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A REVIEW OF RESEARCH IN CONSTRUCTION INCENTIVIZATION

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Due to increased project complexity and technological advancements in the last decade, designers and contractors are expected to render more effort to achieve the challenging project goals. To elicit extra efforts from agents, incentivization has become one of the primary strategies employed by clients. Despite increased academic interest in the design of incentive strategies, results of incentivization on project performance remain mixed. This study aims to reconcile these observations through a systematic review of existing literature on construction incentivization. Accordingly, the following research objectives are achieved: (1) examining the main purposes of using incentives, (2) identifying types of incentives are used in construction projects, and (3) evaluating the impacts on project performance that are derived from the use of incentives. Based on the results of the literature review, a framework to study construction incentivization is developed. This study offers a detailed framework to map the types of incentives with the expected outcomes.

Keywords: Construction incentive, Project performance, Systematic review, Project goals.

1 INTRODUCTION

Construction incentives are the most commonly used tools to elicit extra efforts from contracting parties such as contractors, consultants, and suppliers. For instance, clients can use high-power lump sum contracts with extra payment to incentivize project teams or low-power target cost contracts with risk/reward sharing or cost-reimbursable contracts (Laffont and Martimort 2002). Besides forms of contract, explicit incentives encompassing all types of rewards/penalties for satisfactory/unsatisfactory project performances are possible options. In addition, implicit non-material incentives such as reputation, promotion, repeated business, and tournaments, are often applied for prestigious projects (Li *et al.* 2020, Zhu *et al.* 2020). Incentive/contract theories predict that with either explicit or implicit incentives, more effort by agents can be elicited as long as the incentives provide agents with more profits (Salanié 2005). Indeed, some studies have demonstrated other positive effects of incentives on construction project performances, such as cost savings, schedule reliability, and project quality (Meng and Gallagher 2012). However, many cases have also been reported where individuals or teams involved in incentivizing programs were not as productive as expected, or even less productive than non-incentivized ones (Back *et al.* 2013).

The mostly cited explanation for the inconsistent incentive outcomes comes from Deci and his associates. They argued that economic incentives for task performances cannot be counterproductive (Deci *et al.* 1999, Ryan and Deci 2000, Gagné and Deci 2005). Pecuniary incentives tend to decrease the self-motivation to excel and further undermine individuals' performances. In other words, economic incentives could crowd out intrinsic motivation, which plays a pivotal role in individual task performance especially for those requiring innovation (Benabou and Tirole 2003). Specifically, incentives provided by employers can adversely affect an agent's perception of the task or of their own capability. Individuals may attribute changed actions or performances to economic incentives and devalue the role of intrinsic motivation. The motivation crowding theory, which describes the diminishing effect of economic incentives, has been applied in many fields to explain the unanticipated negative effects of incentives (Frey and Jegen 2001). Despite the unexpected effect of incentives that deviate from the predictions of economic theories, very few studies have attempted to investigate whether incentives can bring positive impacts to construction project performances.

Thus, it is aimed to complement this line of research by conducting a systematic literature review of the use of incentives in construction projects. The research questions developed to guide the literature review are as follows: (1) What are the main purposes of using incentives? (2) What types of incentives are used in construction projects? and (3) What impacts on performance can be derived from the use of incentives? Based on the results of the literature review, we create a framework to study construction incentivization.

The paper is organized as follows. The next section gives an overview of the theoretical background of construction incentivization. In the third section, the research methods used in this study are presented. The results and discussion are outlined in the fourth section. The conclusions are given in the last section.

2 THEORETICAL BACKGROUND

The purpose of using incentives by the principal is to elicit extra effort from the agent. Theories such as principal-agent theory and incentive/contract theory rely on the assumptions that agents are utility maximizers and will take action as long as the incentives offered by the principal are material (Laffont and Martimort 2002). The participation required of the agent can derive greater utilities through accomplishing the task delegated by the principal. The effort that the agent puts into the task can increase the principal's expected benefit by improving project success, while increasing the agent's cost. The incentive constraint requires that the agent should have higher utilities if they take action or put in extra effort compared to the scenario where they do not take action or put in extra effort (Hosseinian *et al.* 2021). In other words, the incentive offered by the principal should be higher than the cost of the agent's effort. In this way, the agent will be keen to participate and put in extra effort into the task. The concept of 'rent extraction' in incentive theory is used to design the optimal incentive, i.e., maximizing the principal's benefit. 'Rent' can be understood as the net profit of the agent, which can simply be identified as compensation minus cost. The goal of incentive design is to induce the agent to put in extra effort or take action with minimum rent. Despite incentive design complying with these economic principles, incentives used in construction often fail to achieve project goals (Kohn 1993).

