Variations in critical success factors of PPP procured construction projects over lifecycle phases

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**Abstract**

There is a proliferation within the literature of critical success factors (CSFs) applicable to projects. Despite contrary evidence, this literature continues to predominantly construe CSFs as static across the project lifecycle. Focusing on PPP procured construction projects, we draw upon lifecycle theories to explore the variation in importance of CSFs over the lifecycle stages of projects. We employ a two staged study involving a search and identification of factors from literature supplemented with a two staged Delphi exercise to explore potential variations in importance of critical success factors (CSFs) over the lifecycle of construction Public-private partnerships (PPPs) projects. Findings point to the existence of 24 CSFs with varying importance over the project lifecycle. Three CSFs, namely: ‘*Economic stability’*, ‘*Good and effective governance structures’* and ‘*Political stability’*, appeared important in three of the four phases. Most CSFs appeared important in two of the four phases while six CSFs, namely, ‘*Engage a team of advisers’*, ‘*Project performance monitoring’*, ‘*Understanding and respecting the goals of the main PPP parties*’, ‘*A fair evaluation team’*, ‘*Transparency in the procurement process*’ and ‘*Commitment and responsibility of project parties*’ appeared in only one phase. In sum, we found that project stakeholders emphasized specific endogenous CSFs as being more important during initial phases of the project (i.e., the ‘*Initiation and conceptualization’* and ‘*Planning’* phases), but that these CSFs then gave way to the prominence of more exogenous CSFs emphasizing change and transformation as the project moved towards the ‘*Execution’* and ‘*Benefits realization’* phases. Theoretical and practical implication of the findings are discussed.

**Keywords**: Critical success factors; Construction; Public-private partnerships (PPPs); Projects; Lifecycle.

## 1.0 Introduction

The notion of project success remains a key topic of interest in the project management literature yet it remains elusive and fraught with ambiguity research(see for example, Ika 2009; Muller and Jugdev 2012; McLeod et al. 2012; Mir and Pinnington 2014; Rolstadås et al. 2014; Albert et al. 2017; Davis, 2017; He et al. 2019; Ika and Pinto 2022, 2023; Pereira et al. 2022; Pinto et al. 2021, 2022; Varajão et al. 2022). As Ika and Pinto (2022) observe “*The all-important notion of project success has received an enormous attention over the last four decades in project management theory and practice. However, the evaluation of project success is a surprisingly open question with few authors using consistent definitions and measures*” (p. 836). Moreover, the literature is replete with studies focused on critical success factors (CSFs) which are “…*conditions, events, and circumstances that contribute” to positive project outcomes*” (Ika 2009, p. 8). Recent studies include Jitpaiboon et al. (2019), Pacagnella et al. (2019) and Ika and Pinto (2023).

This diverse and prodigious literature has led to the proliferation of success factors and is reflective of “…*limited agreement among authors on the factors that influence project success*” (Fortune and White, 2006; p. 54). In fact, as earlier observed by Wateridge (1995), “…*there does not appear to be a consensus of opinion among researchers and authors on…the factors that influence that success*” (p. 171). As Ika and Pinto (2003) write “*Therefore, despite decades of work, the question “what makes projects successful?” continues to garner attention from both practitioners and researchers alike. In particular, since the 1960s, research has continued apace on CSFs both inside and outside project management journals*” (p. 77). However, most CSFs discussed in the literature either vary in terms of purpose and/or scope or are specific to individual projects (Belassi and Tukel 1996; Ika and Pinto 2023). Furthermore, there is also a reality that their development appears not to take into consideration the importance of lifecycle analysis. Importantly, only a few studies (i.e., Pinto and Prescott 1987, 1988; Pinto and Slevin 1988; Patanakul et al. 2010; Liu et al. 2015a; Bao et al. 2018; Ika and Pinto 2023), appear to acknowledge that the importance of individual CSFs is not static across the project lifecycle, and therefore, likely to change/vary. This is despite large scale acceptance in both classical (Adams and Barndt 1983; King and Cleland 1983) and more recent literature that lifecycle analysis is important to apprehend the project success factor phenomenon (Liu et al. 2015a; Osei-Kyei et al. 2017; Liu et al. 2018).

With the above in mind, we set out in this study to explore the variations (changes) in the importance of critical success factors of projects over lifecycle phases. More specifically, we focus on construction Public-private partnerships (PPPs) projects. These are construction projects procured to provide public services (Lee and Schaufelberger 2014) through partnership maintained between the public sector (i.e., government) and the private sector (Liu et al. 2015a, 2015b). Indeed, interest in studies focused specifically on Public-private partnerships (PPPs) projects and their critical success factors has grown unabated over the last few years (see Osei-Kyei and Chan 2015; Ahmadabadi and Heravi 2019; Sehgal and Dubey 2019; Hai et al. 2022; Almeile et al. 2023a, 2023b). Yet, research focused on comprehensively identifying the specific importance of individual CSFs over the lifecycle stages of PPP procured projects appears to be an overlooked area in the literature (Bao et al. 2018; Liu et al. 2018). The persistence of this research gap is surprising for two reasons. First, the lifecycle concept is of particular importance to PPP projects due to the focus of PPP on the integration of commercial, financial, technical, service, and social factors (Clifton and Duffield 2006; Albalate et al. 2017). Second, current literature suggests a need for further research into PPP lifecycles (Narbaev et al. 2020). We suggest that the viability of construction PPP projects is likely to be challenged because their critical success factors rarely seek to take into consideration lifecycle variations. This makes it rather difficult for both scholars and practitioners to fully grasp which success factors are indeed ‘*critical’* and at what phase of the project lifecycle such criticality resides. On this basis, we ask two questions:

RQ1: *What are the key CSFs impacting construction PPP projects?,* and

RQ2: *What is the importance of individual CSFs of construction PPP projects over their lifecycle?*

## 2.0 What makes PPP projects different?

To recap, this paper focuses on construction PPP projects because globally, they have become the primary route for procuring major infrastructure projects (Nguyen et al. 2020; Vassallo et al. 2020; Almeile et al. 2023a, 2023b). Public-private partnerships (PPPs) also represent a viable tool that the public sector (i.e., the government), can rely upon to exploit the expertise and leverage the financial resources of the private sector (Carbonara and Pellegrino 2020; Pellegrino 2021). Furthermore, PPP has been construed as a source/driver for innovation in projects (Carbonara and Pellegrino 2020; Cantarelli and Genovese 2021; Cantarelli 2022).

As shown in Table 1, construction PPP projects are very different from conventionally procured construction projects (Deloitte, 2008; ESCAP 2008; Cuthbert and Choudhary, 2016; Dong et al., 2016; European Court of Auditors, 2018; World Bank, 2022). For example, their viability is essential at project start meaning that framing of a robust business model is essential for their development. In addition, their focus is primarily on outcomes (delivering specific benefits at levels clearly defined) as against outputs (delivering physical assets). Construction PPP projects also have a much longer lifecycle, meaning that relationship management is core to its success. Finally, risk allocation in construction PPP projects is more complex than what is obtainable in projects procured conventionally. For this reason, construction PPP projects should not be developed or managed in the same manner as conventional projects. By extension, construction PPP projects are very likely to engage CSFs that are quite different from those of conventional projects.

