keywords, which are essential in literature search that precedes all research activities. The results of this literature review pinpoint the key issues associated with the principal-agent theory in the leading journals in construction management to date. As is shown in the paper, contracts and risk management are uppermost in the literature surveyed. Together, these two subjects fit very well in the principal-agent framework. This review will provide the basis for future research in construction management and related fields.

Keywords: principal-agent theory, information asymmetry, project management, risk, communication.

## INTRODUCTION

In recent years, the principal-agent theory has been receiving a growing attention in various applied fields, including construction management. The purpose of this paper is to assess this development by reviewing the literature in the field in terms of keywords listed by authors. As the theory concerns information asymmetry, in which one of the parties is better informed than the other, and in which parties do not share the same interests, it is likely to have a growing influence on construction management, where project parties bring together a wide variety of both expertise and interests to the task at hand. Focusing on the leading journals in the field, this review investigates the connection between the principal-agent theory and areas of its application with deeper historical roots in the construction management field.

The first step in the literature review presented here is based on Bröchner and Björk (2008), who have investigated journal choice by leading construction management authors around the world. They have argued that there are seven leading journals in the field, which will be introduced in the next section. To identify the papers to be

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<sup>1</sup> anita@grad.hr

reviewed here, the online archives of these journals have been searched using "principal-agent" as the keyword. These words are most often followed by the word "theory", but words "problem" and "model" can also be found in the literature. Hereafter, only the word "theory" will be used.

The principal-agent theory offers a useful representation of project management as applied to construction and other fields in which project management plays an important role. 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. It provides one of the best known applications of information asymmetry in economics, which is the situation in which one of the two parties is better informed than the other, and in which they do not share the same interests (e.g., Jensen, 2000). In accordance with the principal-agent theory, the following types of information asymmetry apply for project parties: hidden characteristics, hidden information, and hidden intention. These three types of information asymmetry respectively generate the following risks: adverse selection, moral hazard, and hold-up (Jäger, 2008). Different interests of principals and agents postulated by the theory have also been investigated from the vantage point of morality or ethics (e.g., Quinn & Jones, 1995).

In project management, the focus has initially been on the relationship between the project owner and the project manager engaged for a particular project (e.g., Turner & Müller, 2004; Müller & Turner, 2005). However, it has also been extended to other agents engaged in construction, such as contractors, sub-contractors, designers, consultants, and so forth. In the simplest situation, the principal is called the project owner and the agent is called the contractor. Both are guided by self-interest, as well. According to the theory, opportunistic behaviour can be expected from both, but much of the literature is concerned with the contractor's opportunistic behaviour. However, the relationship becomes increasingly complex as the number of project parties grows. It can be assumed throughout that agents will attempt to maximize their benefits even when that may involve a higher damage to the principal (Schieg, 2008).

Previous research has shown that project managers play a crucial role in construction projects, and especially in the construction phase, when they are more important to project success than the project owner and the contractor (Ceric, 2012a,b,c,d). Either collusion or conflict between project managers against the interests of the project owner and contractor can have detrimental effect on project completion within time, budget, and quality desired. In a brief overview, Ceric (2012a: 523) classified the literature relating to the principal-agent theory in terms of the three risks generated by information asymmetry, namely adverse selection, moral hazard, and hold-up. However, it should be noted that the classification in question was not limited to the seven journals investigated in this paper; rather, it was considerably broader in scope. As will be shown below, only two of the above asymmetries appear among the keywords in papers investigated here, and each appears only once.

The remainder of this paper comes in three sections. The literature review methodology employed will be considered first. The key findings of the literature review will be presented next. By way of conclusion, limitations of this study and pointers for future research in this area will be considered. It is to be hoped that construction management research will be enriched by this review.

## METHODOLOGY

The research presented here has followed three distinct steps. The journals to be investigated were selected first. Due to space limitations, the focus was on the top journals in the field of construction management. The journals selected were searched for "principal-agent" as the main keyword in the second step to identify the relevant papers. Finally, the associated keywords in these papers were identified and analysed in the third step. These keywords have deeper roots in the construction management literature than the main keyword. Their identification and investigation is the main contribution of this review. Keywords have become essential in the literature search, which nowadays guides the academic community in any field of research.

