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UNRAVELLING EFFECTS OF PROJECT COMPLEXITY ON PROJECT SUCCESS AND PROJECT MANAGEMENT SUCCESS: A META-ANALYTIC REVIEW

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Abstract. Construction project complexity can be daunting, so both academics and practitioners have been looking for guidance. Previous studies have attempted to reconcile the inconsistencies and complexities in the relationships among project complexity, project success, and project management success. However, such research has failed to establish these clear relationships. Accordingly, the approach of systematic review and meta-analysis is applied in this study to investigate and compare how different project complexity affects project success and project management success by selecting 22 articles and 77 effect sizes. The results indicate that integrational complexity significantly positively affects project success, whereas it is not significantly negatively associated with project management success. Within a technical-organizational-environmental (TOE) framework, effects of organizational, environmental, and technical complexity on project success and project management success are also discussed here. A possible moderator (the national/regional income level) is tested and verified. The findings contribute to the system of knowledge on project complexity and provide guidelines for decision-makers to achieve a balance between project success and project management success in routine operation of construction projects.

Keywords: construction project complexity, project success, project management success, meta-analysis.

Introduction

The construction industry has been suffering from great difficulties in responding to the increasing project complexity (PC) in project management (Williams, 1999). With regard to the constituent elements, PC is regarded as the degree of interrelatedness between project attributes and interfaces, as well as their consequential effects on predictability and functionality (Construction Industry Institute, 2016). As highlighted by Baccarini (1996), PC hinders the clear identification of the goals and objectives of major projects but could contribute to the determination of planning, coordination and control demands. For instance, task complexity, a type of PC, can make the desire of communication more intense of the project stakeholders, because it motivates more coordination, eventually affecting project performance (Kennedy et al., 2011). With the increasing tendency of construction projects to become larger and more technically complex, PC has become an emerging and critical topic in construction project management (Tam et al., 2011). This is because PC is subject to failures, unpredictability, uncertainties and ambiguities, with implications for the project outcome (Mamédio & Meyer, 2020). These uncertainties associated with PC, which vastly affect the project development and execution process, may cause unfavorable impacts on projects success and performance (Safapour et al., 2018). Accordingly, a comprehensive and appropriate understanding of the PC is the precondition for tackling challenge of PC and realizing effective management (Rad et al., 2017).

The problem of poor project outcomes being induced by PC is a main research theme that has received growing attention (Chapman, 2016; Luo et al., 2017a). Having the ability to properly evaluate the PC will bring about a better understanding in any stage of project development, which will be of considerable benefit in successfully managing

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the project and reducing the risks caused by complexity (Wood & Ashton, 2010). Yet, PC commonly results in cost and time overruns, as well as deteriorating performance if an inappropriate governance mechanism is adopted (Ahn et al., 2017). It requires to a comprehensive understanding of PC and how it might be managed is of significant importance for achieving success for all of the parties involved (Wood & Ashton, 2010). It is better to sustain and understand complexity in the project context during project management rather than reducing or avoiding it altogether (Abdou et al., 2016). Although most of empirical evidence has been reported about a negative correlation between PC and project success (PS), they have tended to assess this correlation in one or few aspects of PS. Moreover, it is noticeable that the PC will bring about a positive influence on the project results, which is due to the fact that the attributes generated by complexity could provide some new potentials (Lu et al., 2016; Maqsoom et al., 2020). Previous studies have failed to establish clear relationships between PC, PS and project management success (PMS). This is because the project management literature commonly makes a confusion between PS and PMS and regard them as a single construct with homogeneity, which are actually not (Prabhakar, 2008). PS refers to balancing the incompatible components among different project goals and satisfying diverse requirements of project stakeholders (Project Management Institute, 2009), whereas PMS pays more attention to the realization of project goals and the completion of project tasks (Munns & Bjeirmi, 1996; Cooke-Davies et al., 2007). A proper definition and assessment of PS can facilitate the effective distinction between PS and PMS. To address this issue, scholars have adopted the narrative review and systematic review to thoroughly explore the influences of PC on construction project outcomes (Geraldi et al., 2011; Bakhshi et al., 2016; Luo et al., 2017a), but it is difficult to accurately summarize results and identify how the diversity of PC influences project performance across studies through the synthesis of many existing frameworks for researching complexity (Bosch-Rekveldt et al., 2011; Geraldi et al., 2011; He et al., 2015), which are arguably quite disparate. With the decomposition technique of complexity evaluation, the attribute of interaction and the synergy effect of complexity-induced risk will be undermined, and the possibility of selecting suboptimal risk mitigation strategy will be increased (Qazi et al., 2016). There is a need to develop models and frameworks to examine the influence of PC on PS and PMS. Fortunately, systematic evaluation and meta-analysis are becoming more and more essential technique in social science studies, which are helpful to make clear the state of research field, determine whether the research effect is constant or not, and reveal what research is expected to prove this effect in the future (Swider & Zimmerman, 2010; Kim et al., 2019). Meta-analysis is a statistical technique designed to combine the results of associated studies to yield a larger sample size and provide greater reliability (precision) for any effect estimates. Sophisticated meta-analysis techniques are also available to uncover what level of study or sample characteristics influence the phenomenon being studied (Davis et al., 2014). Until now, few studies have examined the meta-analytic associations among PC, PS and PMS. It is extremely essential for project management not only to accurately comprehend and evaluate PC, but also to be aware of the sophisticated interaction between PC and project performance, which can help project stakeholders determine the priority of crucial complexity and opt for the optimal mitigation strategies. Accordingly, our study aims to: (i) statistically synthesize the state of research on the effects of PC on PS and PMS by using a systematic review and meta-analysis; (ii) examine whether the correlations among PC, PS and PMS varies according to each of PC dimensions; (iii) explore why the same variable relationship exists systematic discrepancies in effect sizes within various studies.

The remaining part of the paper proceeds as follows. The review of literature is detailed in Section 1. Section 2 presents the hypotheses. Section 3 introduces the research methodology and analytical procedures. The research results and discussion are provided in Sections 4 and Section 5, respectively. Last section summarizes the conclusions, implications, and limitations, as well as future work.

1. Literature review

1.1. PC

The PC has gradually raised managers' concerns and has become a topical research theme since 1990s. Numerous academics have presented their different thoughts on this issue. Baccarini (1996) pioneered a comprehensive study of PC, which was first defined as being "composed of various interrelated parts", then described particularly as differentiation and interdependencies. Tatikonda and Rosenthal (2000) regarded PC as the nature, quantify and magnitude of organizational subtasks and subtasks interaction posed by the project. Hass (2008) characterized complexity as a complex or complicated configuration of numerous interconnected elements that is difficult to comprehend or address. Dao et al. (2017) defined PC as the degree of interdependence and differentiation of various project elements, and their consequential effects on project decision-making. It appears that there is not even a single definition of PC that can encompass all characteristics (Qureshi & Kang, 2015). To date, the construction industry has not yet provided a unified and accurate definition of PC because of the discrepancies in theoretical foundations and research viewpoints (Ma & Fu, 2020). However, a primary fact is that PC involves two basic elements, namely, the properties of project subsystems and the characteristics of interactivity among subsystems (Kermanshachi & Safapour, 2019). Moreover, PC is a multidimensional concept, which exists in multiple dimensions and exerts greatly different influences on project outcomes (Bjorvatn & Wald, 2018). Hence, in our study, from the overall perspective (the project itself as a whole), PC refers to the characteristics of a project, which renders the overall behavior of the project hard to understand, predict and control (Vidal & Marle, 2008). When it comes to project attributes and features, PC be described as the degree of interaction between project properties and interfaces, as well as their eventual effects on predictability and functionality of projects (Dao et al., 2017).