Table 1: Differences between PPP and conventionally procured construction projects

|  |  |  |
| --- | --- | --- |
| **Criteria** | **Construction PPP project** | **Conventionally procured construction projects** |
| Suitability | Generally unsuitable for small one-off projects (i.e., projects with value less than £20 million) | Suitable for all sized projects |
| Type of asset involved | Primarily ‘greenfield’ projects (i.e., new assets); although can also involve ‘brownfield’ projects (i.e., maintenance, upgrade, and management of existing assets). | A mixture of ‘greenfield’ and ‘brownfield’ projects. |
| Strategic focus | Focus on delivering specified benefits at defined levels. | Focus on delivering a particular class/type of assets. |
| Social value | Very important | Not important |
| Procurement approach | Public sector party selects private sector party/concessionaire to design and build a project. | Project sponsor selects firm to design and build a project. |
| Awarding criteria | Successful bidder will need to satisfy mandatory regulatory requirements which provides best ‘value for money’ | Successful bidder will need to satisfy minimum cost requirements set out by the project sponsors. |
| Funding | Funding/financing is responsibility of private sector party/concessionaire who also manages and operate the asset on its completion. | Funding/financing is responsibility of project sponsor who can choose to manage and operate the asset on its completion or appoint separate firm to operate the asset. |
| Payment | Upfront funding/financing is made by the private sector party/concessionaire. | Project sponsor makes payments against specific milestones and at project completion. |
| Role of external funding sources | Significant role for development finance institutions (e.g., World Bank Group). | Significant role for commercial lenders. |
| Responsibility of private sector party | Usually maintains responsibility over the contract/operational lifecycle of the asset. | Completes construction phase and hands over asset to project sponsor. |
| Upfront costs | Disproportionately high up-front costs associated with project preparation/tendering. | Significant up-front costs associated with project preparation/tendering. |
| How the private party is paid | Private sector party/concessionaire finances all or part of the necessary capital expenditure and then seek to recover costs/expenditure through a range of payment mechanisms. | Project sponsor finances all or part of the necessary capital expenditure. |
| Asset/services specificity | Specifications are generally focused on outputs (the project deliverables) and outcomes (the project benefits) as against inputs (how the project will be implemented). | Specifications are generally focused on inputs (how the project will be implemented) as against outputs (the project deliverables). |
| Contract structure | Contract tends to bundle multiple project functions or phases (etc. institutional, policy, and regulatory framework), together. | Project functions or phases are often fragmented and unbundled. |
| Duration | Typically have a long tenure (≥ 20 years ≤ 30 years) | Typically have a short tenure (≤ 20 years) |
| Risk sharing (Design, construction, financing, operation, and maintenance) | Responsibility often resides with the private sector party/concessionaire (who is provided with incentives to meet specific standards) | Risk is generally allocated to the party best suited for its management; usually the project sponsor. |
| Risk sharing (Regulatory and political risks) | Responsibility often resides with the public sector partner. | Risk is generally allocated to the party best suited for its management; usually the project sponsor. |

Public-private partnerships (PPPs) projects come in different forms (see Fouad et al. 2021). They can entail for example, the government commissioning a project and on completion, over the duration of the contract (the lifecycle) paying the concession holder for the resultant service. Another form of PPP may involve the government commissioning a project, providing revenue or debt guarantees to the concession holder, but payment to the concession holder for services being made directly by users. Other forms of PPP project may involve various combinations of the first and second type. There are also different types of Public-private partnerships (PPPs) projects. These includes Concessions, Build-Own-Operate (BOO), Build-Operate-Transfer (BOT), Build-Own-Operate-Transfer (BOOT), Build-Transfer (BT), Build-Lease- Transfer (BLT)/Build-Transfer-Lease (BTL), and Design-Build-Finance-Operate-Maintain (DBFOM) projects (Bovaird 2004; Turner 2004; Yescombe 2007; Delmon 2010; Gambo and Gomes 2014; Delmon 2015; Alexander et al. 2019). Public-private partnerships (PPPs) projects can also be in the form of Service contracts, Management contracts and Lease contracts (ADB 2008)

**3.0 Theory**

*3.1 General theoretical framing*

As a fully comprehensive review of lifecycle literature is beyond the scope of this present study, we will present a generalized but simple overview of this theory.

An important point noteworthy of mention is that there is no monolithic lifecycle theory per say (Jones 2015). Instead, what exists is a number of different theories and ideas based on different assumptions on the dynamics and constraints associated with the lifecycle. However, despite the heterogeneous nature of lifecycle theory, its key benefit according to O’Rand and Krecker (1990) is that it represents a viable means to “…*simplify complex social phenomena by invoking familiar schema in scientific thought*” (p. 242).

Reference to ‘*Lifecycle’* directs us to various ontogenesis-related literatures (drawn from several different disciplines), dealing with a biologically enthused sequence of successive, linear and irreversible changes experienced by organisms over a time period (see Levinson et al. 1978; O’Rand and Krecker 1990; Hill and Kaplan 1999; Jones 2015). In basic terms, ‘ontogenesis’ refers to studies focused on exploring and understanding how the behavioral or anatomical attributes of individual organisms develop from the earliest stage to decline (Bame Nsamenang 2006).

Core to the ‘*Lifecycle’* is the assumption that (i) all phases are sequential (ii) successful completion of one phase is a pre-condition for the successful completion of the next (iii) all ‘normal’ organisms pass through these phases and (iv) all phases exhibit unique attributes which must be achieved within a specific phase (Etzkowitz and Stein 1978). Lifecycle theory is important because it offers scholars evolutionary explanations relating to the timing of key life events (Hill and Kaplan 1999). Thus, time and variation considerations are at the core of the lifecycle concept (Zimbardo and Boyd 1999; Kivetz and Tyler 2007). In particular, time is important in understanding the lifecycle because it serves to ensure that events (phases) are ordered in a sequential manner. Furthermore, because time cannot be reversed, it plays a major role in facilitating how individuals frame not only their perspective of past and current events, but also the future. The lifecycle, therefore, represents a sequence of time-related phases which sets out the developmental experiences and variations individuals will go through (Levinson et al. 1978). These phases have been broadly framed against ‘*Birth’*, ‘*Development/growth’*, ‘*Maturity’* and eventual ‘*Decline’* (Reinert 1979; Day 1981).

Lifecycles symbolized temporality because it entailed social reproduction; in effect, it represented an acknowledgement that organisms will at some point eventually ‘*Decline’* andbe replaced. This replacement represents the transition from one generation to another. Baltes et al. (1998) observes that while each phase of the lifecycle is likely associated with specific mechanisms and processes, these are expected to change across the entire lifecycle.