Social psychologists have proposed theories to explain the unexpected outcomes of using incentives. Deci and Ryan (2000) developed the self-determination theory to highlight that individual motivation that stems from the satisfaction of innate psychological needs. In this regard, the basic psychological needs include needs for competence, autonomy, and relatedness. Competence refers to the perception of being effective or a belief in one's capability to implement the work with skill (Spreitzer 2008). Autonomy refers to the individual's ability to self-regulate

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their plans and actions. Relatedness represents the tendency toward relatively broad connectedness with others (Deci and Ryan 2000). Moreover, Frey and Jegen (2001) proposed motivation crowding theory, which explains how economic incentives crowd-in or crowd-out intrinsic motivation. Crowd-in effect refers to the phenomenon when incentives reinforce or strengthen intrinsic motivation in some cases, e.g., when rewards as incentives signal recognition of competence (Fehr and Falk 2002). The crowd-out effect means that incentives would decrease the level of intrinsic motivation under certain circumstances, e.g., imposing heavy sanctions as a signal of hostile action can reduce intrinsic motivation (Corduneanu *et al.* 2020). These social psychological theories provide a plausible explanation for failed incentive programs.

3 RESEARCH METHODS

A systematic review of the incentivization literature was conducted to identify and categorize prior research. The review follows a structured approach to analyze and categorize literature, enabling replication. The purpose of the review is to provide collective insights into synthesizing and analyzing existing research. The process of a systematic literature review includes identification, evaluation, summarizing of the relevant individual studies, and providing researchers with a holistic overview of prior evidence.

Following the literature review method used by Kujala *et al.* (2021), the systematic literature review was conducted as follows. Three leading peer-reviewed journals of project management in this field, the International Journal of Project Management (IJPM), Project Management Journal (PMJ), and International Journal of Managing Projects in Business (IJMPB), and two ASCE (American Society of Civil Engineers) journals of construction management, i.e., Journal of Construction Engineering and Management (JCEM) and Journal of Management in Engineering (JME), were selected to capture relevant research on the use of construction incentives. This can be justified as these journals represent the main body of knowledge in construction project management research. Specifically, the keyword used for literature search was 'incentive'. The period was set from January 1994 to January 2024, with a 30-year time span. The specific literature search and analysis process are presented as follows:

(i) The first stage of the literature search collected a total of 92 research papers from IJPM, PMJ, IJMPB, JCEM, and JME.
(ii) The second stage of literature selection aimed to identify papers that addressed research questions related to construction incentivization. A structured Excel database was created, comprising the 92 papers. All papers were read and reviewed by the authors to decide whether the paper addressed the issues of construction incentive. Papers that did not address construction incentivization or addressed incentivization as a sub-objective were excluded in this process. After the process of literature selection, a total of 54 papers were identified as relevant for the next step analysis.
(iii) In the third stage, we carefully reviewed the content of the 54 papers to identify specific incentivization approaches and impacts discussed in the existing literature.

4 RESULTS AND DISCUSSION

Based on the systematic literature review, five categories of construction incentivization research were identified. Table 1 presents the main categories, theoretical bases, and incentivization approaches and impacts identified in the literature. These five categories include economic incentive schemes, implicit incentive schemes, performances of incentives, incentivization for sustainability, and incentivization for new technology adoption. The theoretical bases and incentivization approaches of each category are discussed in the following paragraphs in detail.

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Table 1. Category of research relevant to construction incentivization.