Studies that examined PC could be divided into two groups, which have been derived primarily from the work of Baccarini (1996). The first group approached PC based on the viewpoint of complexity theory and focused on managing the complexity within a project (Sage et al., 2011; Piperca & Floricel, 2012; Thamhain, 2013; Cicmil et al., 2017). The second group manages PC by applying project management practices according to contingency theory and addresses project management practices, such as risk and uncertainty management. However, studies of the second group have been more focused on characterizing PC rather than its management (Williams, 2018). Since Baccarini (1996) examined the factors associated with PC and identified its dimensions as organizational complexity and technical complexity, various scholars have explored the components of PC. Williams (1999) introduced uncertainty into the composition of PC, listing it as organizational complexity, technical complexity, and uncertainty. Geraldi et al. (2011) considered PC to include uncertainty, as well as structural, dynamic, pace, and sociopolitical complexity (five-factor model). Maylor et al. (2013) analyzed the five-factor pattern and combined the five factors with three dimensions of complexity, namely, structural, sociopolitical, and emergent complexity. It is worth noting that several scholars regarded PC as an integrational construct without any sub-dimensions, which significantly affects PS (Leban, 2003; Lu et al., 2016; Guo et al., 2019). With the increases in project scale and influencing factors, the field of research into PC has gradually extended. For instance, Bosch-Rekveldt et al. (2011) extended from projects to their external environments by considering the effects of the environments and integrating them into a technical-organizational-environmental (TOE) framework for analyzing PC. Given the complicated nature of megaprojects, PC comprises technical, organizational, goal, environmental, cultural, and information complexity (He et al., 2015). Luo et al. (2017b) in their study stated that PC was a multi-dimensional concept that involved seven compositions, that is, organizational, technical, environmental, task, information and goal complexity. Hence, theoretical and empirical studies have endeavored to define and evaluate PC with the introduction of case studies and surveys (Pich et al., 2002; Xia & Lee, 2004; Cooke-Davies et al., 2007). However, scholars have overlooked the obvious reality that complexity tends to influences projects in a hybrid paradigm. With each type of construction project being a aggregation of various complexities, the eventual project performance will vary correspondingly (Ma & Fu, 2020). Even if the expanded and re-defined dimensions deepen the understanding of PC, it is still difficult to identify its nature and characteristics in construction project management by combining the available knowledge (which is arguably quite dispersed and disparate) into an integrated framework. Unlike the previous research on construction frameworks, our study selected integrational PC, technical, organizational, and environmental complexity (the TOE classical framework) to compare their specific effects on PS and PMS.

1.2. PS and PMS

PS has been narrowly deemed to realize expected results in time, cost and quality since the 1980s (Atkinson, 1999). As the background of the construction industry changes, the most acceptable definition of PS is to keep a balance between competing demands of project quality, scope, time and cost, and to satisfy diverse attentions and expectations of project stakeholders (Project Management Institute, 2009). PS criteria has evolved from the iron triangle of cost, time and quality to a more comprehensive concept of success that embraces various viewpoints (Pollack et al., 2018; Ma & Fu, 2020; Imam & Zaheer, 2021). It has been acknowledged that PS or failure may be determined by individual participants' explanation of success criteria, and therefore a more elaborate view is needed (Davis, 2018). Many other criteria have been added more recently: stakeholder satisfaction (Dvir et al., 2003), short-term efficiency and long-term effectiveness (Müller & Jugdev, 2012; Shafi et al., 2021), value creation (Laursen & Svejvig, 2016; Martinsuo, 2020), health and safety (Hu et al., 2016), sustainability (de Carvalho & Rabechini Jr., 2015), and preparations for future business success (Mir & Pinnington, 2014). Unfortunately, the lack of commonly agreed-upon success criteria has led to the risk of comparing apples to oranges in discussions of PS (Albert et al., 2017). It is frequently observed that projects being delivered on time, within budget and meet to the required specifications are deemed as failed projects. For instance, the Los Angeles metro project is perceived as a failure, since it failed to mitigate the traffic issues and eventually canceled the rest of the project, even though the construction project managers achieved their goals by advancing the schedule and delivering on budget (Shenhar et al., 2016).

With regard to the PS, two perspectives should be emphasized. One perspective stipulates that the management of a project could be successful from the aspects of scope, quality, and budget, but it doesn't take into account meeting client's expectations. The other perspective holds that each of business objectives should be achieved and project management should comply with the demands of schedule, budget and quality. According to the definition of Munns and Bjeirmi (1996), the former perspective is PMS, whereas the latter indicates PS. A distinction is made in existing studies between PS and PMS (De Wit, 1988). PS demonstrates the assessment of the comprehensive goals of a project, which is a broader concept covering the influence of the project (Munns & Bjeirmi, 1996). PMS, being a traditional viewpoint, mainly focus on the successful realization of the cost, time and quality objectives of the project process and tasks (Munns & Bjeirmi, 1996; Cooke-Davies et al., 2007). These events are deemed as the responsibility of the project management teams and successful results would be perceived as PMS (Andersen, 2014). Moreover, PMS accounts only for the internal efficiency of a project's management (Ika, 2009), whereas PS pertains to both internal or external efficiency and effectiveness in the short term or long term (Shrnhur et al., 1997; Ika, 2012). Hence, a conclusion can be drawn that PS encompasses a broader view of projects. Achieving PS is inevitably more challenging than realizing PMS because the former involves longer-term and more customer-oriented results (Cooke-Davies et al., 2007). Successful project management techniques can beneficial to project achievements but cannot guard against project failure (Munns & Bjeirmi, 1996).

Based on the above review, it is imperative to understand the problem of comparing apples to oranges in discussions of PS and PMS. Consequently, our study strictly distinguished PMS (iron triangle criteria: time, cost, and quality/scope) from PS (e.g., iron triangle criteria, efficiency, effectiveness, value creation, and stakeholder satisfaction) to compare and analyze how PC affects these two project outcomes.

2. Hypotheses formulation

2.1. Integrational PC, PS and PMS

In construction project management, PC remains one of the most contentious subjects (Bakhshi et al., 2016). The initial points to manage the PC comprise learning about the essence of PC and its effects on the implementation and eventual deliverables of a project (Ma & Fu, 2020). Previous articles have proved negative correlation between PC and PS (Hanisch & Wald, 2014; Guo et al., 2019), but their findings have been inadequate when applied in reality because of the absence of in-depth and detailed analysis on the relationship between PC and PS (Bosch-Rekveldt et al., 2011). In particular, several scholars regarded PC as unidimensional construct (integrational PC), which is significantly related to PS. For instance, Leban (2003) and Lu et al. (2016) evaluated research hypotheses and demonstrated that PC was significantly and positively connected with PS. Similarly, Park and Lee (2014) emphasized that PC practically motivate project stakeholders to share knowledge with each other, making contribution to overall project performance. In addition, Eriksson et al. (2017) illustrated that PC is positively linked to explorative learning and project performance. Doloi (2014) reported that the more complicated the project is, the more easily it is to realize project cost savings, time savings and error minimization when implementing project management. Hence, our study expects that integrational PC will be positively bound up with PS.