The versatility of lifecycle theories has led to its adoption over the years, by numerous and very different disciplinary areas. This includes entrepreneurship (Fisher et al. 2016; Hincapié 2020; Xiao and Wu 2021), marketing (Day 1981; Bauer and Auer‐Srnka 2012), sociology (O’Rand and Krecker 1990; George 1993), organization studies (Smith et al. 1985; Pettigrew 1990; Armenakis and Bedeian 1999; Lester et al. 2003), tourism research (Zehrer and Raich 2010), and operations (Cao and Folan 2012)/ project management (Jaafari 2000).

*3.2 Operations/project management framing*

The application of lifecycle concepts to project management can be traced to the seminal works of Adams and Barndt (1978, 1983), King and Cleland (1983) and Westland (2006). The main focus of the project lifecycle was to enhance practical decision-making in projects by providing a clearly expressed descriptive structure that articulates the relative dynamics of the success or failure of a project from start to eventual discontinuation. In the widest sense, the project lifecycle also allows projects to be divided into distinct manageable units of work (phases) that facilitate effective control (Paton and Andrew 2019). In very basic terms, it is employed as a means to ensure that the complexity associated with projects is structured (Kloppenborg et al. 2014). It must however be noted that the project lifecycle represents more than a basic description of the development of a project from its conception to its disposal. Alexander et al. (2019) for example notes that the project lifecycle represents a set of key management devices and tools. Project lifecycles can therefore be employed in numerous capacities to support project work practices (see Patanakul et al. 2010).

While the literature suggests that project phases can be consecutive/sequential, overlapping/intersecting, spiral (Patanakul et al. 2010) or concurrent (Powell et al. 1999; Bashir et al. 2022), there is a recognition drawing from product lifecycle literature (see Day 1981; Golder and Tellis 2004; Cao and Folan 2012) and more recently, phase transition studies that the boundaries between project phases may be dynamic in nature (see Abd Razak et al. 2020; Locatelli et al. 2020; Whyte and Nussbaum 2020).

Observations have been made by van den Ende and van Marrewijk (2014) that because projects involve constant change, they are best understood “…*as a contextual process of change from start to termination*” (p. 1134). Various operations/project management works of scholarship have adopted and used the lifecycle in a manner similar to its framing in the foundational ontogenesis-related literatures (see Iveson et al. 2022). For example, the lifecycle has been employed as an analytical framework for the study of the development phases of projects (Vuorinen and Martinsuo 2019). It has also been used to understand how projects can be conceptualized. For example, lifecycles have been employed to symbolize temporality in projects (Turner and Müller 2003; Winch and Sergeeva 2022).

Drawing upon lifecycles theories, the project lifecycle therefore posits that the needs, priorities, and challenges projects will face span over a period of time. Phase changes over the lifecycle will also give rise to the emergence (and eventual decline) of new, different, and changing (i) risk (either abstract or concrete – see Marshall et al. 2019), (ii) views on the legitimacy of the project (Fisher et al. 2016) and (iii) different forms of project politics (see for example, Gray and Ariss 1985). Over the lifecycle, projects will also be exposed to the (iv) generation and decline of new information and knowledge (Faccin and Balestrin 2018; Labuscagne 2020). However, the deterioration of knowledge may be controlled if knowledge is acquired and then maintained in a manner that outweighs age-related losses over the lifecycle (Lindenberger 2001).

Based on Levinson et al’s. (1978) earlier assertion that “…*each season (*i.e., *phase) or era has its own distinctive and unifying qualities, which have to do with the character of living*” (p. 18), the lifecycle therefore acknowledges that while moving through a sequence of phases (transformations), variations will emerge in terms of CSFs as a project seeks to adjust to different environmental, operational, and organizational exigencies and constraints. Furthermore, due to differences/ heterogeneity in these exigencies and constraints, variations in terms of the salience of these CSFs are likely to exist. In sum, changes over the project lifecycle suggests that the importance of various components of effectiveness and priorities (technical efficiency, coordination priority and political support) of the project are also likely to change (Smith et al. 1985).

*3.3 Basic model of the project lifecycle*

In this study, we adopt a basic model of the project lifecycle which is broadly framed/ reminiscent of earlier ontogenesis phases (see Reinert 1979; Day 1981). This lifecycle contains four phases/stages; namely, *‘Initiation/conceptualization’,* ‘*Planning’*, ‘*Execution’* and ‘*Benefits realization’* (Pinto and Slevin 1988, 1989; Pinto and Covin 1989; Pinto and Prescott 1987, 1988, 1990; Kloppenborg et al. 2014; Zwikael and Meredith 2018). Different types of activities will dominate each phase of the project lifecycle.

Projects start in the *‘Initiation/conceptualization’* phase with priorities being established, resources being marshalled, and the project ideology (mission) being set out. In the ‘*Planning’* phase, the design, list of tasks and preliminary schedule are formulated and institutionalized. Commitment (including financial guarantees) from key stakeholders including the wider society is also sought and obtained. For this reason, at this phase, communication and team cohesion are essential. This phase of the project particularly places an emphasis on internal processes, procedures, policy, and practices in different areas such as risk allocation and management. It is, therefore, primarily endogenous in nature (as is the *‘Initiation/conceptualization’* phase). The ‘*Execution’* phase focuses on production and transformation. This phase is therefore both endogenous and exogenous. In the final phase (‘*Benefits realization’*), the focus is on ensuring that at project *‘Closure’* and *‘Termination’*, the key milestones identified earlier in the project have been achieved in a manner that ensures that the primary benefits are delivered. This phase is, therefore, primarily exogenous in nature. Other basic models of the project lifecycle containing varying number of project lifecycle phases/stages have been advanced, including those by the Office of Government Commerce (2017), the Project Management Institute (2021), the Association of Project Management (2022) and the Chartered Institute of Building (2022).

## 4.0 The literature

‘*Critical success factors*’ (CSFs) have been defined by Rockart (1982) as “…*the key areas of activity necessary to be focused to ensure competitive performance towards an organization’s strategic goals*” (p. 4). To the best of our knowledge, prior studies that have explicitly addressed changes/variations in applicable CSFs across the project lifecycle are limited to Pinto (Pinto and Slevin 1988, 1989; Pinto and Covin 1989; Pinto and Prescott 1987, 1988, 1990), Patanakul et al. (2010), Liu et al. (2015a) and Bao et al. (2018). The study by Zare Ravasan and Mansouri (2016) may also be of relevance as it is set within the context of project lifecycles. However, it focuses on Critical failure factors (CFFs). We have thus not taken this study into consideration. This is because of observations made by Chipulu et al. (2019) that due to asymmetrical and multidimensional differences between project success and project failure, significant conceptual differences exist between the notion of Critical success factors (CSFs) and Critical failure factors (CFFs).