Again, this literature review is based on Bröchner and Björk (2008). Their research focused on the preferences of the authors contributing to the construction management field. They followed the most cited authors, whose preferences they furthermore investigated by means of an opinion survey. In the process, they identified 45 journals in the field, from which they identified the seven leading ones. Together with their publishers, the seven leading journals in construction management identified by Bröchner and Björk (2008: 742) are shown in Table 1. For purposes of this literature review, each of their online archives was subsequently searched for the keyword "principal-agent". The results will be presented in the next section.

*Table 1: Top construction management journals by authors (Bröchner & Björk, 2008)*

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

It should be noted that the archives of the journals go back to different years. In this case, JCEM archive goes back to 1930, BRI to 1973, CME and IJPM to 1983, AIC to 1992, ECAM to 1994, and CI to 2001. Therefore, the present review is slightly biased toward the journals with farther-reaching archives. As will be shown below, however, the bulk of the literature cited falls within the last decade. Therefore, the historical reach of the archives does not appear to be of great relevance in this particular case.

The main contribution of this review is in the analysis of the associated keywords, many of which have considerable history in the construction management literature. Namely, the papers identified in the leading journals in the field have subsequently been probed by analysing the associated keywords listed in papers found. Their incidence pinpoints the areas to which the principal-agent theory has been applied to date, and in which it is likely to play the most prominent role at this stage. As will be shown in the next section, some of them have deep roots in the field.

## KEY FINDINGS

The incidence of the keyword "principal-agent" in the seven journals selected for this review is shown in Table 2. All together, 55 papers containing the main keyword have been found. According to the search, however, it appears in only two paper titles, three abstracts, and no more than five lists of keywords, which are essential in literature search. The leading journal in terms of the keyword is IJPM with 30 papers, followed by CEM with ten, JCEM with six, ECAM with five, and BRI and CI with two each. However, no papers containing the keyword have been found in AIC, which is included here on account of the argument provided by Bröchner and Björk (2008). That journal will thus be excluded from further investigation in this review.

*Table 2: Incidence of the keyword "principal-agent" in selected journals*

Keyword / Journal	AIC	BRI	CI	CME	ECAM	IJPM	JCEM
Papers	0	2	2	10	5	30	6
Titles	0	0	0	0	0	2	0
Abstracts	0	0	0	1	0	2	0
Keywords	0	1	0	1	0	3	0

The 55 papers cited in the seven top construction management journals are presented in Table 3. Most of the papers appeared in print in the 2000s, and especially between 2005 and 2012. The peak was in 2012, when 13 papers bearing the keyword "principal-agent" appeared in print. The previous peak year was in 2009 with eight papers. This shows that the research in question is by and large recent. However, it should be noted that the first papers in this series appeared in the early 1990s. In particular, Ward et al. (1991) and Ward and Chapman (1991) lead the pack.

*Table 3: Papers cited*

Acronym	Papers cited
AIC	None
BRI	Lützkendorf & Speer (2005), Ürge-Vorsatz et al. (2007)
CI	Davidson (2009), Vennström & Eriksson (2010)
CME	Boukendour (2007), Bowen et al. (2007), Ward & Chapman (2008), Yung & Lai (2008), Hossain (2009), Tuuli et al. (2010), Sha (2011), Bowen et al. (2012), Ling & Tran (2012), Rose & Manley (2012)
ECAM	Hsieh & Forster (2006), Eriksson & Laan (2007), Badenfelt (2008), Bemelmans et al. (2012), Hughes et al. (2012)
IJPM	Ward et al. (1991), Ward & Chapman (1991), Williams (1993), Ogunlana (1996), Farrell (2003), Turner & Müller (2003), Müller & Turner (2005), Yu et al. (2005), Jensen et al. (2006), Koch & Buser (2006), Smyth & Morris (2007), Turner et al. (2008), Hossain (2009), Hossain & Wu (2009), Huang & Chang (2009), Pinto et al. (2009), Corvellec & Macheridis (2010), Hölzle (2010), Mahaney & Lederer (2010), Müller & Turner (2010), Bakker et al. (2011), Kapsali (2011), Koppenjan et al. (2011), Braun et al. (2012), Chang (2012), Eriksson (2012), Flyvbjerg (2012), Hsu et al. (2012), Ika et al. (2012), Bond-Barnarda et al. (2013)
JCEM	Cheah et al. (2004), Ho (2006), Puddicombe (2009), Zhang (2009), Hosseinian & Carmichael (2012), Xiang et al. (2012)