When it comes to the correlation between integrational PC and PMS (iron triangle), there are a number of studies that gives evidence of negative correlations between these two variables. For instance, de Carvalho and Rabechini Jr. (2015) stated that PC was negatively correlated with project cost performance and schedule performance. Similarly, Nguyen et al. (2019) demonstrated that PC had negative effects on cost and time performance. Moreover, Khattak and Mustafa (2019) reported that there is a negative connection between PC and project performance. Consequently, the primary influence of PC on PMS is deemed to be negative, in the sense that PC expands the demand for coordination and information processing (Hanisch & Wald, 2014). In our study, findings regarding the relationships among PC, and PMS deriving from the construction industry were collected and to examine the following hypotheses in order to reduce the confusion caused by the different viewpoints in studies and to allow the relationship among variables to become more explicit and reliable. Hence, our study expects that integrational PC will be negatively associated with PMS.

H1a: The integrational PC is positively correlated with PS.

H1b: The integrational PC is negatively correlated with PMS.

2.2. Different PC on PS and PMS within the TOE framework

Previous studies have shown that PC could be categorized depending on various complexity elements, which have different effects on PS and PMS (Hanisch & Wald, 2014; Liu et al., 2019). William's Model (Williams, 1999), the five-factor model (Geraldi et al., 2011), the TOE framework (Bosch-Rekveldt et al., 2011), the six-dimensional model (He et al., 2015), and seven-dimensional framework (Luo et al., 2017b) appear frequently in studies on PC and project management. These frameworks also incorporate similar elements but classify them. They also differ in focus and context (Cantarelli, 2020). However, there are few studies paying concern to the effects of PC on PS from a perspective of combination and integration. One of the obstacles in overcoming the complexity of the project is that the term has been extensively and intuitively adopted to the extent that research results varied according to the context (Dikmen et al., 2021). Since our study concerned the construction industry, the concept and classification of PC were more consistent with the characteristics of construction projects. After attentively examining and analyzing these theoretical frameworks, the TOE model by Bosch-Rekveldt et al. (2011) is considered most suitable and will be utilized in this study, because it focuses on large engineering projects, the definition and dimensional division of PC has been more broadly acceptable in the construction industry (Cantarelli, 2020). The TOE framework consists of three levels, with the highest level being the technical, organizational, and environmental complexity categories. These three classifications are further branched out into the sub-category level and element level, which provide a broad framework for the study and evaluation of the PC.

Organizational complexity, which is the degree of operational interdependencies and interactions among elements of project organizations, has been discussed in previous studies. Such complexity comprises the assignment of tasks, the distribution of decision-making responsibilities and authority, as well as allocation of relationships in both reporting and communication (Abdou et al., 2016). Khattak and Mustafa (2019) verified that organizational complexity (e.g., non-availability of resources and skills and lack of organization internal support) was negatively related to project performance through a self-administered survey in Pakistan. Likewise, in construction temporary organizations, organizational complexity is primarily brought about by the heterogeneous and diverse project teams and stakeholders, as well as ambiguous hierarchies. Growing organizational complexity leads to a higher requirements for coordination (Pich et al., 2002). Yet, the size, the degree of interconnectivity, and the diversification of the project organization members impede the foundation of common norms, language schemes and trust, which will reduce the project effectiveness and efficiency (Floricel et al., 2016), and hinder project cost and schedule performance improvement (Nguyen et al., 2019). Therefore, our study proposes that organizational complexity will be negatively related to PS and PMS.

Technical complexity denotes the diversification of certain aspect of a task, as well as the interdependencies among tasks and teams, which is negatively related to project completion and operation (Floricel et al., 2016). With this in mind, in construction project organizations, there are usually a lot of activities which are interrelated and time-dependent, and thus the time available to coordinate these activities is very limited (Hanisch & Wald, 2014). As a result, technical complexity is largely driven by temporariness and the uniqueness of the tasks, resulting in frequent alterations of tasks and the composition of the team over time. Furthermore, project interdependency as an element of technical complexity, hinders project completion and operation (Floricel et al., 2016), as well as is negatively correlated to project portfolio success (Kock et al., 2020). In addition, technical complexity, includes largeness and uncertainty in scope and new experience with technology, which will be detrimental to PMS, including cost and schedule (Nguyen et al., 2019). Consequently, our study proposes that technical complexity will be negatively associated with PS and PMS.

Environmental complexity includes the natural, business, political, and regulatory environments in which a project operates. Bosch-Rekveldt et al. (2011) concluded that in large-scale engineering projects, environmental complexity has a negative influence on project performance, because of existence of interfaces between different disciplines and the absence of internal support from the company. According to the study of Floricel et al. (2016), market and institutional element of project environmental complexity decreased the operation, completion and value creation performance. Additionally, project stakeholders are required to make timely decisions and take proper response to new situations with available information under highly unpredictable construction environment (Krishnan et al., 2016). Nonetheless, information regarding the construction project environment is usually asymmetrically possessed by project stakeholders, which enables the information holders to act opportunistically in their partnership transactions (Klein et al., 1990). Construction projects are easily affected with the growing frequency of external interference when the environmental complexity is high (Li et al., 2012), thereby raising the possibility of deviating from the original project goals and detrimental to cost-effectiveness (Nguyen et al., 2019), relationship performance (Gao et al., 2018) and PS (Luo et al., 2020). Hence, our study expects that environmental complexity negatively correlated to PS and PMS.

$H2a_1$: The organizational complexity is negatively correlated with PS.

$H2a_2$: The organizational complexity is negatively associated with PMS.

$H2b_1$: The technical complexity is negatively correlated with PS.

$H2b_2$: The technical complexity is negatively associated with PMS.

$H2c_1$: The environmental complexity is negatively correlated with PS.

$H2c_2$: The environmental complexity is negatively associated with PMS.

2.3. Moderating effects of the national/regional income level

In light of World Bank analytical classification, the countries and economies have been classified into low (L) income, lower-middle (LM) income, upper-middle (UM) income and high (H) income countries (World Bank, 2015). In our study, the differences in project management among countries (regions) with four types of income levels (LM, UM, H and Mixed) have been discussed and analyzed. The construction industry is an essential contributor to the development and prosperity of society by being one of the main sectors for job creation and public wealth distribution (Sultan & Alaghbari, 2023). Yet, the construction industry is unable to preserve its sustainability as it has some unique characteristics, such as a multilevel, dynamicity, multidisciplinary, complexity and instability (Gamil et al., 2020). The level of success in construction project development depends heavily on the levels of managerial, financial, business environment, and economic development (Takim & Adnan, 2008). Numerous publications have examined the differences in the construction practices and industries of diverse income level countries (Lizarralde et al., 2013; Banihashemi et al., 2017).

In lower-middle income countries, project management tools and techniques usually lead to poor management performance because of several social, cultural, economic, and financial problems in the early phases of development (Abbasi & Al-Mharmah, 2000). Many low-income countries are currently suffering from serious economic difficulties as a result of higher energy costs, growing inflation and declining exchange rates, as well as immense social problems (e.g., rising urban population and unemployment), which are putting pressure on the construction industry's resources and capabilities (Ofori, 2000). The high national/regional income level will offer strategic and invaluable advantages to project organizations by the project management process (using measurement tools and techniques), which would also contribute to the ability to improve project performance. Hence, our study investigates the moderating role of national/regional income level that may explain why some PC in a particular country have higher negative effects on PS and PMS than those in different countries.

H3a: The four types of income levels have moderating effects on the relationships between PC and PS.