No.	Main category	Theoretical bases	Incentivization approaches and impacts identified in the literature
1	Economic incentive scheme	Game theory, agent theory, incentive/contract theory	Implementing economic incentive/disincentive to motivate project participants. Studies have investigated the optimization of incentive schemes, and many of them focused on PPP projects. More researches are needed to examine the real impacts of these proposed optimal incentive schemes.
2	Implicit incentive scheme	Agent theory, self-determination, social capital theory	Implementing non-material incentives like reputation incentive (Li *et al.* 2020, Zhu *et al.* 2020), tournament incentive (Lv *et al.* 2022) and boosting intrinsic motivation for performance improvement (Solheim-Kile and Wald 2019). Studies have shown that the implicit incentive scheme is workable in enhancing performances.
3	Performances of incentives	Incentive/contract theory	Incentivization for project performances, like quality (Garg and Misra 2023), cost (Choi *et al.* 2021), schedule, safety (Meng and Gallagher 2012). The focus of studies was on the relationship between incentivization and project performances. Inconsistent findings were reported in existing literature.
4	Incentivization for sustainability	Game theory, prospect theory	Financial-based incentive or penalty plan for sustainability, like reducing construction waste (Mahpour and Mortaheb 2018) and carbon emissions reduction (Huang and Fan 2022, Kim *et al.* 2022).
5	Incentivization for new technologies adoption	Game theory	Incentivization for adoption of new technologies or methods, like blockchain (Lu *et al.* 2021), MiC (Modular Integrated Construction) method (Chen *et al.* 2023). Empirical evidence should be collected in future studies to validate the impacts of incentivization for new technologies adoption.

- **Economic incentive schemes**: This category is about designing optimal incentive to achieve maximum benefit for the principal with due regard to the risk preferences of the principal and agent. Many studies have focused on target cost contracts with risk/reward sharing incentives and attempted to propose optimal sharing fractions between the principal and agent (Chang 2014, Hosseinian *et al.* 2020). Another important research stream examines how to allocate risks and determine subsidies to incentivize PPP (public-private partnership) project participants (Zhang and Liu 2022, Liu *et al.* 2024). The theoretical bases include game theory, agent theory, and incentive/contract theory. Most studies are theoretical and use simulation methods. Further empirical studies are needed to validate the proposed models.
- **Implicit incentive schemes**: This category refers to using non-material incentives like reputation, promotion, and tournaments to motivate agents. These studies highlight the motivational aspects (i.e., intrinsic motivation) and contend that satisfying psychological needs for autonomy and competence is crucial. In addition to agent theory, social psychological theories like self-determination theory and social capital theory are valuable theoretical bases. The findings of these studies indicate that implicit incentive schemes can incentivize participants' performances and lead to enhanced project performances (Solheim-Kile and Wald 2019, Zhu *et al.* 2020).
- **Performances of incentives**: This category examines the impacts of incentives on project performances. Studies examining the performances of incentives focus on the relationship between incentives and resulting project performances (Meng and Gallagher 2012, Choi *et al.* 2021, Garg and Misra 2023). Most studies report a positive relationship between the use of incentives and performance improvements. However, there are differing views suggesting that incentives might have limited or even counterproductive effects.

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- **Incentivization for sustainability**: This category focuses on incentive/disincentive for attaining sustainability goals, such as reducing carbon emissions (Huang and Fan 2022, Kim *et al.* 2022). The concepts of game theory and prospect theory are applied to optimize incentive programs. Most studies are theoretical and require further empirical studies for validation.
- **Incentivization for new technology adoption**: This category aims to promote the use of new technologies and methods (Lu *et al.* 2021, Chen *et al.* 2023). However, most of these studies need empirical evidence to examine the impacts of proposed incentive schemes.

5 CONCLUSION

A systematic literature review is conducted to categorize studies relevant to construction incentivization in this study. Five categories, including economic incentive schemes, implicit incentive schemes, performances of incentives, incentivization for sustainability, and incentivization for new technology adoption, were identified by carefully reviewing 54 papers from IJPM, IJPBM, PMJ, JCEM, and JME. This study contributes to the literature on construction incentive by enhancing understanding of incentivization approaches and impacts. In future studies, a generic framework with specific incentivization approaches for different incentivization purposes can be created to guide incentive design.

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