In criticizing project management scholars for framing CSFs as static over the project lifecycle, Pinto and Prescott (1987) conducted a survey of 418 project management practitioners with the aim of examining changes in CSF importance across project lifecycle phases. Their findings suggest that the relative significance of CSFs significantly varied depending on the stage in which a project resided within. A key conclusion from their study being that the use of CSFs was cognizant of wider organizational factors. This study was extended by Pinto and Prescott (1988). Here, the focus was to explore the relative importance of specific CSFs across four stages in the project lifecycle. Based on a survey of 408 project management practitioners, they also found that the relative importance of a number of the CSFs significantly varied over the course of the project (with slight differences in terms of importance of specific CSFs to the 1987 study). These studies were further extended in Pinto and Slevin (1988, 1989). On the notion that CSFs were generally classified against those focused on (i) initial planning and those related to the (ii) tactical operationalization of projects, the focus in Pinto and Prescott (1990) was to examine planning and tactical project CSFs variations. Similar variations were also found. Furthermore, they found that the relative importance of CSFs was determined by the use of either efficiency or value measures.

All the Pinto papers employed the four phased/staged project lifecycle (i.e., *‘Initiation/conceptualization’,* ‘*Planning’*, ‘*Execution’* and ‘*Benefits realization’*). There are four additional studies of relevance that contribute to our understanding of CSF variations across the project lifecycle.

The first is Patanakul et al. (2010). This study focused on the practice among project management practitioners in using specific project management tools and techniques across all phases of the project lifecycle. Drawing upon the Pinto studies (also employing the same four phased/staged project lifecycle), among the many findings from Patanakul et al. (2010) were that effective use of project deliverables and CSFs will imply the use of different project management tools and techniques across different phases of the project lifecycle. For example, they found the use of analogous communication plans and estimates, but not checklists as important during the ‘*Initiation/conceptualization’* phase. Similarly, they found the use of bar charts as detrimental as likely to result in poor monitoring and control in later project phases such as ‘*Planning’* and ‘*Execution’.*

The second is Liu et al. (2015a). This study is relevant because it explicitly acknowledged the non-static nature of CSFs within the lifecycle of PPP projects. However, their study differs from the Pinto studies and to an extent, Patanakul et al. (2010) in that their study was framed against a bespoke three phased PPP project lifecycle consisting of (i) ‘*Initiation and planning’* (covering a range of project tasks flowing from investment appraisal to draft contract preparation), (ii) ‘*Procurement’* (covering contract bidding and financial closure) and (iii) ‘*Partnership’* (covering building/construction, operation, and asset maintenance). Liu et al. (2015a) observed that success relates to (i) the outcome of the project itself (i.e., the product or project success) and (ii) the success of the delivery process (i.e., the success of project management).

The third study is Liu et al. (2018). While this study did not focus on CSFs, it examined how effective and efficient performance management systems are able to enhance the ability of PPP projects to achieve their strategic objectives. Most importantly, it acknowledged the need for a lifecycle perspective for evaluating PPP project performance.

The fourth study is Bao et al. (2018). While they did not examine CSFs, their study is relevant to us as it sought to undertake a review of academic literature on PPP published from 1996 to 2016, from the perspective of the project lifecycle. In the process of identifying research trends from the project lifecycle perspective, they identify a range of challenges (which we can construe as CSFs) specific/dominant to individual phases of the PPP lifecycle. As in Liu et al. (2015a), the study by Bao et al. (2018) does not employ the four phased/staged project lifecycle employed in the Pinto papers. Instead, it adopts a six phased PPP project lifecycle consisting of ‘*Project identification’*, ‘*Project preparation’*, ‘*Competition’*, ‘*Preferred bidder phase’*, ‘*Contract signing’*, ‘*Design’*, ‘*Construction’*, ‘*Operation’*, and ‘*Transfer’*.

As we had earlier highlighted, there is wide acceptance in the literature that (i) lifecycle analysis is important to any understanding of project success (ii) that CSFs are in fact, phase contingent. However, most CSF studies (including those specific to PPP projects), appear to focus on CSFs specific to individual PPP phases or espouse a static view of CSFs (see Ika and Pinto 2023 for CSF studies in general). For example, studies focusing on CSFs relevant to specific PPP phases have included Ahadzi and Bowles (2004), Robinson and Scott (2009), Ng et al. (2012), Tang and Shen (2013) and more recently, Liu et al. (2016) and Simon et al. (2020). Conversely, there has been a proliferation of studies espousing a static perspective of CSFs in PPP. Examples of these studies include earlier studies by Chou and Pramudawardhani (2015), Ameyaw et al. (2017), Osei-Kyei and Chan (2017a, 2017b), Kavishe and Chileshe (2019), Muhammad and Johar (2019), Sehgal and Dubey (2019). More recent studies include Ngullie et al. (2021), Chileshe et al. (2022), Debela (2022) and Hai et al. (2022). In some instances, these studies have sought to undertake country-focused comparisons of CSFs for PPPs. Considering methodological and data diversity, the reliability of these comparisons remains questionable (see Chou and Pramudawardhani, 2015; Osei-Kyei and Chan, 2017a). In addition to these studies, there has also been a proliferation of review studies espousing a static perspective of CSFs in PPP. Examples of these studies include Osei-Kyei and Chan (2015) who reviewed PPP literature on CSFs published between 1990 and 2013, Simon et al. (2020) who undertook a review of CSFs (specific to the tendering process) in PPP literature published between 2003 and 2019, Zhang et al. (2020) who reviewed PPP literature on CSFs published between 2009 and 2019 and Almeile et al. (2023a, 2023b) who reviewed PPP literature on CSFs published between 1997 and 2021.

**5.0 The study**

*5.1 The study approach*

To identify the key CSFs that affect PPP in projects and then examine their variation over the project lifecycle, we set out to undertake a two staged study as similarly reported in Luthra et al. (2015a, 2015b, 2018) and Al-Mazrouie et al. (2021). This consisted of: *First*, a three-step search of the academic literature on PPP success factors was undertaken to identify the specific CSFs (consisting of comprehensive search, visual examination, and review). *Second*, we undertook a two-step Delphi study focused on classifying the CSFs into groups and then mapping the CSFs to the project lifecycle. We show in Figure 1 a diagrammatical representation of the approach adopted in the study.