H3b: The four types of income levels have moderating effects on the relationships between PC and PMS.

3. Research methodology

3.1. Literature search

This study used the approaches of systematic review and meta-analysis, which can identify and critically appraise, as well as collect and analyze the data of relevant research (Snyder, 2019). The literature search was conducted with Web of Science, ProQuest, EBSCO, and Google Scholar. To avoid omissions, our study searched and selected the references of reviews and related studies, then finally combined a variety of results to construct a database of 678 records.

3.2. Inclusion and exclusion criteria and coding procedures

The selection procedure is carried out based on the preferred reporting items for systematic reviews and meta-analyses (PRISMA) (Phinias, 2023). Figure 1 illustrates a flow chart that visually describes the search process and strategy. The criteria for each review (excluding reviews on theoretical topics) to be involved in the meta-analysis were: (i) the review reported on the empirical research of experimental or survey data; (ii) it had at least one correlation between PC and PS, project performance, or PMS, as well as indicators (e.g., Pearson correlation coefficient, path coefficient, *t*-value, and *p*-value) that could be converted into effect sizes; (iii) it had a clear sample size; (iv) it was or included a construction project; (v) where conference and academic papers were repeated, only one paper was selected.

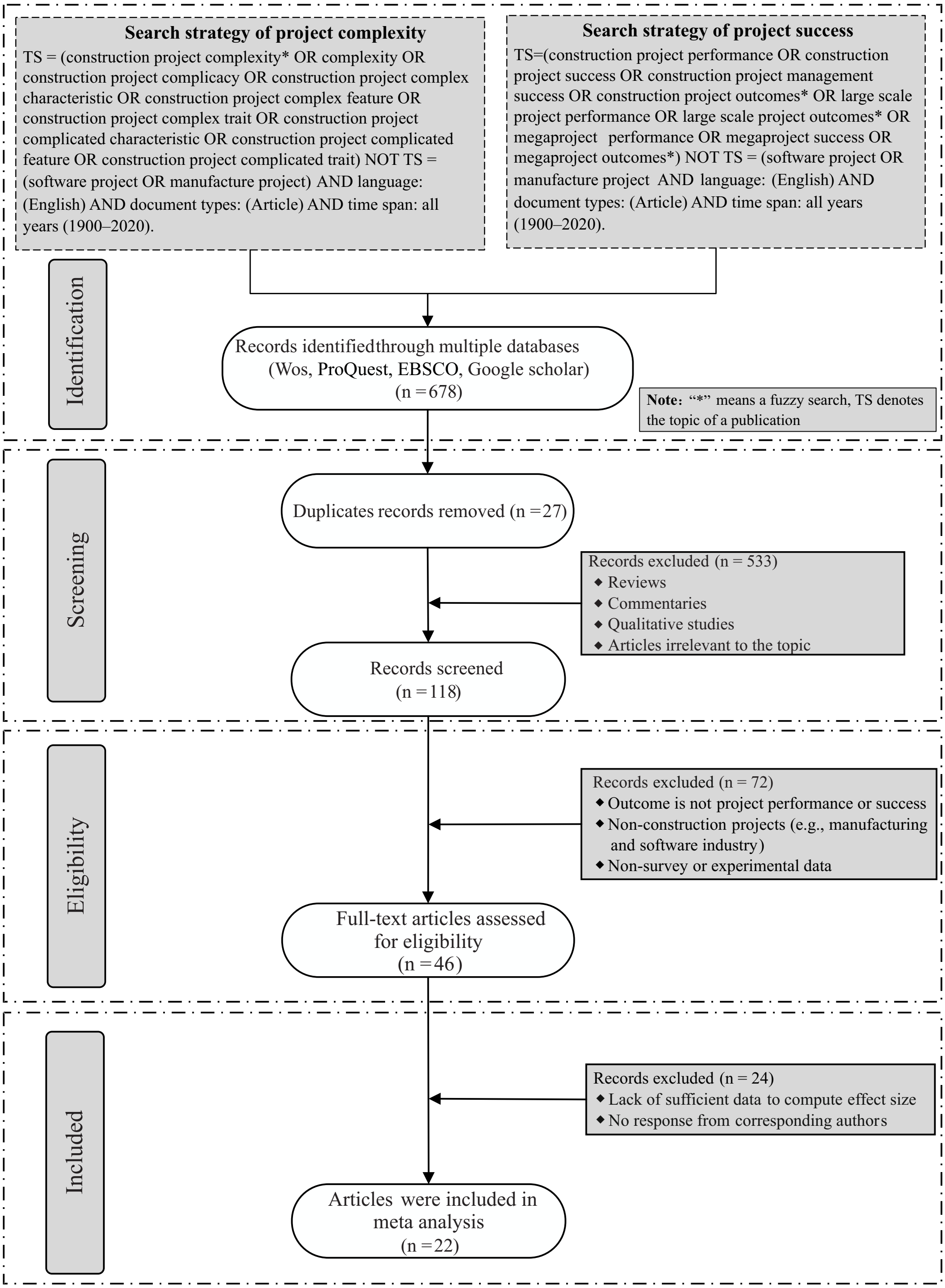
3.3. Characteristics of selected studies

Across the selected studies, there were 22 published papers containing 77 effect sizes and a total sample size of 11,218 participants (see Appendix). Higgins et al. (2019) suggested that analysis based on existing data is often unbiased, even when based on a smaller sample size than the original dataset. Moreover, Hagaman and Wutich (2016) demonstrated that a sample size of 20–40 is necessary to achieve data saturation of cross-site meta-themes. Similarly, after mathematical simulation, Lin (2018) indicated that the sample size of 10 to 20 may be large enough to produce the expected meta-analysis results. Accordingly, the sample size of this study is appropriate for meta-analysis. The participants were from several countries in Asia, Europe, North America and Latin America. Of the selected papers, 1 was a dissertation and 21 were publications. Of these same papers, 10 regarded PC as a single dimension, whereas the other 12 examined PC in terms of environmental, organizational, and technical dimensions. Moreover, 18.2% of the papers were published in the year 2020, 22.7% in 2019, 13.6% in 2018, 4.6% in 2017, 9.1% each in the years 2014–2016, and 4.6% each in 2012, 2011, and 2004.

3.4. Meta-analytic procedures

This study is intended to focus on the effects of PC on PS and PMS by applying a meta-analysis that systematically combined with previous empirical results. A meta-analysis is not only designed to integrate evidence, but also to determine what model should be utilized, and how results should be explained (Borenstein et al., 2009). All the empirical analysis were performed with the Comprehensive Meta-Analysis (CMA) software, Version 3.3.070 (Borenstein et al., 2005). CMA, a computer program funded by the National Institutes of Health in the United States, offers researchers an efficient and user-friendly way to conduct meta-analyses, which can be downloaded from the website (http://www.meta-analysis.com). Its spreadsheet view and menu-driven interface allow users to quickly enter data and perform basic analyses, while its advanced features enable researchers to explore true effect distributions, compare effect sizes in subgroups, run meta-regressions, estimate the potential effect of publication bias, and yield high-resolution plots. When Pearson's correlation coefficient (r) was provided in detail, other statistics (e.g., t- and p-values) were used to compute effect sizes (Hittner & Swickert, 2006; Borenstein et al., 2009).

This study processed the data according to the following steps. Firstly, coding was performed by two researchers for higher reliability and the results were in comparison. According to the reliability rules (reliability = number of matching items/total number of items) proposed by Huberman and Miles (2002), the reliability



Note: Last retrieval time September 2020.