This paper attempts a classification of keywords in selected papers so as to determine the connection between the "principal-agent" keyword and the associated keywords. In the 55 papers identified there are 276 keywords, or about five of them per paper. A large number of identical keywords are shared by several papers. Due to space limitations, only the most important among them are presented here. For instance, keywords such as "construction" and "construction industry", as well as "construction management" and "project management", are excluded from further analysis. General keywords, such as "environment" and "sustainability", and indefinite keywords, such as "control" and "flexibility", are also excluded. Similarly, names of countries and organizations, such as the World Bank, are excluded, as are technical terms, such as "Monte Carlo method" and "regression analysis". In addition, the main keyword "principal-agent" is excluded here since the five papers in which it explicitly occurs are already presented in Table 2. The 21 remaining keywords, which appear in 64 instances, are presented in Table 4. It should be noted that there are 24 such instances in IJPM, 15 in CME, 12 in JCEM, eight in ECAM, three in BRI, and two in CI.

*Table 4: Incidence of associated keywords in selected journals excluding AIC*

Keywords / Journal	BRI	CI	CME	ECAM	IJPM	JCEM
Adverse selection	1					
Communication			1		3	
Contracts			3	1	2	2
Corruption			2			
Financial management						2
Hold-up					1	
Incentives				1	1	
Information asymmetry	1					1
Information systems	1					1
Opportunism			1			
Partnership				2		2
Procurement		1		1	1	1
Professional ethics			1			
Risk management			1	1	4	2
Social networks			2		2	
Strategic planning						1
Supply chain management		1		1	2	
Temporary organizations					2	
Transaction costs			2		2	
Trust				1	1	
Uncertainty			2		3	

As can be seen from Table 4, the most important keywords associated with the principal-agent theory are "contracts" and "risk management", which appear in eight papers each. They are followed by keyword "uncertainty" with five instances. Finally, keywords "communication", "partnership", "procurement", "social networks",

"supply chain management" and "transaction costs" are just behind, as they appear in four papers each. Predictably, combinations of these keywords occasionally appear in the same papers. The connection between "contracts", "risk management" and "uncertainty" is worth noting in this connection, as risks can sometimes be identified only in broad terms, thus precluding precise assessment. In turn, this means that contracts between the principal and agents cannot be formulated in precise terms, either. This is very much in line with the principal-agent theory, as well.

The "transaction costs" keyword is worth exploring briefly. In particular, this involves the connection between the principal-agent theory and transaction cost theory. Elinor Ostrom and Oliver Williamson shared a Nobel prize in 2009 for their work on economic governance performed in the 1970s and 1980s. Their contributions focus on hierarchical structures such as firms and other institutions that play a role outside markets proper. Transaction cost theory has evolved into New Institutional Economic (NIE) in recent years. The principal-agent theory also plays an important part in this wider theoretical framework. Its place within NIE is worth exploring in the future, but such an analysis falls outside the scope of this paper.

Returning to the results of this review, they show that the principal-agent theory has had only a superficial impact upon construction management research published to date. The keyword "principal-agent" thus appears in the body or references of a large number of papers, but it rarely appears in titles, abstracts, or lists of keywords, which are of great importance in literature search. In other words, it is typically mentioned only in passing. Therefore, much remains to be done in the future to bring opportunistic behaviour in general into the mainstream of construction management research, let alone in its focus. This will be further discussed in the conclusions.

