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A Note on Developing A New Type of Construction Contracts to Promote New Technologies and Sustainability

Jonas Anund Vogel[1]*, Hans Lind[2] and Cyril Holm[3]

[1]*Department of Energy Technology, Royal Institute of Technology, Brinellvägen 68, SE-10044 Stockholm, Sweden*

[2]*Department of Real Estate and Construction Management, Royal Institute of Technology, Stockholm Sweden*

[3]*Faculty of Law, Stockholm University, Stockholm, Sweden*

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***Corresponding author:** Jonas Anund Vogel, Department Energy Technology, Royal Institute of Technology, Brinellvägen 68, SE-10044 Stockholm, Sweden

Abstract

In its different forms, the built environment is the single largest energy consumer in the EU, and one of the largest carbon dioxide emitters. Green buildings and smart technologies are two of the most important elements to reach this goal. In a situation where the use of new technologies and new knowledge becomes more important as well as the news flow increase the role of the technical consultant becomes more important. Also, the client/developer role become increasingly important when buildings turn from storage facilities to service generating entities. A closer alliance between client and consultant is necessary to align business models with new technologies. Contracts are the most important instrument to shape incentive structures for optimal economic outcomes, as well as for shaping incentives for optimal operation of smart and sustainable buildings. In this paper we propose a contract design that incentivise consultants to fully use their knowledge to make sure that planned systems are installed and operated in an optimal manner. There are in general two approaches to this type of contract design. The first is to write a detailed contract setting out how to deal with possible outcomes going forward. The second, and the approach used in this paper, is to write a less detailed contract that sets out a framework of incentives for continuing cooperation and to keep a good reputation.

Keywords: Contracts; Incentives; Construction sector; Sustainable buildings; Collaboration

Introduction

At present, buildings account for approximately one-third of total CO_2 emissions in the world. Contrary to expectations, this share is continually increasing [1,2]. There are possible avenues to decrease this share, such as introducing resource-saving technologies, using environmentally friendly building materials, and installing interactive tools to nudge users of a building towards resource-efficient behaviour [3-7].

As we see it, there are challenges ahead just to make use of the best available technology, especially in a situation when technologies develop fast. Once installed, there is an additional challenge to operate it at full potential. Currently, this is often far from the case. The gap between design and reality - or between estimated and actual resource use – is known as the "performance gap" [8,9]. Such a performance gap can result in increased operational costs, lower asset values [10], and missed resource-related targets [11]. The reasons for such failures are to be found in problems in design, construction, and operation [12], but also, as we focus on in this article, in a non-optimal incentive structure and hence in broader contractual issues [13,14].

A further challenge is to continuously update technology and make adjustments when there is new knowledge. The ongoing digital transformation emphasize the need for flexibility. This is also a matter of risk management and risk-sharing as new technologies will be riskier [15,16]. The idea in this paper is that when technologies develop fast and there is a need to introduce new technologies quicker, more room should be given to the technical consultant, or the combination of developer and consultant, as that actor or combination of actors can be expected to have the best knowledge. As new technologies by definition are riskier, a crucial issue will be how to manage and share these risks.

This research develops a strategy for mitigating buildings' environmental impact through innovative contracts that support the adoption of new technologies. By addressing the performance gap and refining incentive structures, it explores the sometimes complicated dynamics between technology, knowledge, risk, on the one hand, and contractual design, on the other hand. The proposed contract model, developed with input from industry stakeholders, strives to align interests across construction projects, promoting collaboration, effective risk management, and the integration of sustainable technologies. As introducing a new type of contract is risky it is important to "test" ideas of new contracts in a dialogue with practitioners before we can expect that actors in the sector are willing to test a new type of contract in practice.

Contracts are the most important instrument to shape incentive structures for optimal economic outcomes, as well as for shaping incentives for optimal operation of smart and sustainable buildings. In this paper, we propose a contract design that incentives consultants to fully use their knowledge to make sure that planned systems are installed and operated optimally. There are in general two approaches to this type of contract design. The first is to write a detailed contract setting out how to deal with possible outcomes going forward. The second approach, the approach used in this paper, is to work with a less detailed contract and focus on the interplay between contract design and a reputation mechanism.