Figure 1: The research approach



*5.2 Search and identification of factors*

To ensure that we obtained a true reflection of PPP specific CSFs cited in research papers, a review of CSFs for PPP in project management literature between 1997 (date of publication of the earliest journal article) to 2021 (date of completion of review) was undertaken. To ensure theoretical grounding, we sought to identify relevant factors from the literature by conducting a *‘Rapid review’* search of the literature (see Grant et al. 2009). We commenced our factor search and identification against ‘*Title’*, ‘*Abstract’* and ‘*Keywords’* in the SCOPUS database engine. The SCOPUS database was used to search the literature such as scientific journals, books, and conference proceedings because it is one of the largest abstract and citation database engines (Osei-Kyei and Chan 2015). Furthermore, SCOPUS is considered to perform better with respect to its accuracy and coverage compared to other databases engines such as Web of Science Core Collection, PubMed, and Google Scholar (Osei-Kyei and Chan 2015). To limit the search, we employed the following keywords in the search filter: (i) ‘*Project management’*, (ii) ‘*Construction’* and (iii) ‘*Infrastructure’.* We also included as our search (as inclusion criteria), (i) ‘*Articles’*, (ii) ‘*Journals’*, and (iii) ‘*English language*’. In doing so, restricting our search to construction/infrastructure articles. This is reflective of the reality that while PPPs have been used to procure projects in a variety of other industry sectors, its use was primarily construed for use in infrastructure/construction projects (see House of Commons 2015). Furthermore, its present use has been dominated by public infrastructure/construction (see National Audit Office 2018; HM Treasury and Infrastructure and Projects Authority 2019a, 2019b). Our search resulted in 312 articles being obtained. Our search resulted in 312 articles being obtained.

We then sought to identify and exclude articles deemed irrelevant to our study by examining each of the identified articles. We did not employ ‘*PPP’* in the search because of our recognition that the term is associated with a diversity of meanings (Bovaird, 2004; Yescombe, 2007; Delmon, 2010; Gambo and Gomes, 2014; Delmon, 2015). In fact, this diversity in terminology exists not only across countries, but also in some instances, exists within a single country. An example, being in the United Kingdom where the Private Finance Initiative (PFI) refers to new government-paid PPPs while on the other hand, existing government-paid PPPs are referred to as ‘Franchises’. The literature does not cite any specific, consistent, or standard naming nomenclature for PPP and across different countries and in effect, different studies, PPP has been used to describe different types of contract/contractual arrangements. Earlier, we had highlighted these to include ‘BOO’, ‘BOT’, ‘BOOT’, ‘BT’, ‘BLT/BTL’, ‘Concessions’ and ‘DBFOM’ project/contract types.

As the objective of our study was to gain an understanding of the critical factors (CSFs) that contribute to the success of PPP in construction projects, we eliminated all articles that did not explicitly address CSFs of PPP in construction projects. Mindful also of earlier work by Chipulu et al. (2019) which asserts a major conceptual difference between ‘*Project success’* and ‘*Project failure’*, we also excluded all articles that explicitly addressed Critical failure factors (CFFs) of PPP in construction projects. Following this process of exclusion, we identified 17 articles with Table 2 showing a breakdown by authorship, title, outlet, and year of publication. In Table 3, we show a breakdown of the articles by source country and researchers etc. This shows the global application of the identified CSFs.

Table 2: The 17 identified articles (by authorship, title, outlet, and year of publication)

|  |  |  |  |
| --- | --- | --- | --- |
| **Author/s** | **Title** | **Outlet** | **Year of publication** |
| Askar and Gab-Allah | Problems facing parties involved in Build, Operate, and transport projects in Egypt | ASCE Journal of Management in Engineering | 2002 |
| Dixon et al. | Lessons from the private finance initiative in the UK: Benefits, problems, and critical success factors | Journal of Property Investment and Finance | 2005 |
| Li, Akintoye, Edwards and Hardcastle | Critical success factors for PPP/PFI projects in the UK construction industry | Construction Management and Economics | 2005 |
| Jefferies | Critical success factors of public private sector partnerships: A case study of the Sydney SuperDome | Engineering, Construction and Architectural Management | 2006 |
| Chan et al. | Critical success factors for PPPs in infrastructure developments: Chinese perspective | ASCE Journal of Construction Engineering and Management | 2010 |
| Dulaimi et al. | The execution of public-private partnership projects in the UAE | Construction Management and Economics | 2010 |
| Ng et al. | A structural equation model of feasibility evaluation and project success for public–private partnerships in Hong Kong | IEEE Transactions on Engineering Management | 2010 |
| Cheung et al. | A comparative study of critical success factors for public private partnerships (PPP) between Mainland China and the Hong Kong Special Administrative Region | Facilities | 2012 |
| Ismail | Critical success factors of public private partnership (PPP) implementation in Malaysia | Asia-Pacific Journal of Business Administration | 2013 |
| Tang and Shen | Factors affecting effectiveness and efficiency of analyzing stakeholders’ needs at the briefing stage of public private partnership projects | International Journal of Project Management | 2013 |
| Liu and Wilkinson | Critical factors affecting the viability of using public-private partnerships for prison development | ASCE Journal of Management in Engineering | 2015 |
| Hsueh and Chang | Critical success factors for PPP infrastructure: perspective from Taiwan | Journal of the Chinese Institute of Engineers | 2017 |
| Osei-Kyei and Chan, 2017c | Comparative analysis of the success criteria for public–private partnership projects in Ghana and Hong Kong | Project Management Journal | 2017 |
| Osei-Kyei and Chan, 2017d | Developing a project success index for public–private partnership projects in developing countries. | ASCE Journal of Infrastructure Systems | 2017 |
| Ahmadabadi and Heravi | The effect of critical success factors on project success in public-private partnership projects: a case study of highway projects in Iran | Transport Policy | 2019 |
| Osei-Kyei and Chan | Model for predicting the success of public–private partnership infrastructure projects in developing countries: a case of Ghana | Architectural Engineering and Design Management | 2019 |
| Nguyen et al. | Success factors for public-private partnership infrastructure projects in Vietnam | International Journal on Advanced Science, Engineering and Information Technology | 2020 |

Table 3: The 17 identified articles (by source country and researchers etc)

|  |  |  |
| --- | --- | --- |
| **Country** | **Number of articles** | **Number of researchers** |
| Australia | 3 | 7 |
| China | 7 | 11 |
| Egypt | 2 | 4 |
| Japan | 1 | 1 |
| Malaysia | 1 | 1 |
| New Zealand | 1 | 1 |
| Singapore | 3 | 2 |
| Taiwan | 2 | 4 |
| Thailand | 1 | 1 |
| UAE | 1 | 2 |
| UK | 1 | 3 |
| USA | 2 | 3 |
| Vietnam | 1 | 1 |
| **Total** | **17** |

*5.3 Two-step Delphi study*

### *5.3.1 The Delphi technique*

To facilitate the mapping of the CSFs to the project lifecycle, we first undertook to classify the emergent CSFs into groups based on their conceptual similarity. This allowed for the narrowing down of the quantity of the factors in each domain (see Shang and Seddon 2002). This was then followed by the actual mapping of the CSFs to the project lifecycle. Both endeavors were undertaken using the Delphi technique which we now briefly describe.