Opportunistic behaviour covers a wide range of phenomena, but corruption can be found among its extreme forms. According to Bowen et al. (2007: 631), unethical conduct associated with this term includes "collusion, bribery, negligence, fraud, dishonesty and unfair practices". As Bowen et al. (2012: 885) maintain, "corruption is a pervasive stain on the construction industry in many countries". And they add: "South Africa is no exception". But only these two among the 55 papers reviewed here deal with corruption, and in South Africa only. Given the widespread reputation of construction, a much larger number would thus be expected in the literature.

Concerning agent opportunism, Sharma (1997: 775) offers a useful enumeration of the restraints on such behaviour: self control, client control (principal), bureaucratic control (contracts), and community control. The second and the third constraint are dominant in the extant literature in construction management. However, the research community in this field also has a role to play in restraining opportunistic behaviour. The better it is understood, the less scope will it have for further development. Therefore, this is a useful pointer for future research in construction management. It itself is a form of community restraint on agent opportunism in construction.

## **CONCLUSIONS**

As this literature review shows, the main interest of researchers in construction management associated with the principal-agent theory is a combination of contracts and risk management to limit the principal's exposure. This has been shown by analysing keywords that appear in papers containing the "principal-agent" keyword. The associated keywords provide a clear picture of the focus of recent research. The review presented here needs to be extended in a number of related ways.

To begin with, this literature review should be extended to a wider selection of journals in the field. Over the years, many new journals have appeared, and they are gradually assuming ever greater importance. At this stage, there are around 50 of them. Although the seven journals selected for investigation in this paper are purportedly the very best, the whole field needs to be understood more thoroughly. The literature review presented in this paper offers only the first albeit essential step in this endeavour. It is to be hoped that are steps are soon to follow, however.

Also, the overlap between the principal-agent theory and transaction cost theory within the framework of NIE would be worth exploring in the future. A wider literature review connecting the two theoretical frameworks would be helpful in pointing out both the overlaps and substantial differences between the two in the context of construction management. In particular, such a review would need to focus on the difference between markets and firms, as well as other institutions involved.

Finally, future research should also investigate the widespread reputation of construction for a wide range of opportunistic behaviour, from collusion to more severe forms of corruption and graft. So far, the construction management research has apparently eschewed this important area of research, which is at the focus of the principal-agent theory. It is to be hoped that this review will provide an impetus for such research in the future. That would make it well worth the effort.

## REFERENCES

- Badenfeld, U (2008), The selection of sharing ratios in target cost contracts, "Engineering, Construction and Architectural Management", 15(1), 54-65.
- Bakker, R M, Cambré, B, Korlaar, L and Raab, L (2011), Managing the project learning paradox: A set-theoretic approach toward project knowledge transfer, "International Journal of Project Management", 29(5), 494-503.
- Bemelmans, J, Voordijk, H and 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), 342-368.
- Bond-Bernard, T J, Steyn, H and Fabris-Rotelli, I (2013), The impact of a call centre on communication in a programme and its projects, "International Journal of Project Management" (in press).
- Boukendour, S (2007), Preventing post-contractual opportunism by an option to switch from one contract to another, "Construction Management and Economics", 25(7), 723-727.
- Bowen, P A, Akintoye, A, Pearle, R and Edwards, P J (2007), Ethical behaviour in the South African construction industry, "Construction Management and Economics", 25(6), 631-648.
- Bowen, P A, Edwards, P J and 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), 885-901.
- Braun, T, Ferreira, A I and Sydow, J (2012), Citizenship behaviour and effectiveness in temporary organizations, "International Journal of Project Management" (in press).
- Bröchner, J and Björk, B-C (2008) Where to submit? Journal choice by construction management authors, "Construction Management and Economics", 26(7), 739-749.
- Ceric, A (2012a), Communication risk in construction projects: application of principal-agent theory, "Organization, Management and Technology an International Journal", 4(2), 522-533.