The structure of the paper is as follows. In section 2 the theoretical framework is presented. In section 3 the methodology is described and in section 4 the preliminary new contract is presented and motivated. Section 5 presents the problems that the actors pointed out in the preliminary contract and how these can be handled in an improved contract. Concluding comments can be found in section 6.

Theoretical Background

Contract Law is important because the world of business is largely conducted on contracts that set out the terms of cooperation between business partners. As such, it is one of the pillars of how the economy functions and leads to material welfare. Contract law is the "plumbing" [17] of contracting; it sets out how to contract according to the law on issues such as (i) the formation of contracts, (ii) the contents of the contract, (iii) the termination of contracts, and (iv) the basis for contractual liability and damages. One starting point for this study is economic contract theory and the general question of how to handle the principal/agent relationship and create incentives for efficient solutions. Important contributions to this literature are for example Coase [18,19], Ostrom [20,21], Holmström and Milgrom [22,23], Hart [24,25], and Hart and Holmstrom [26].

The following aspects of contract theory are especially important for the design and analysis of the preliminary contract presented below:

i. Asymmetric information and opportunistic behavior. In a complex economy, actors specialize and have different sets of knowledge. The fundamental cause of principal-agent problems is the need for specialization and cooperation and the risk of opportunistic behavior of both principals and agents. We return to issues related to fairness and trust below, but we believe that one should always as a benchmark analyze the consequences of a specific contract design in a situation where actors are driven by self-interest.

ii. An important distinction is between observable facts and those that are verifiable[1]. If the behavior of a contracting party is verifiable in a court, then the parties can contract on this behavior and introduce punishments if the terms of the contract are not fulfilled. But in some situations, the behavior might be observable by the parties but not verifiable in a court, and then other ways have to be found to create incentives.

iii. A central thesis in contract and game theory is that it is easier to create incentives in a repeated transaction or, more generally, where reputation is important. If important information is observable but not verifiable, then the principal can create incentives by (credibly) promising future business opportunities if the agent behaves well.

iv. In a wider sense, contract theory is about the efficient allocation of decision rights. This is a core issue in this paper where the focus is on the respective roles of primarily the client and the technical consultant.

v. In a dynamic economy, incentive problems do not only concern the use of existing knowledge but also how to create incentives to continually update knowledge. This is also central for the analysis in this paper, as one starting point is that we live in a situation where the flow of new information related to sustainability has increased.

vi. The risk for opportunistic behavior can also arise in situations where a contract needs to be renegotiated. In projects that take several years to finalize, the client can - in a world where there is a constant flow of new knowledge and new technologies - be expected to want to change some parts of a design during the implementation of the project, and there need to be incentives that make renegotiations cheap and leading to efficient solutions.

vii. The effect of risk allocation is also central. For example, if a contract assigns risk to a party that does not have the resources to handle high risk, it can be expected that the decision-maker will favor safer solutions. But one starting point in this article is that it is urgent to introduce new more sustainable solutions and that new technologies typically are riskier. The question of risk allocation then becomes especially important.

Traditional contract theory assumes self-interested parties and as we argued above is it always important to test how contracts work given this assumption. It should, however, be mentioned that later research shows the importance of ethical

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behavior, fairness, and trust for functioning contractual relations and efficiency (see for example [25,27-30]. We will return to these aspects below in the evaluation of the proposed contract.

Methodological Approach

The study was carried out in two steps. The first was to develop a preliminary contract. In this stage, an informal deductive approach was used. It was important to try to predict the consequences of a specific contract design. To predict what will happen in different situations we employed theoretical models, such as in deductive mathematical modelling. This approach includes making assumptions about the actors´ motives, as well as their choice situations. In this way, the aim was to investigate possible real-life outcomes, much like game theory. This study does not present any mathematical models but uses the same reasoning as in deductive mathematical modelling. The informal models must cover both how different rational actors would use existing knowledge, but also their incentives to keep updated on the latest technologies and knowledge.