Figure 1. The flow diagram of study selection process and search strategies

of the coding was found to be 86.36%. Both researchers discussed and analyzed any disagreements with a third researcher to ensure that the coding results were consistent. Secondly, the application of correlation coefficients may bring about problematic error formulations, and therefore the approach of Hunter and Schmidt (2004) is introduced in meta-analysis, which could correct the unreliability of independent and dependent variables. Missing values (i.e., the reliability of the criterion or predictor) were calculated by adding the mean value across the studies where the information was available (Hunter & Schmidt, 2004; Lee et al., 2020). In order to preserve more information as much as possible, our study makes meta-analysis of all eligible effect sizes in each study by allowing research to contribute multiple effect sizes. The corrected population correlation for each study was converted to Fisher's z scale, and subsequent analysis is conducted with the converted values (Lipsey & Wilson, 2001).

Significance tests and moderator analyses were carried out by random effect models (Borenstein et al., 2007), which permits the possibility of random differences between studies associated with variations in procedures, measures, or settings, which are beyond the sampling error of the subject level. The effect sizes computed for all the studies were the correlations of the effect sizes with the associated p-values with a 95% confidence interval. The correlation effect sizes were regarded as small if they were less than or equal to 0.10, medium in size if equal to 0.25, and large if greater than or equal to 0.40 (Lipsey & Wilson, 2001). Confidence intervals not including zero were explained as representing statistically significant results. The heterogeneous characteristics of the studies was measured by Q and I^2 statistics. It was also necessary to explain τ^2, especially in the random effect model, which was used to allocate the weight of each study and adjust the variance variation (Borenstein et al., 2009). The data combination in meta-analysis is conducted on the basis of the random effect model, which is more applicable in case of inconsistent results (Neely et al., 2010).

4. Research results

4.1. Association between integrational PC and PS

The results indicate positive and non-significant effects between integrational PC and PS (ES = 0.227, $p < 0.05$). Thus, *H1a* is supported. However, the statistical results (Q = 124.762, $p < 0.001$, I^2 = 95.992%, τ^2 = 0.129) demonstrate that most of the observed variance in the effect sizes was not because of chance. The differences in the effect sizes due to the moderator variables should be investigated. In the subsequent sensitivity analysis, one study was removed at a time and 6 estimations were obtained, varying from 0.007 to 0.321, which indicates no ineligible effect of any study.

4.2. Association between integrational PC and PMS

The estimate of the effect size between integrational PC and PMS for all studies is –0.053 ($p > 0.05$), indicating a negative and non-significant effect between integrational PC and PMS (*H1b* was rejected). The results of heterogeneity (Q = 237.389, $p < 0.001$, I^2 = 95.366%, τ^2 = 0.016) indicate that it is also necessary to further explore the potential effects of the moderators. In the subsequent sensitivity analysis, one study was removed at a time and 12 estimations were acquired, ranging from –0.061 to 0.028, which indicates no ineligible effect of any study.

4.3. Links between PC, PS, and PMS within the TOE framework

Table 1 presents the effect sizes, 95% confidence interval, p-value and I^2 of PS and PMS. Regarding the type of PC (PC), especially the relationship between PC and PS, organizational complexity reports a negative yet statistically insignificant influence on PS (ES = –0.026, $p > 0.05$). Moreover, technical complexity (ES = 0.048) and environmental complexity (ES = 0.041) demonstrate positive effects on PS, though these forms of complexity do not yield statistically significant results.

In the PC-PMS relationship, environmental complexity, organizational complexity, and technical complexity are negatively related to PMS. However, only technical complexity yields a statistically significant effect (ES = –0.209, $p < 0.05$). Regardless of the significance, organizational complexity demonstrates a larger effect size (ES = –0.168) than do environmental complexity (ES = –0.162). Beyond that, the negative influence of the organizational complexity on PMS (ES = –0.168) is higher than on PS (ES = –0.026). Consequently, the specific effects of the three types of PC have been confirmed and understood, thus *H1b*, $H2a_1$, $H2a_2$, $H2b_1$, $H2c_1$ and $H2c_2$ are rejected, whereas $H2b_2$ is supported.

4.4. Moderator analyses

As shown in Table 2, the national/regional income level has significant moderating effects on both PS and PMS (see Q_b and the corresponding p-value). The PC-PS results reported that the degree of influence of PC on PS in upper-middle income countries is significantly higher (ES = 0.166, $p < 0.05$) than in lower-middle income countries (ES = 0.112, $p > 0.05$) and mixed outcomes (ES = 0.027, $p > 0.05$). For the PC-PMS relationship, the effect size of lower-middle income countries was higher (ES = –0.198, $p < 0.05$) than that of mixed outcomes (ES = –0.119, $p < 0.05$). Likewise, the studies in high-income countries presented slightly larger effect sizes (ES = 0.153, $p < 0.05$)

Table 1. The results of different project complexity on PS and PMS

Project complexity	Project success					Project management success				
	k	*ES*	95%CI	*p*	I^2	*k*	*ES*	95%CI	*p*	I^2
Integrational project complexity	6	0.227	0.036,0.401	0.020	95.992	12	–0.053	–0.137,0.032	0.225	95.366
TOE framework										
Environmental complexity	12	0.041	–0.096,0.177	0.558	68.575	4	–0.162	–0.325, 0.010	0.064	60.252
Organizational complexity	19	–0.026	–0.132,0.080	0.630	88.116	4	–0.168	–0.329, 0.004	0.055	60.094
Technological complexity	16	0.048	–0.068,0.162	0.421	85.616	4	–0.209	–0.368,0.040	0.016	0.000

Note: *k* – number of effect size; *ES* – effect size.

Table 2. Results of the moderator analyses

Dependent variables	Moderators	Categories	k	ES	95% CI	p	Q	df	p_Q	I^2
Project success	The national/regional income level	H	18	–0.067	–0.166,0.033	0.188	90.399	17	0.000	81.194
		UM	13	0.166	0.053,0.275	0.004	211.065	12	0.000	94.315
		LM	5	0.112	–0.087,0.302	0.271	29.371	4	0.000	86.381
		Mixed	17	0.027	–0.081,0.135	0.616	27.740	16	0.034	42.321
	Qb_{income} = 9.688, p = 0.021									
Project management success	The national/regional income level	H	4	0.153	0.021, 0.279	0.023	101.764	3	0.000	97.052
		LM	15	–0.198	–0.277, -0.116	0.000	26.139	14	0.025	46.440
		Mixed	5	–0.119	–0.227, –0.008	0.036	46.446	4	0.000	91.389
	Qb_{income} =19.648, p = 0.000									

Note: k – number of effect size; ES – effect size; Q_b indicates χ^2 between groups; LM, UM, H, Mixed presented lower-middle income, upper-middle income, high income and mixed countries, respectively.