- Ceric, A (2012b), Minimizing communication risk in construction: a Delphi study of the key role of project managers, "Journal of Civil Engineering and Management" (in press).
- Ceric, A (2012c), Strategies for minimizing information asymmetries in construction projects: project managers' perceptions, "Journal of Business Economics and Management" (in press).
- Ceric, A (2012d), The principal-agent theory and the role of project managers in construction: guidelines for future research, Proceedings of the Joint CIB (International Building Council) Conference, Working Commissions 55, 65, 89, and 118, and Task Groups 76, and 78, "Management of Construction: Research to Practice", Niraj Thurairajah, Ed., Montreal, Canada, June 26-29, 766-776.
- Chang, C Y (2012), Understanding the hold-up problem in the management of megaprojects: the case of the Channel Tunnel Rail Link project, "International Journal of Project Management" (in press).
- Cheah, C Y J, Garvin, M J and Miller, J B (2004), Empirical study of strategic performance of global construction firms, "Journal of Construction Engineering and Management", 130(6), 808-817.
- Corvellec, H and Macheridis, N (2010), The moral responsibility of project selectors, "International Journal of Project Management", 28(3), 212-219.
- Davidson, C (2009), The challenge of organizational design for manufactured construction, "Construction Innovation: Information, Process, Management", 9(1), 42-57.
- Eriksson, E and Laan, A (2007), Procurement effects on trust and control in client-contractor relationships, "Engineering, Construction and Architectural Management", 14(4), 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" (in press).
- Farrell, L M (2003), Principal-agency risk in project finance, "International Journal of Project Management", 21(8), 547-561.
- Flyvbjerg, B (2012), Quality control and due diligence in project management: getting decisions right by taking the outside view, "International Journal of Project Management" (in press).
- 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), 678-688.
- Hossain, L (2009), Communications and coordination in construction projects, "Construction Management and Economics", 27(1), 25-39.
- Hossain, L (2009), Effect of organisational position and network centrality on project coordination, "International Journal of Project Management", 27(7), 680-689.
- Hossain, L and Wu, A (2009), Communications network centrality correlates to organisational coordination, "International Journal of Project Management", 27(8), 795-811.
- Hosseinian, S M and Carmichael, D G (2012), An optimal incentive contract with a risk-neutral contractor, "Journal of Construction Engineering and Management" (in press).
- Hsieh, H Y and Forster, J (2006), Residential construction quality and production levels in Taiwan, "Engineering, Construction and Architectural Management", 13(5), 502-520.
- Hölzle, K (2010), Designing and implementing a career path for project managers, "International Journal of Project Management", 28(8), 779-786.



- Hughes, D, Williams, T and Ren, Z (2012), Is incentivisation significant in ensuring successful partnered projects, "Engineering, Construction and Architectural Management", 19(3), 306-319.
- Hsu, J S C, Shih, S P, Chiang, J C and 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), 329-340.
- Huang, Y L and Chang, S H (2009), Design professionals' legal risks increased under nature's attack: Chichi Earthquake experience, "International Journal of Project Management", 27(6), 544-551.
- Ika, L A, Diallo, A and Thuillier, D (2012), Critical success factors for World Bank projects: an empirical investigation, "International Journal of Project Management", 30(1), 105-116.
- Jäger, C (2008), "The Principal-Agent Theory within the Context of Economic Sciences", Norderstadt, Herstellung und Verlag, Books on Demand GmbH.
- Jensen, M.C. (2000), "The Theory of the Firm: Governance, Residual Claims, and Organizational Forms", Cambridge, Massachusetts, Harvard University Press.
- Jensen, C, Johansson, S and Löfström, M (2006), Project relationships – a model for analyzing interactional uncertainty, "International Journal of Project Management", 24(1), 4-12.
- Kapsali, M (2011), Systems thinking in innovation project management: a match that works, "International Journal of Project Management", 29(4), 396-407.
- Koch, C and Buser, M (2006), Emerging metagovernance as an institutional framework for public private partnership networks in Denmark, "International Journal of Project Management", 24(7), 548-556.
- Koppenjan, J, Veeneman, W, Van der Voort, H, Ten Heuvelhof, E, and Leijten, M (2011), Competing management approaches in large engineering projects: the Dutch RandstadRail project, "International Journal of Project Management", 29(6), 740-750.
- Ling, F Y Y and Tran, P Q (2012), Effects of interpersonal relations on public sector construction contracts in Vietnam, "Construction Management and Economics", 30(12), 1087-1101.
- Lütykendorf, T and 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), 182-195.
- Mahaney, R C and Lederer, A L (2010), The role of monitoring and shirking in information systems project management, "International Journal of Project Management", 28(1), 14-25.
- Müller, R and 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), 398-403.
- Müller, R and Turner, J R (2010), Leadership competency profiles of successful project managers, "International Journal of Project Management", 28(5), 437-448.
- Ogunlana, S O (1996), Construction delays in a fast-growing economy: comparing Thailand with other economies, "International Journal of Project Management", 14(1), 37-45.
- Pinto, J K, Slevin, D P and English B (2009), Trust in projects: an empirical assessment of owner/contractor relationships, "International Journal of Project Management", 27(6), 638-648.