Introducing new contracts is risky as it is difficult to predict what will happen in different complex situations. To reduce the risk in implementing the proposed contract we thought that the contract needed to be "tested" by letting a larger number of different types of actors look at the contract and present their reflections about especially potential problems when implementing the contract. This was done in several different ways. The first was to use the reference group for the larger project in which contractual design is one issue. This reference group consists of representatives from clients, contractors, and consultants - both from the public and private sectors - and also other researchers. In the second step, the design principles were presented for three large private property owners who also act as developers. They have a different focus: housing, offices, and shopping centers. In the third step, the proposed contract design was discussed with legal experts at the Federation of Swedish Innovation Companies.

A New Type of Contract for More Sustainable Solutions

The general idea behind the contract that is proposed below is to design a rather simple contract and then rely primarily on a reputation mechanism to align the interests of the parties. Arguments for and against more detailed contracts are discussed in several recent articles. Wang, Lu and Wei [31] discuss the effects of more detailed contracts in the context of the Chinese construction sector. They underline the possible conflict between detailed contracts with power based on such contracts and good relations between the parties that more flexibility can create. When the situation is more complex it might also be the case that the developer does not use the power that the contract formally gives. The role of trust in solving design quality problems is analyzed more in detail by Uusitalo et. al. [32]. Based on a detailed case study they point out that many factors affect the possibility of solving design quality problems and even though trust can make it easier they argue that trust is neither a necessary nor sufficient condition for problem-solving.

Description of The Contract Structure

As mentioned in the introduction the role of the technical consultant becomes more important when more up-to-date knowledge is needed to reach sustainability goals. In an earlier article [13] standard consultancy contracts are criticized for not creating the right incentives in this situation. In this section, an alternative type of contract is sketched. It is assumed that a client wants to build a smart and sustainable building. The main thrust of our ideas is to set out an extended alignment of incentives between developer and consultant over a contractual timeframe that includes the meeting of operational targets of a building.

Traditional construction contracts manage the design and consulting work from ideation to the start of the construction works. However, to make smart and sustainable buildings possible and incentives the consultant to fully commit, the contract scope should change to the whole process, from ideation to building operation. This could be achieved by changing the overall objective for the design and construction assignments. Instead of ending the contract at the final inspection, it should continue until stable operational performance is verified, which typically would take a few years.

One way to manage the incentives and knowledge transfer is to let the consultant be fully included in all decisions related to the technical systems in the building. This means that the consultant and the developer jointly lead the construction project from idea to verified performance and they have to agree about the decisions made. As the developer/client typically has less technical knowledge it will in practice mean that the client on many points delegate authority to the consultant. This also means that the consultant and the developer are jointly responsible for the information and training of the personnel that manages a jointly developed building. Such information and training aim to operate said building at (i) targeted and (ii) verified, operational performance.

The consultant and the developer are jointly responsible for, (i) the requisite technical know-how in the planning phase, and (ii) coordination of technical installations in the construction phase. The consultant is contracted until the time when targeted and verified performance should be met. In detail, this entails (1) That the consultant is involved throughout the whole process in close collaboration with the developer. An important instrument for such a collaboration is frequent joint financial and technical meetings. (2) That the consultant is designated as a fully mandated representative for the developer in all aspects

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related to the contract. (3) That the consultant is responsible for the coordination of installations, project management, and optimization of building operations. (4) That the consultant leads the information handling process and is responsible for transferring relevant information to the developer when the contract concludes; that is, when targeted and verified operations are met.

The most pressing issues relate to the phase after construction and concern tracking of issues, interconnected systems, responsibility, and timeframes for fixing the issues. The proposed agreement addresses this situation by making the consultant the designated representative for the developer in all these issues. Because the consultant is responsible for the system delivering on target, s/he is in a natural position to track issues with those targets. In addition, the contract gives the consultant the power and the means to resolve issues by contacting contractors, sub-contractors, etc. In essence, the consultant will know what to do, will have the decision-making power to make things happen, and as we will describe later – have incentives to act. The contract shall stipulate that the consultant has the right to enforce necessary issues "without delay", or, the consultant will resolve an issue on behalf of the client. Here there could be discussions related to just how quick "without delay" is. The main idea here, of course, is to prevent delays from cascading through the system.