Defined as a “…*method where a number of experts can be asked for predictions, which are then shared amongst the group and they are asked to predict again, and so on until the predictions cluster around a particular forecast*” (Greener 2008, p. 100). The Delphi technique has been widely used or acknowledged in operations (Meredith et al. 1989; Flynn et al. 1990; McCarthy 1992) and project management research (Chipulu et al. 2016a; Al-Mazrouie et al. 2021).

The Delphi technique has three main features: (i) anonymity, (ii) repeated processes with control response and (iii) statistical response. Unlike ordinary survey research, the series of repetitions enshrined in the Delphi technique helps to generate a consensus on the issue of interest due to participant having an opportunity to evaluate, adjust and/or stand by their responses. This allows for the elimination or reduction in the variability of the feedback needed to reach an agreed point on the precise value (Hallowell and Gambatese 2009). In effect, our focus was to attain group consensus on the results and not on individual responses (Habibi et al. 2014). Therefore, on the basis of prior studies (Chipulu et al. 2016a; Al-Mazrouie et al. 2021), a mean score that measures consistency and agreement was adopted to measure the panel evaluations. More specifically, we did not record results if the mean was less than 0.67. If the mean was equal to, or greater than, 0.67, the results were recorded as very close matches.

### *5.3.2 Classifying (grouping) and mapping the emergent CSFs*

The process we adopted is similar to that reported in Al-Mazrouie et al. (2021) and Ojiako et al. (2023a). The classification/mapping exercise was conducted in Saudi Arabia with a number of project management practitioners /experts (all were Saudi nationals) being were selected to participate in the study. All participants were carefully chosen on the basis of significant verifiable professional (managerial and technical) experience/competence in PPP project delivery similar to that required for eligibility for status of Chartered Engineer (CEng)/Chartered Project Professional (ChPP) as required for Professional Engineers by the Saudi Council of Engineers (SCE); the professional institution heavily involved in construction and infrastructure delivery in Saudi Arabia. We focused on Saudi Arabia because of recent uptake in PPP projects in the country (Almeile et al. 2023a, 2023b). Most recently, the Saudi government has shown its fervor for PPP by designating PPP spending close to $1.2 trillion (Government of Saudi Arabia 2016; JLL 2017; National Center for Privatization 2021; The official Saudi Press Agency 2021).

The Delphi process was specifically undertaken with practitioners’ cognizance of earlier assertions made by Pinto and Covin (1989) that there are fundamental differences to the management of projects as conceived by practitioners and scholars (p. 59). In addition, Pinto and Covin (1989) observed that often, scholars have sought to advance generalized decision rules (such as CSFs), while on the other hand, practitioners have oriented towards decision rules specific to their unique management challenges. On this basis, noting that the CSFs were gleaned from academic literature, conducting the Delphi study with practitioners afforded our study a critical element of triangulation.

As the classification/mapping exercise was conducted in Saudi Arabia, the Delphi study was conducted in Arabic, the official and dominant business language. Despite this, the authors were cautious of the need to ensure that no misinterpretation and or lack of comprehension arose from translations from English into Arabic (and the other way around) of the emergent CSFs during the classification and mapping exercise. For this reason, ensuring syntactical and grammatical equivalence was of paramount priority to the authors. Throughout the classification/mapping exercise, we were conscious that some of the words used to describe the emergent CSFs potentially had intricately different meanings when translated directly from English into Arabic (and vice versa). This was very important noting that some of the participants were not English speakers. To therefore address this potential source of misinterpretation, we largely repeated the process described by Ojiako et al. (2023a) on how to ensure language (syntactical and grammatical) equivalence between Arabic and English.

From the literature, it is evident there are some disagreements about the optimal composition and panel size required for an effective Delphi technique to function (Mittermaier and Steyn 2009; Habibi et al. 2014). There is no research offering evidence of any significant correlation between Delphi effectiveness and the number of panel members. Rowe and Wright (1999) indicate that the panel sample size of a Delphi technique could be from three members to as many as eighty.

A traditional Delphi study is structured against three main processes: (i) engaging with an expert group (ii) employing repetitive rounds of engagement to express and then revise/adjust responses with a view towards reaching consensus and (iii) communicating feedback from this process (Belton et al. 2019; Barrios et al. 2021). Two rounds of the Delphi technique were carried out. In the first round, each panel member was asked to independently evaluate the matching degree of a given CSFs with the groups that emerged from the meaning and measurement index using a three-point Likert scale, coded as 0= ‘*not agree at all’,* 1 = neither agree or disagree and 2= ‘*strongly agree’*. Our decision to employ a three-point scale (i.e., in comparison to the use of a five, seven or nine-point scale), was influenced by a recent study by Lange et al. (2020). The main findings from their study being that agreement/unanimity during Delphi was highly influenced/dependent on both the rating scale and threshold of consensus existing within sampled populations. Notably, they observed that reliability variations potentially served as a major foundation of bias in consensus studies and that final consensus was significantly influenced by rating scale and consensus criteria. Their findings suggest that the three-point scale provided the most realistic/ straightforward choice among rating scales (they had compared the use of a three, five and nine-point scale). The findings from Lange et al. (2020) are in line with earlier studies on measurement accuracy. For example, Jacoby and Matell (1971) discussed the same point. They note based on a comparison of the ‘test-retest’ reliability and concurrent and predictive validity coefficients of 18 rating formats that “…*both reliability and validity are independent of the number of scale points used for Likert-type items*” (p. 498). More specifically, they summate that to the extent that the number of items within a survey inventory is sufficient, an increase in measurement precision will not result in greater reliability or validity of the measurement instrument.

A three-point Likert scale was therefore employed because it offered the panel members a simple and reasonable polar scale of agree and disagree in addition to a neutral option. In the second round of the Delphi, each panel member was asked to consider either retaining or revising their earlier judgments in the light of the aggregated peer judgments. The outcome of the Delphi process as relates to the emergent classifications (grouping) and mapping is presented (in percentages), is shown in Appendix 1.

For the purposes of mapping the CSFs, we adopted the ontogenesis-inspired four phase project lifecycle espoused in the literature (Pinto and Slevin 1988, 1989; Pinto and Covin 1989; Pinto and Prescott 1987, 1988, 1990; Kloppenborg et al. 2014; Zwikael and Meredith 2018). This project lifecycle consists of *‘Initiation/conceptualization’,* ‘*Planning’*, ‘*Execution’* and ‘*Benefits realization’* (which includes *‘Closure’* and *‘Termination’*).

As projects tend to confront a slew of contextual (e.g., economic), institutional (e.g., governance), and managerial (e.g., monitoring) challenges (Ika and Saint-Macary 2023), we offer further groupings of the CSFs. In particular, we draw upon the multi-level perspective of transition processes occurring across three analytical levels: the ‘*macro’*, ‘*meso’* and the ‘*micro’*-level to argue that CSFs can occur across, within and between different levels (Petro et al. 2019; Kühl et al. 2023).