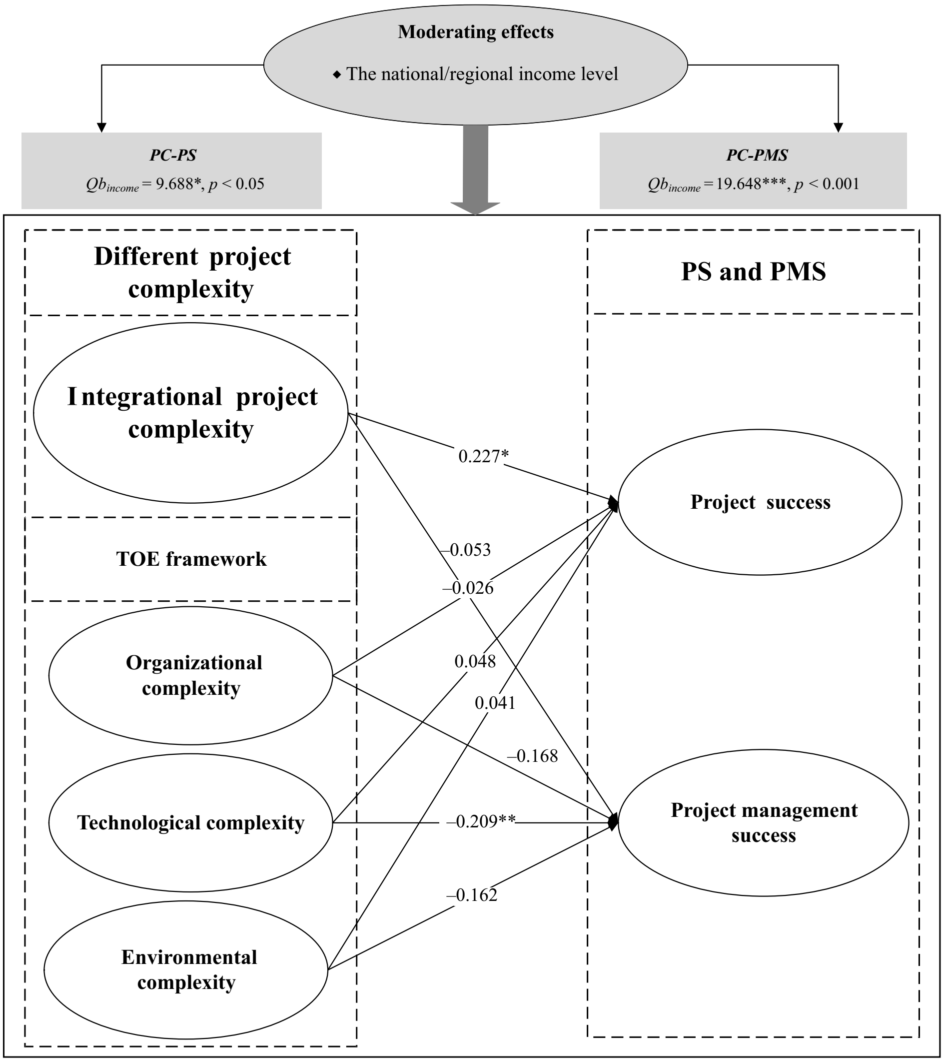


Figure 2. Results of model and hypotheses testing

than in mixed countries (ES = 0.119, p < 0.05). Consequently, the potential moderating effect of the national/regional income level has been established and *H3a* and *H3b* have been verified. The test results of the model and hypotheses are presented in Figure 2.

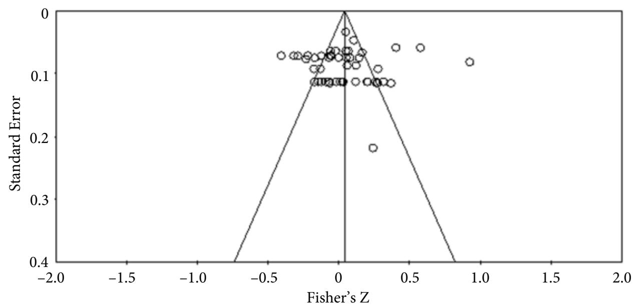
4.5. Publication bias

The research selection in meta-analysis is an essential procedure. Ideally, all studies that meet the predetermined selection criteria should be involved in the analytical process, yet it is very difficult to achieve in practice. Consequently, several related studies may be disregarded in meta-analysis, which may result in so-called sample selection issues in statistics such as a publication bias (Hedges & Olkin, 2014). The standard error on the vertical axis and the conversion of Fisher's Z effect size on the horizontal axis jointly make up the funnel plot (Light & Pillemer, 1984). In terms of publication bias, the funnel plots (see Figure 3) suggest the results of our meta-analyses are unlikely to be affected by publication bias.

5. Discussion

5.1. Effects of integrational PC on PS and PMS

The findings demonstrates that the effect size of integrational PC on PS presents a positive and statistically significant correlation. This result corroborated the ideas of Doloi (2014). He suggested that the aspects of cost savings, time savings, and error minimization, a more complex a project would more easily realize the complexity of management. Moreover, construction projects with highly complex interactions ought to be equipped with project managers who have the highest levels of emotional and managerial quality, thus allowing them to fully exert their potential and influence the project results greatly through their leadership styles (Müller et al., 2011). In the present study, the scope of PS was not limited to cost, time, and quality but extended to long-term criteria, such as stakeholders' satisfaction, value creation, and innovation, positively related to PC (Floricel et al., 2016; Liu et al., 2019) and resulting in a positive connection between PC and PS as a whole. The possible reasons for this finding are as follows. (i) The association between PC and PS is not a simple one-way correlation because other variables may intervene in or control formation of different mechanisms, such as cooperation duration (Lu et al., 2016) and organizational maturity (Crispim et al., 2019). (ii) As Hirschman (1967) suggested, for projects involving high complexity or uncertainty, project managers may apply the "Hiding Hand Principle" as a mechanism for making the risk-averter take risks, and in the process, turning them into less of a risk averter. Although the Hiding Hand has been severely criticized quite a lot (Adelman, 2013; Alacevich, 2014; Flyvbjerg, 2016), this viewpoint could still help projects achieve success in an unpredictable mode (Gasper, 1986). Specifically, the Hiding Hand allows project managers to confront complexity, get it through, think out of the box, learn from practice, and achieve success through creative errors (Ika & Söderlund, 2016). In addition, when the providential hand covers up difficulties, project managers could move forward stepwise, at the same time, believing in instruments enabling them to clearly identify the objectives, to know the situation, fully utilize resources, and reduce the negative influence on the project environment (Ika, 2012). Altogether, our research provides an in-depth and detailed understanding of the relationship between PC and PS, and findings are more convincing and comprehensive in practical application.



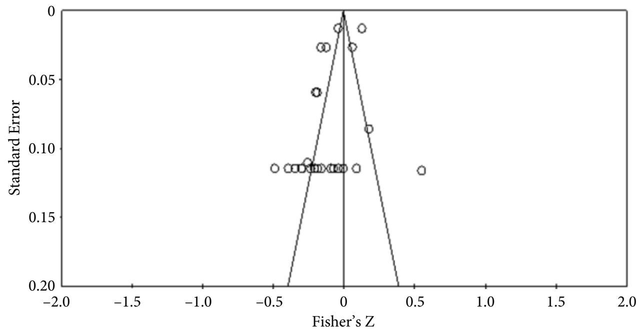


Figure 3. Funnel plot of Standard Error for project complexity, project success (the top) and project management success (the bottom)

Regardless of the statistical significance, there is a negative connection between integrational PC and PMS. This result is partly in accordance with the findings of Bjorvatn and Wald (2018). They demonstrated that construction PC augmented unscheduled delays and overspending. This conclusion is in agreement with other previous works that have found PC to be strongly correlated with schedule growth and cost growth (Nguyen et al., 2019). More specifically, underestimations of PC caused low performance, cost overruns, and schedule delays in complex construction projects (Thomas & Mengel, 2008; Luo et al., 2020). Additionally, in construction projects, PMS focuses upon the successful achievement of cost, time and quality objectives (Baccarini, 1996). PC leads to cost estimation error (Winch, 1989) and comprises the randomness, interdependencies, and uncertainties of a project's inputs and outcomes (Geraldi & Adlbrecht, 2007), thus diminishing the chances of PMS. Accordingly, our study clarifies the discrepancies between existing research and reveals more reliable, accurate connections between integrational PC and PMS.