As mentioned, the consultant manages service throughout the contract period. This is to ensure that all interconnected systems behave as planned. If systems are procured and constructed by special system providers, as is often the case with HVAC systems, the consultant will coordinate actions to optimize overall system performance, thereby avoiding the optimization of single stand-alone systems to the detriment of the system that is the building.

The consultant is remunerated based on hours worked. In addition, the parties can agree on a bonus to be paid if the agreed targets are met. The bonus may also be divided into tranches if the project is evaluated after different stages. Traditionally, consultants cannot manage large upfront costs. For our model to incentivise the consultant to perform at the top level there could be adjustments to the hourly fees for the total project. For instance, the price/hour could be lower throughout the whole project, while the bonus part gets the total remuneration to a market level. If the price/hour is below the market rate, the risk of adding unnecessary hours arguably decreases, while the incentive to reach targets increases.

Constructing an efficient bonus system is, however, not easy. Relating the bonus to very specific measurable targets can, as discussed in the theory section, lead to sub-optimization where the consultant primarily focuses on bonus-related parameters. Palm [33] studied contracts between private property owners and property management companies and found a contract where it simply was said that there could be a bonus if the client was satisfied with the work. The advantage of such a formulation is that the agent needs to focus on making the client satisfied and it therefore reduces the risk for sub-optimization. The agent is however completely dependent on the goodwill of the client as no measurable target is specified. As discussed more in detail in the next section, the proposed contract is dependent on a functioning reputation mechanism and such a mechanism is also necessary when there is this kind of general formulation about bonuses in the contract. It could also be possible to find a middle ground where client satisfaction is the main parameter, but where measurable targets are introduced as indications of whether the client has reasons to be content or not.

For safeguarding the developers' economic interests, the contract also includes a paragraph stating that the developer can at each meeting choose to end the contract. This is necessary as the developer is economically responsible. If such a paragraph is not introduced, the developer may rightly fear that the consultant proposes measures that are too costly or reduce revenues. Both parties should have an incentive to think about profitability.

Analysis of Incentives and Risks

As we have argued above, to run and optimize smart and sustainable buildings there is a constant need for having access to up-to-date and relevant information, as well as access to all systems of a building. An important idea with the proposed type of contract is that it should lead to the passing of this information from the consultant to the developer in a way that allows s/he to operate the building in a way that takes full advantage of climate-friendly technology, as well as being cost-effective. For this to be possible, we suggest the consultant leave all rights and information to the developer, and as mentioned above this included performing necessary training and education for the developer's own or hired facility management personnel for systems to be operated at optimal levels.

A basic problem from an incentive perspective is, as indicated above, that the contract gives more power to the consultant while s/he has no long-term responsibility for the economic return of the investor. There are, however, at least four mechanisms that reduce this risk and strengthen the incentives for the consultant to take economic aspects into account.

i. The client/developer can terminate the contract at any time if they think that the consultant proposes or takes measures that increase the risk or cost for the investor unreasonably. This can, however, lead to a situation where the consultant accepts solutions that are not as good as is possible from a sustainability perspective to keep their job. but this can be counteracted by mechanism 3 below.

ii. A bonus system that focuses on the actual performance concerning the performance calculated at the outset of the project, also considering mutually accepted changes along the project lifespan. A third party could independently verify the performance in the relevant dimensions if that is judged necessary.

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iii. The most important incentive is, as we see it, the reputation of the consultant and of the developer/client. Let us assume that there is a demand for smart and sustainable buildings performing in line with theoretical calculations and expectations. Let us further assume that a consultancy firm describes itself as professionals in delivering just this. If the consultant in a project demands measures that are not economically reasonable, and the client/developer terminates the contract, this will affect the reputation negatively and reduce future demand for the services of the consultant. The same will happen if the consultant gives way to pressure from the client/developer and accepts lower quality and/or weak performance and sustainability. This should reduce demand from developers who take sustainability seriously and have a reputation linked to this. Similarly, if the developer terminates the contract without conclusive arguments, this will affect the reputation of the developer.