- Puddicombe, M S (2009), Why contracts: evidence, "Journal of Construction Engineering and Management", 135(8), 675-682.
- Quinn, D P and Jones, T.M. (1995), An agent morality view of business policy, "Academy of Management Review", 20(1), 22-42.
- Rose, T M and Manley, K (2012), Adoption of innovative products on Australian road infrastructure projects, "Construction Management and Economics", 30(4), 277-298.
- Schieg, M (2008), Strategies for Avoiding Asymmetric Information in Construction Project Management, "Journal of Business Economics and Management", 9(1), 47-51.
- Sha, K (2011), Vertical governance of construction projects: an information cost perspective, "Construction Management and Economics", 29(11), 1137-1147.
- Sharma, A (1997), Professional as agent: knowledge asymmetry in agency exchange, "Academy of Management Review", 22(3), 758-798.
- Smyth, H J and Morris, P W G (2007), An epistemological evaluation of research into projects and their management: methodological issues, "International Journal of Project Management", 25(4), 423-436.
- Turner, J R and Müller, R (2003), On the nature of the project as a temporary organization, "International Journal of Project Management", 21(1), 1-8.
- Turner, J R and 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), 327-336.
- Turner, J R, Huemann, M and Keegan, A (2008), Human resource management in the project-oriented organization: employee well-being and ethical treatment, "International Journal of Project Management", 26(5), 577-585.
- Tuuli, M M, Rowlinson, S and Koh, T Y (2010), Dynamics of control in construction project teams, "Construction Management and Economics", 28(2), 189-202.
- Ürge-Vorsatz, D, Harvey, L D D, Mirasgedis, S and Levine, M D (2007), Mitigating CO2 emissions from energy use in the world's buildings, "Building Research and Information", 35(4), 379-398.
- Vennström, A and Eriksson, P E (2010), Client perceived barriers to change of the construction process, "Construction Innovation: Information, Process, Management", 10(2), 126-137.
- Ward, S C and Chapman, C B (1991), Extending the use of risk analysis in project management, "International Journal of Project Management", 9(2), 117-123.
- Ward, S C, Chapman, CB and Curtis, B (1991), On the allocation of risk in construction projects, "International Journal of Project Management", 9(3), 140-147.
- Ward, S C and Chapman, C B (2008), Stakeholders and uncertainty management in projects, "Construction Management and Economics", 26(6), 563-577.
- Williams, T M (1993), Risk-management infrastructures, "International Journal of Project Management", 11(1), 5-10.
- Xiang, P C, Zhou, J, Zhou, X Y and Ye, K H (2012), Construction project risk management based on the view of asymmetric information, "Journal of Construction Engineering and Management", 138(11), 1303-1311.
- Yu, A G, Flett, P D and Bowers, J A (2005), Developing a value-centred proposal for assessing project success, "International Journal of Project Management", 23(6), 428-436.

- Yung, P and Lai, W C (2008), Supervising for quality: an empirical examination of institutional arrangements in China's construction industry, "Construction Management and Economics", 26(7), 723-737.
- Zhang, X (2009), Win-win concession period determination methodology, "Journal of Construction Engineering and Management", 135(6), 550-558.