We construe ‘*macro’* CSFs as external institutional factors occurring at the strategic level of the sponsoring organization. They originate from outside the sponsoring organization. In this sense, they are exogenous. They include strategic level economic, legal, and political factors. Earlier, Longman and Mullins (2004) had observed that “…*any strategy session that is worth its salt ultimately distils vision [statements] into critical business issues, and if the organization is really serious, these issues get distilled into projects*” (p. 54). Thus, on the basis that projects are generally employed to deliver organizational strategy (Ojiako et al. 2015; Maylor et al. 2018; Chipulu et al. 2019; Petro et al. 2020, Al-Hanshi et al. 2022), we see ‘*meso’* level CSFs as those focused on the interaction and engagement between the organization and individuals. Although ‘*meso’* level CSFs originate from outside the project (i.e., they are exogenous), their impact can be controlled within the project. They include project governance factors. We see ‘*micro’* level CSFs as originating from inside the project (i.e., they are endogenous) with their impact controlled within the project by the activities of individual practitioners. This multi-level perspective provides a simple framework to offer further groupings of the identified CSFs. We argue that since it is widely accepted that PPP projects are generally complex multi-stakeholder endeavors, they are more likely to have at their disposal the expertise to deal with the challenges associated with ‘*micro’* and *meso*-level CSFs but face stiffer challenges addressing *macro*-level CSFs.

## 6.0 Results

*6.1 The identified CSFs*

From the reviewed literature, we identified CSFs that appeared in at least two articles. Our review found 24 such CSFs as is shown in Table 4. The top three CSFs for PPP projects reported in the literature are (i) ‘*Available policies and regulations’*, (ii) ‘*A strong and good private consortium’*, and (iii) ‘*Transparency and competition in PPP procurement process’*. Each of these CSFs were identified 13, 12 and 12 times respectively in the literature. This accumulation shows how significant these factors are to the success of PPP projects, regardless of the phase of the project.

Table 4: CSFs for construction PPP in projects

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **No.** | **CSFs for PPP construction projects** | **Source** | | | | | | | | | | | | | | | | | **Total** |
| **A** | **B** | **C** | **D** | **E** | **F** | **G** | **H** | **I** | **J** | **K** | **L** | **M** | **N** | **O** | **P** | **Q** |
| 1 | Available policies and regulations |  | X | X |  | X |  | X | X | X | X | X |  | X | X | X | X | X | 13 |
| 2 | A strong and good private consortium |  | X | X | X | X |  | X | X | X | X |  | X | X |  | X |  | X | 12 |
| 3 | Transparency and competition in PPP procurement process | X | X | X | X | X |  | X |  | X | X |  |  | X |  | X | X | X | 12 |
| 4 | Appropriate risk allocation and risk-sharing |  | X | X |  |  | X | X | X | X | X |  | X | X |  | X |  | X | 11 |
| 5 | Political stability |  | X | X | X |  | X | X | X | X | X |  |  | X |  | X |  | X | 11 |
| 6 | Available financial market |  | X | X | X |  |  | X |  | X | X |  |  | X |  | X | X | X | 10 |
| 7 | Good and effective governance structures |  | X |  | X |  |  | X |  | X | X |  | X | X | X |  | X | X | 10 |
| 8 | Picking the right project | X | X | X | X | X |  | X |  | X | X |  |  |  |  |  | X | X | 10 |
| 9 | Supportive and understanding community |  | X | X | X | X |  | X |  | X | X |  |  | X |  | X |  | X | 10 |
| 10 | Realistic financial study |  | X | X | X |  |  | X |  | X | X |  |  | X | X |  |  | X | 9 |
| 11 | Economic stability |  | X | X |  |  |  | X | X | X | X |  |  | X |  |  | X | X | 9 |
| 12 | Engage a team of advisers |  |  | X | X | X | X |  |  |  |  | X |  |  | X | X | X |  | 8 |
| 13 | Commitment and responsibility of project parties |  | X |  |  |  | X | X |  | X | X | X |  | X |  |  |  | X | 8 |
| 14 | Promising economy/economic growth |  | X | X | X |  |  | X |  | X | X |  |  | X |  |  |  | X | 8 |
| 15 | Government guarantees |  | X | X |  |  |  | X |  | X | X |  |  | X |  |  |  |  | 6 |
| 16 | Well organized host government |  | X |  |  |  |  | X |  | X | X |  |  | X |  | X |  |  | 6 |
| 17 | Innovation in delivering public services |  |  | X | X | X |  |  | X |  |  |  |  |  | X |  |  |  | 5 |
| 18 | Open and constant communication among stakeholders |  |  |  | X |  | X |  |  |  |  | X |  |  |  | X | X |  | 5 |
| 19 | Value for Money (VFM) assessment |  |  | X |  | X |  |  | X |  |  |  |  |  | X | X |  |  | 5 |
| 20 | Favorable contracts and agreements |  |  | X |  |  |  |  |  |  |  |  | X |  | X |  |  | X | 4 |
| 21 | Availability and organizing resources |  |  | X | X | X |  |  |  |  |  |  |  |  |  |  |  |  | 3 |
| 22 | Understand and respect the main PPP parties each other’s goals |  |  |  |  |  | X |  |  |  |  | X |  |  |  |  | X |  | 3 |
| 23 | A fair evaluation team |  |  |  |  |  |  |  |  |  |  | X |  |  |  | X |  | X | 3 |
| 24 | Project performance monitoring |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | X | X | 2 |
| A = (Askar and Gab-Allah 2002), B = (Li et al. 2005a), C = (Zhang 2005c), D = (Jefferies 2006), E = (Salman, Skibniewski and Basha, 2007), F = (Jacobson and Choi 2008), G =(Chan et al. 2010a), H = (Dulaimi et al. 2010), I = (Cheung et al. 2012), J = (Ismail 2013), K = (Tang and Shen 2013), L = (Liu and Wilkinson 2015), M = (Chou and Pramudawardhani 2015), N = (Liu et al. 2015), O = (Hsueh and Chang 2017), P = (Osei-Kyei et al. 2017), Q = (Nguyen et al. 2020). | | | | | | | | | | | | | | | | | | | |

### *6.2 The emergent CSF classifications (groupings)*

The outcome of the Delphi process was the emergent classifications (groupings). The outcome of this process resulted in the 24 CSFs being classified/combined into 12 groups, as shown in Figure 2. These groupings will now be described.