iv. As discussed in Cidik & Boyd [34] how well cooperation works in a construction project also depends on what they call a "shared sense of purposefulness". Given the current climate-related problems and the need for a more sustainable construction sector such a shared sense of purpose should be natural in the kind of cases discussed in this article and such a shared sense of purpose would further reduce the risk of opportunistic behavior. In economic theory there is, as mentioned in the introduction, a trend arguing that to understand actual behavior, ethical aspects have to be taken into account and this strengthens the incentives to "do the right thing" in situations with asymmetric information and risk for opportunistic behavior.

A final comment on further risks from the perspective of the client/developer is the following. One risk is that the consultant works inefficiently and spends too many hours on the project. It can however be argued that the reduced hourly price and the importance of the bonus make it risky for the consultant to work "too much" as it might lead to termination of the contract by the developer [35,36]. This reduces the risk for the developer of having to pay for too many hours. Another risk from the developer´s perspective is that the consultant does not deliver the sustainable building that was promised and chooses techniques that do not hold what they promise. The bonus and the importance of the consultant´s reputation should, however, reduce this risk.

Comments on the Proposed Contract and Possible Adjustments

One question that came up in several discussions was problems related to measuring and verifying the performance of a building.

We agree that this is a very important issue but there are for, example, several environmental certification systems where measuring and evaluation is a core issue. Over time this problem has become less pressing, and as underlined in the last section, reputation mechanisms and trust should reduce this problem. Another issue related to this was questions about the design of a bonus system. How should a bonus system be designed and how can conflicts related to the bonus system be reduced and managed? The contract sketched above can be used both with and without bonuses and if bonuses are used, they can be stronger or weaker. As discussed above they can also be designed in very different ways, from relating the bonus to measurable features or to how satisfied the client is in general. The choice here is up to the parties, and over time this part of the contract can be developed when experience in the use of the contract increases.

A further argument related to measurement issues was the following: How a building functions depends on the interaction of a large number of components and how the work installing them was carried out. This means that even though the consultant has done a very good job, the performance may in some dimension not reach the target. This creates a large risk for the consultant.

If this is believed to be a big problem, it is an argument against using a bonus system. If there is no bonus the client and consultant can just agree that the consultant has done a good job and there should be no economic losses for the consultant and no loss in reputation, even if measurable targets have not been reached due to factors outside the control of the parties. Another argument was that the contract focuses on the relation between the client and consultant and the larger role of the latter. But how does this affect the contracts with other parties, for example, the contractor and the subcontractors?

As we see it, it is logical with a basic Design-Bid-Build structure if the client and the consultants decide what should be built. The contractor should then just build what these parties have agreed about. In a situation where there is a continuous flow of new information, there is however a need to make changes during rather late stages in the process, and this points in the direction of introducing some partnering elements in the contract with the contractor. Both what the contractor should do and the economic remuneration to the contractor must be able to change even rather late into the construction phase. It was also argued that there should at least be a preliminary fixed length of the contract between the client and contractor. A prediction of the construction period and the time it will take to adjust the technical systems is then made. If there are delays and other kinds of problems, then the contract length can be adjusted but a preliminary fixed length makes things clearer and reduces the risk of opportunistic behavior. The starting point for the proposed contract was that the consultant is the part that has the most updated knowledge. It was, however, pointed out that companies that produce various components can have even better knowledge and also be working with a service component including maintenance and performance guarantees.

We are somewhat sceptical on this point. How a building functions depends on the interaction of several components, and this makes guarantees related to a specific component

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problematic. The producer could blame outside factors if their component does not work as promised. There is also a risk for opportunistic behavior when a client interacts with a specific producer and depends on information from that producer. We would instead underline that it is important that the consultants have good contacts with various producers and collect independent information about how their products work and how they interact with other components.

It was furthermore argued that when building operation is outsourced there are often short contracts, and this makes it more difficult to operate the building to optimal performance. We agree with this, and it is of course true that performance does not only depend on the factors regulated in the proposed contract. It is however in the end up to the developer to decide how to organize property management. There seems to be a trend in Sweden of doing more in-house, primarily related to customer relations, but operating a technologically complex building could also be an argument for doing more in-house.