5.2. Different PC on PS and PMS

There is a positive relationship between environmental complexity and PS in our study. The findings echo the conclusion of Elbanna (2015), who stated that environmental complexity was an essential determinant of project processes (intuition and reflexivity), which, in turn, positively linked to PS and speed of completion. Environmental complexity directly affects the quantity and properties of information processing, because this complexity may also lead to more excellent use of cognitive simplification processes (Papadakis et al., 1998). On the contrary, there is a negative connection between environmental complexity and PMS. The result is in accordance with the findings of Tatikonda and Rosenthal (2000). They emphasized that the significant negative influence of PC on project outcomes did not affect the entire project outcome but rather the specific project goals, such as schedule performance and cost performance in PMS. And more importantly, our research results have been further strengthened and deepened the discoveries of Nguyen et al. (2019), who highlighted that there exist negative correlation between environmental complexity, schedule performance and cost performance. Organizational complexity is the most familiar issue in construction projects and is related to many distinct and interdependent elements (Williams, 1999). Our findings suggest that organizational complexity negatively affects PS and harms PMS. This is because the sizes, degree of interconnectedness, and diversity of the project participants impede the foundation of shared norms, language schemes, and trust. This result corroborates the ideas of Winge et al. (2019). They suggested that high organizational complexity complicated the coordination of actors and operations through using comparative analysis through using comparative analysis. Moreover, our findings further support the conclusion of Antoniadis et al. (2011), who stated that unmanaged organizational complexity could lead to a reduction in project performance. Additionally, the research result is similar to the viewpoint expressed by Tansley and Newell (2007). They stressed that organizational complexity with flexible and changeable internal and external frontiers will impede coordination, thus negatively affecting organizational success. Regarding the technical complexity, our findings present the positive effect of technical complexity on PS, which extend the results of Floricel et al. (2016). They pointed out that a positive correlation existed between technical complexity and project innovation performance. Some explanations may explain this result. On the one hand, in construction projects with high technical complexity, the extensive use of new knowledge increases the likelihood of high innovation performance. Furthermore, increasing technical complexity led to greater control over the flow of the processes and to more predictable results for projects (Swanson, 1997). On the anther hand, construction projects, especially megaprojects, usually adopted highly complex technology and drawn substantial attention (Li et al., 2019). Over time, such complexity may increase the costs of the claims and the duration of the construction stage in megaproject management. For the limitations of cost and time in project management, as Trinh and Feng (2020) described, increased technical complexity produced ever-changing and unpredictable safety risks with a higher likelihood of accidents for contractors' employees during the construction phase. Accordingly, our findings illustrate that PC can be differentiated by different complexity features, which exert various effects on PS and PMS, providing a comprehensive framework for the study and assessment of PC.

5.3. The moderating effects of the contextual moderator

The most important finding in our study is the significant moderating effects of the national/regional income level on PS and PMS. Our conclusion is similar to that of Miao et al. (2017), who demonstrated that contextual moderators are designed to describe different research contexts and study settings, and to provide an explanation for why the same variable relationships have systematic differences in effect sizes across studies. For the moderating effect of national/ income, Lizarralde et al. (2013) stressed that the construction industry in lower-middle income countries is more easily subject to unstable political and economic circumstances. Accordingly, our results are in line with conclusion of Rwelamila and Purushottam (2012). Specifically, these countries have serious challenges including insufficient qualifications of personnel, low-level project management capability and absence of suitable organizational structure, thus resulting in poor construction project performance (Banihashemi et al., 2017). While for lower-middle income countries, it is found that they are short of knowledge of project management techniques and tools, and spend less time on reporting and monitoring (Abbasi & Al-Mharmah, 2000). In these countries, therefore, applying proper project management tools is an effective channel to improve management competency, achieve successful completion of projects and thus realizing development objectives of projects. By comparison, countries with high income and upper-middle income have a good economic environment and favorable legal framework, which help to sufficient knowledge of project management, high levels of professional training, and flexible organizational structures and facilitate the handling of the PC by implementing an efficient and effective policy framework and well-designed technologies (Osei-Kyei & Chan, 2017). Overall, the significant differences between lower-middle income and high-income countries may be due to the different levels of technical capabilities in project management (Al-Mohammad et al., 2023). It could be described that "mastering of existing technologies and coping with PC" is a primary concern for lower-middle income countries, whereas "appropriately utilizing PC and boosting project innovation performance" is essential for high and upper-middle income countries. Our findings thus extend previous research on the nature of PC in project management and effectively explain and enrich the current debate through the lens of the contextual moderating variable, concerning the different response strategies that are appropriate for countries with different income levels towards PC.

Conclusions and implications

Conclusions

Until now, the relationship among PC, PS and PMS still remains in controversy. To addresses this knowledge gap, our study applies an approach of systematic review and meta-analysis and selects 22 articles with 77 effect sizes to clarify these relationships. In general, it seems that the influence of integrational complexity on PS is positive and significant but negatively and insignificantly correlated with PMS. Within the TOE framework, the specific effects of the three types of PC (i.e., organizational, environmental, and technical complexity) on PS and PMS were compared and discussed. We also discovered the moderating effects of the national/regional income level on the research outcomes. The theoretical and practical implications of our findings are of great value to researchers and practitioners from different disciplines working in construction projects.

Theoretical and practical implications

The theoretical contributions of this article are threefold. First, based on empirical evidence in construction projects, our study determines whether the research on PC is worthy of further discussion. It juxtaposes the positive effects and negative effects of PC on project outcomes and identifies which of these two perspectives has the most empirical validity. Furthermore, it goes beyond the notion of PC and PS as integrational constructs and investigates the role of the different dimensions of both PC and PS, thus deepening project managers' understanding of the two kinds of success and helping them to resolve the dilemma expressed by "the operation was a success, but the patient died" (Ika, 2015). Second, in this study, four types of PC were identified, and their influences on the project outcomes were emphatically discussed to reduce the deviations caused by different national/regional income levels. This systematic approach provides the theoretical guidance for project managers to better meet the challenges of PC and move away from the prevailing one-size-fits-all approach to project management (Ika, 2012). Last but not least, there is evidence suggesting that project participants hold very different mental models of PC and are likely to differ on which characteristic is the most important (Mikkelsen, 2021). Hence, researchers should keep in mind that only one measure for the complexity of a project would not suffice. To grasp situations as a whole, a constructive worldview should be considered when addressing PC.