One of the property owners pointed out that they also own a construction division and for them, it would be natural to include staff from that division together with the technical consultant in the construction process. A more general point is the need to adjust that contract to the type of client where, for example, clients who build more regularly can have a more active role in the cooperation with the technical consultant.

We also met more conservative reactions among property owners: The new contract seemed complex, and they did not see any major problems in how they worked now. Others were more interested in testing the new contract but so far, they have not taken any major steps in that direction. A more specific comment from the legal experts concerned the termination of the contract. In ordinary contracts, termination is only possible if the other party has made major mistakes. We explained that in the proposed contract the client needs to protect their economic interest when the consultant is given more power, and the possibility to terminate the contract is then important. Some economic compensation to the consultant for the termination of the contract could however be introduced, but the client should not have to refer to some mistake to have the right to terminate the contract.

Concluding Comments

To make smart and sustainable buildings possible on a large scale, we need to rethink the role of different actors involved in construction projects and also how to incentivise actors to fully commit and to be present from ideation to operation. Building smart and sustainable buildings with interconnected systems is fundamentally different from constructing traditional buildings with many separate subsystems. This article proposes that empowering technical consultants can be one way to move towards this goal, given their expertise in new technologies. A closer alliance between client and consultant becomes important to align business models with new technologies, which shifts the balance towards models that include partnering elements and away from models where several parties typically are rather passive.

This paper presents a possible contract design for client-consultant collaboration. The same ideas can be used for developing client-contractor collaboration or consultant-contractor collaboration. The important thing is to ensure that all actors involved have strong incentives to optimize the overall performance of the final product and to get all actors to understand the overall purpose of the project.

The study points to the broader challenges of fostering innovation in construction, emphasizing the need for a cultural shift towards more adaptive and collaborative practices. It suggests that while technological solutions are vital for reducing CO_2 emissions, their success also relies on contractual incentives for technological deployment. Hopefully, this article contributes to sustainable construction, by advocating further experimentation with new contract types to achieve sustainable, efficient building practices amidst rapid technological evolution.

As with all innovation, there is a need for "early adopters" - actors who are willing to take the extra risk. This could be private actors but there is also a role for public actors that can be more willing to take risks to speed up the change to a more sustainable society. As in much construction the nexus of private and public - on multiple levels - will be a decisive factor.

A final comment is that the theoretical development in contract theory where ethical aspects, fairness, trust, shared sense of purpose, and reputation mechanism are given more important roles implies that future research should look closer at how ideas and results in these areas can be used to analyze and improve the workings of the construction industry.

References

1. Berardi U (2013) Clarifying the new interpretations of the concept of sustainable building. Sustain Cities Soc 8(2013): 72-78.
2. International Energy Agency (2019) International Energy Agency.
3. Hargreaves T, Nye M, Burgess J (2013) Keeping energy visible? Exploring how householders interact with feedback from smart energy monitors in the longer term. Energy Policy 52: 126-134.
4. Nguyen TA, Aiello M (2013) Energy intelligent buildings based on user activity: A survey. Energy and Buildings 56: 244-257.
5. Norouzi M, Chàfer M, Cabeza LF, Jiménez L, Boer D (2021) Circular economy in the building and construction sector: A scientific evolution analysis. J Building Eng 44: 102704.
6. Wallin J, Knutsson J, Karpouzoglou T (2021) A multi-criteria analysis of building level graywater reuse for personal hygiene. Resour Conservation Recycl Adv 12: 200054.

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7. Wilkinson S, Zalejska Jonsson A (2021) Student accommodation, environmental behavior and lessons for property managers. Property Management.
8. Galvin R (2014) Making the "rebound effect" more useful for performance evaluation of thermal retrofits of existing homes: Defining the "energy savings deficit" and the "energy performance gap." Energy and Buildings 69: 515-524.
9. Gana V, Giridharan R, Watkins R (2018) Application of Soft Landings in the Design Management process of a non-residential building. Architect Eng and Design Manage 14(3): 178-193.
10. Anund Vogel J, Lind H, Lundqvist P (2016) Who is Governing the Commons: Studying Swedish Housing Cooperatives. Housing, Theory and Society 33(4): 424-444.
11. Fedoruk LE, Cole RJ, Robinson JB, Cayuela A (2015) Learning from failure: Understanding the anticipated-achieved building energy performance gap. Building Research and Information 43(6): 750-763.
12. Way M, Bordass B (2005) Making feedback and post-occupancy evaluation routine 2: Soft Landings - Involving design and building teams in improving performance. Building Res and Info 33(4): 353-360.
13. Anund Vogel J, Lind, H., & Holm, C (2019) Incentivising innovation in the construction sector: The role of consulting contracts. Construct Econom Building 19(2): 181-196.
14. Anund Vogel J (2020) Incentivising Innovation in the Swedish Construction Industry [Royal Institute of Technology].
15. Duong TBA, Pham T, Truong QH, Nguyen K, Pham CH, et al. (2023) Risk in sustainable construction supply chains: construct development and measurement validation. Construction Management and Economics 41(8): 634-650.
16. Duflo E (2017) The economist as plumber. American Economic Review 107(5): 1-26.
17. Nguyen HD, Do QNH, Macchion L (2021) Influence of practitioners' characteristics on risk assessment in Green Building projects in emerging economies: a case of Vietnam. Eng Construct Architect Manage 30(2): 833-852.
18. Coase RH (1937) The Nature of the Firm. Economica 4(16): 386-405.
19. Coase RH (1960) The Problem of Social Cost. J Law & Economics 56(4): 837-877.
20. Ostrom E (1990) Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge University Press.
21. Ostrom E (2005) Understanding institutional diversity. Princeton University Press.
22. Holmström B, Milgrom P (1991) Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design. J Law Econom Organization 7: 24-52.
23. Holmström B, Milgrom P (1994) The Firm as an Incentive System. The American Economic Review 84(4): 972-991.
24. Hart OD (1975) On the optimality of equilibrium when the market structure is incomplete. Journal of Economic Theory, 11(3): 418-443.
25. Hart O (2017) Incomplete contracts and control. The American Economic Review 107(7): 1731-1752.
26. Hart O, Holmstrom B (2010) A theory of firm scope. The Quarterly J Economics 125(2): 483-513.
27. Halonen-Akatwijuka M, Hart O (2020) Continuing contracts. J Law, Economics, and Organization 36(2): 284-313.
28. Palanski ME, Kahai SS, Yammarino FJ (2011) Team Virtues and Performance: An Examination of Transparency, Behavioral Integrity, and Trust. J Business Ethics, 99(2): 201-216.
29. Finegan JE (2000) The impact of person and organizational values on organizational commitment. J Occup and Org Psychol 73(2): 149-169.
30. Stephenson AK (2009) The Pursuit of CSR and Business Ethics Policies: Is it a Source of Competitive Advantage for Organizations? J Am Academy of Business 14(2): 251-262.
31. Wang R, Lu W, Wei Y (2021) Owners' use of contract-based power in construction project transactions: restrictions from process specificity and uncertainty. Construction Management and Economics 39(2): 117-132.
32. Uusitalo P, Lappalainen E, Seppänen O, Pikas E, Peltokorpi A, et al. (2021) To trust or not to trust: is trust a prerequisite for solving design quality problems? Construction Management and Economics 39(4): 279-297.
33. Palm P (2007) Closing the loop: The use of Post Occupancy Evaluations in real-estate management [Royal Institute of Technology].
34. Çıdık MS, Boyd D (2020) Shared sense of purposefulness: a new concept to understand the practice of coordinating design in construction. Construct Manage Econom 38(1): 18-31.
35. Andrén Y (2007) Ledning av delad entreprenad: för och nackdelar med construction management.
36. Lind H, Nyström J (2011) The Explanation of Incomplete Contracts in Mainstream Contract Theory: A Critique of the Distinction between "Observable" and "Verifiable." Evolut Institut Econom Rev 7(2): 279-293.

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