This study also provided some practical implications to project managers aiming to increase the performance levels of construction project management. First, it is necessary to break away from the traditional perspective and reexamine the effect mechanism of PC on PS and PMS for project participants. Also, each project requires detailed assessment of the specific structure of its complexities, stakeholders' views on these complexities, and the diversified leadership styles (Müller et al., 2011), thus allowing owners and contractors to select project managers with the appropriate qualifications (e.g., high emotional and managerial quality) and to accurately inform decision-makers about the complexity, ambiguity, and persistent technological and structural modifications. High-quality and suitable managers can take effective measures and advantage of the positive role of PC while avoiding its adverse effects, thereby achieving the expected balance between the hard and soft elements of PS and PMS. Second, PC in the construction industry includes complicated tasks, competition, political interferences and pressures, and conflicting priorities centered around various project participants (Adigbo, 2020), all of which result in the need for crucial and strategic management practices. Both contractual governance and relational governance are fundamental strategies for coping with the previously mentioned risks (Lu et al., 2016). According to Moore et al. (2018), PC can negatively influence project performance regarding estimation errors by the contractor. Greater emphasis should be placed upon flexibility, rather than efficiency, in project-oriented network organizations. Project contracts provide clear specifications for permissible or impermissible contents to reduce uncertainty, and enforce legal rules and standards to minimize opportunistic risks (Roehrich & Lewis, 2010). In addition, contract governance provides a reliable and predictable scheme when changes or disputes appear, which contributes to addressing time and cost issues, as well as to alleviate the constraints of temporal complexity. For the negative correlation between some classification of PC (e.g., organizational complexity and technical complexity) and PMS, appropriate relational governance can be used to reduce inevitable re-negotiation costs, decrease the costs of revising a project contract, and enhance the target consistency by increasing the adaptability of the project contract to the project's uncertainty and complexity. Furthermore, relational governance mitigates conflicts among partners, stimulates practical problem solving, and boosts interorganizational learning in a dynamic environment (Abdi & Aulakh, 2017), thus effectively reducing organizational complexity derived from rigid contract terms.

Limitations and future work

There are some limitations associated with the meta-analysis. First, studies without appropriate statistical results were not included in the meta-analysis; therefore, it remains unclear whether the inclusion of these studies would have changed our results. Future research could utilize more advanced approaches to embrace all relevant studies and develop a large sample to discuss effect of PC on project outcomes. Second, the potential mediating effects and path analysis were overlooked in this study. The future work can employ meta-structural equation modeling (meta-SEM) method to test the mediating role of some variables (e.g., leadership style) in the indirect link between PC and project outcomes. Third, the differentiation between PS and PMS is only addressed in our study, while the possible effect of the distinction between PS and project performance on our findings is not intensively discussed. Hence, making a clarification to the ontology or epistemology (subjective or objective) of PC, this knowledge gap can be studied from a variety of perspectives and to make sure that the presented evaluation model is robust and catches the distinctions in a comprehensive manner.

Disclosure statement

No potential conflict of interest was reported by the authors.

Author Contributions

Zhibin Hu: Conceptualization, Methodology. Guangdong Wu: Data curation, Writing – Original draft preparation. Junwei Zheng: Visualization, Investigation. Xianbo Zhao: Writing – Reviewing and Editing. Jian Zuo: Writing – Reviewing and Editing.

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APPENDIX

Summary of studies included in the meta-analysis

Reference	Sample size	Sample region	Source	Income level	PS/PMS items	Types of project complexity	Number of outcomes
Teller et al. (2012)	134	Germany	Article	H	PS ◆ average project success ◆ portfolio synergies ◆ strategic fit ◆ portfolio balance	Portfolio size Project interdependency	2
Müller et al. (2011)	119	North America, Europe, Australia	Article	H	PS ◆ project objectives (e.g., time, cost, and quality) ◆ overall satisfaction (e.g., customer satisfaction, reoccurring business and meeting requirements)	Complexity of fact Complexity of faith Complexity of interaction	3
Doloi (2014)	77	Australia	Article	H	PMS ◆ cost ◆ time ◆ reduce design error	Project complexity	1
Hanisch and Wald (2014)	197	Austria, Germany, and Switzerland	Article	H	PS ◆ effectiveness ◆ efficiency	Structural complexity Task complexity Temporal complexity	8
de Carvalho and Rabechini Jr. (2015)	1387	Argentina, Brazil, and Chile	Article	Mixed	PMS ◆ cost ◆ time ◆ margin	Project complexity	3
Lu et al. (2016)	225	China	Article	UM	PS ◆ project performance (e.g., cost, time, quality and expectations) ◆ relationship satisfaction	Project complexity	1
Elbanna (2015)	450	United Arab Emirates (UAE)	Article	H	PS ◆ achieving project objectives ◆ solving its main problem ◆ stakeholders' satisfaction ◆ its impact on firm performance	Environmental complexity	1
Moore et al. (2018)	5775	USA	Article	H	PMS ◆ one-time completion ◆ profit margin	Project complexity	2
Floricel et al. (2016)	81	North America, Europe, Latin America, Africa, Australia	Article	Mixed	PS ◆ completion ◆ innovation ◆ operational ◆ value creation	Institutional complexity Market complexity Organizational complexity Technical complexity	16
Eriksson et al. (2017)	138	Swedish	Article	H	PMS ◆ time	Project complexity	1
Gao et al. (2018)	180	China	Article	UM	PS ◆ partner responsiveness ◆ partner satisfaction ◆ reoccurring business	Environmental complexity Organizational complexity Technical complexity	3
Nguyen et al. (2019)	79	Vietnam	Article	LM	PMS ◆ cost ◆ time	Environmental complexity Infrastructural complexity Organizational complexity Scope complexity Sociopolitical complexity Technological complexity Overall project complexity	14

Reference	Sample size	Sample region	Source	Income level	PS/PMS items	Types of project complexity	Number of outcomes
Guo et al. (2019)	152	China	Article	UM	PS ◆ cost ◆ time ◆ quality ◆ reoccurring business	Project complexity	1
Liu et al. (2019)	290	China	Article	UM	PS ◆ cost ◆ schedule ◆ information communication ◆ value creativity ◆ environmental effects ◆ market competitiveness ◆ reoccurring business	Contract complexity Task complexity	2
Trinh and Feng (2020)	78	Vietnam	Article	LM	PS ◆ safety performance (the incident rate)	Environmental complexity Organizational complexity Technical complexity Overall project complexity	4
Maqsoom et al. (2020)	171	Pakistan	Article	LM	PS ◆ cost ◆ time ◆ quality ◆ customer requirements	Project complexity risk	1
Kock et al. (2020)	181	Germany	Article	H	PS ◆ strategy implementation ◆ future preparedness ◆ portfolio balance ◆ average project outcome quality ◆ synergy exploitation	Project interdependency Portfolio dynamics Portfolio size	3
Crispim et al. (2019)	865	USA, Brazil, Canada, India, Italy, Spain	Article	Mixed	PS ◆ cost ◆ time ◆ quality ◆ technical specifications achievement ◆ customer satisfaction	Project complexity	1
Luo et al. (2020)	245	China	Article	UM	PS ◆ cost ◆ time ◆ quality ◆ health and safety ◆ environmental performance ◆ participants' satisfaction ◆ user satisfaction ◆ commercial value	Environmental complexity Goal complexity Information complexity Organizational complexity Task complexity Technological complexity	6
Bjorvatn and Wald (2018)	285	45 countries	Article	Mixed	PMS ◆ time ◆ cost	Project complexity	2
Khattak and Mustafa (2019)	85	Pakistan	Article	LM	PMS ◆ cost ◆ time ◆ scope	Project complexity	1
Leban (2003)	24	USA	Disser-tation	H	PS ◆ cost ◆ time ◆ performance ◆ business goals and objectives ◆ stakeholder satisfaction	Project complexity	1
Total	11,218	–	–	–	–	–	77

Notes: LM, UM, H, Mixed presented lower-middle income, upper-middle income, high income and mixed countries, respectively.