Figure 2: Combined grouping of identified CSFs

Financing CSFs

The CSFs for PPP construction projects based on the type of similarity from the literature

Economic Environment CSFs

Public Sector CSFs

Available financial market

Government guarantees

Realistic financial study

Availability and organising resources

Promising economy/economic growth

Economic stability

Engage a team of advisers

Good and effective governance structures

Picking the right project

Project performance monitoring

Understand and respect all PPP parties’ goals

Commitment and responsibility of project parties

Open and constant communication among stakeholders

Political stability

Effective Project Management CSFs

Well-organised host government

Shared Responsibility between Partners CSFs

Innovation in delivering public services

Political Environment CSFs

A strong and good private consortium

Innovation CSFs

Appropriate risk allocation and risk-sharing

Private Sector CSFs

Supportive and understanding community

Risk Management CSFs

Social Environment CSFs

Available policies and regulations

Favourable contracts and agreements

Legal CSFs

A fair evaluation team

Transparency and competition in the procurement process

Procurement CSFs

VFM assessment

*6.2.1 Financing:* Public-private partnerships (PPPs) projects are basically projects which involve long-term agreements between the public and private sector for infrastructure (i.e., construction/implementation and/or management) and/or services (i.e., its provision) (Carbonara and Pellegrino 2020). By their nature therefore, PPP projects go beyond infrastructure construction, extending to its operations and finance (Carbonara et al. 2016). While PPP projects offer numerous benefits to the public sector, they are associated with significant uncertainty which has a major impact on *ex ante* (i.e., pre-contract) and *ex-post* (i.e., post-contract) transaction costs (Carbonara et al., 2016). Generally, these transaction costs (i.e., costs associated with the procurement, monitoring, and enforcement of PPP projects), tends to be much higher than those for conventionally/traditionally procured projects (Jacobson and Choi, 2008; Soliño and de Santos, 2010). A key driver for the public sector to seek to procure projects using PPP is an acknowledgement that by partnering with the private sector, the public sector is able to supplement the financing of major infrastructure projects with private sector funds, thus allowing for the public sector to channel funds to other endeavors (Sheng et al. 2020; Almeile et al. 2023b). Thus, from a finance perspective, the PPP arrangement primarily represents a means of addressing limitations in the funding capacity of the public sector.

*6.2.2 Economic environment:* Previous studies noted that a positive economic environment, which includes (i) economic stability and (ii) the availability of well-organized resources are major determining factors in the success of PPP projects (Wang et al. 2019; Almeile et al. 2023b). The economic environment plays a major role in market predictability (Cheung et al. 2012). Most importantly, macro-economic and political stability is likely to have a major knock-on effect on the viability of the concession, impacting areas such as contract (Soecipto and Verhoest 2018) and concession/tariff viability (Ng and Xie 2008). Harris and Pratap (2009) noted that economic considerations constitute a major driver for PPP project failure. More specifically, they found that shocks in the economy are likely to increase the likelihood that a PPP project will be cancelled by more than 8%.

*6.2.3 Public sector:* As PPP projects usually involve significant economic and financial commitment by the public sector (Casady et al. 2020), they are generally politically contentious in nature. Most PPP projects face challenges relating to risk distribution between the public and the private sector. Their costs may be underestimated while their benefits, overestimated (Flyvbjerg et al. 2009). PPP projects can be marred by corruption (Iossa and Martimort 2016; Schomaker 2020). Governments have sought different means of addressing concerns with PPP projects by focusing on improving governance structures to (i) manage the often-complex relationships it has to maintain during the lifecycle of PPP projects (Wang et al. 2019) and mobilize private capital through various incentives (Irwin et al. 2018; Kim et al. 2020; Schwartz et al. 2020). A core focus of this governance philosophy is its ability to comprehensively capture and limit the impact of fragmentation between policy making and implementation (Warsen et al. 2018). Good and effective governance structures across the project lifecycle is therefore a crucial component of PPP success (Casady et al. 2020). The public sector has a number of interests in procuring PPP projects. For example, by requiring robust asset maintenance, the government can ensure that the long-term value of public assets is secured over the lifecycle of the projects (Fouad et al. 2021).

*6.2.4 Project management:* Effective project management is key to infrastructure PPP project success. Fouad et al. (2021) has observed that when properly and competitively structured, PPP projects have been shown to deliver projects in time. There are a number of reasons including (i) PPP emphasis on advanced financial arrangements and (ii) that PPP partners generally have to deliver the project before able to commence cost recovery. Classical organization behavior literature has identified ‘*Coordination priority’* which focuses on long-term integration of project activities and resources as one of the three key priorities of management (see Smith et al. 1985). In the present study context, effective project management in PPP requires the integration of standards and guidelines into the PPP environment. Fischer et al. (2006) observes that key to project management effectiveness is ensuring that resources and strong expertise is readily available to provide competent support at the government level (required for planning) and also at the concessionary level (required for implementation).

*6.2.5 Legal:* As in the case of an appropriate economic environment, PPP projects require robust legal frameworks. The absence of a robust legal framework can have both direct and indirect negative consequences for PPP projects triggering contractual risks (Aladağ and Işik 2022). Legal considerations are particularly important in PPP projects because the law sets out the frameworks needed to enable the implementation and delivery of PPP policy. Furthermore, the law serves to regulate and enforce both contractual and non-contractual relationships (AlRaeesi and Ojiako 2021).

*6.2.6 Political environment:* Previous studies have noted that the prevailing political environment will have a major impact on PPP outcomes. In particular, as observed by Baker et al. (2019), stability in the political environment is a condition for both viable PPP policy and its enforcement to prevail. This is particularly the case in developing countries where political volatility has been deemed to represent a major risk to private sector investment in PPP projects. Stability in the political environment is particularly important as power entails the exercise of power, which is often outside the domain of the private sector (Cheung et al. 2012; Dewulf and Garvin 2020; Kim and Kwa 2020). The risk of political volatility is particularly a concern for the private sector because it can potentially lead to the public sector renegading on its contractual obligations and in the process, exposing private sector partners to significant financial losses (Brada et al. 2006; Aladağ and Işik 2022).

*6.2.7 Procurement:* PPP procurement system plays a vital role in encouraging the private sector to participate in providing public services, particularly if it is transparent (Bovis 2008; Bovis 2009; Reynaers and Grimmelikhuijsen 2015). In particular, Bovis (2009) observes that transparency (and the resultant accountability) by introducing openness in PPP procurement serves as the basis for best practice. It therefore has a direct impact on not only how contracting parties behave, but also ensures that the interface between the public and private sectors is built upon strong economic, legal and policy foundations. Thus, transparency serves as a basis for introducing operational efficiencies within the PPP market.

*6.2.8 Shared responsibility between partners:* The effective sharing of responsibilities can help mitigate against power imbalances between contracting parties in PPP projects (Osei-Kyei et al. 2017; Wang et al. 2019). This is especially important noting that the public and private sector are generally driven by different interests (Bryson et al. 2006; Boyer et al. 2016). The public sector may occasionally find itself in a situation where information advantage resides within the private sector leading to significant tensions (Boyer et al. 2016). The existence of shared responsibility resides on the notion that through collaboration/partnering, public and private sector actors are able to bring their resources together. In the process, they develop a broader platform for addressing complex operational and production related problems/challenges that are rife in PPP projects. Often, such shared responsibility will extend to risk sharing. Shared responsibility between partners allows for capabilities and resources to be pooled and shared, resulting in more efficient and superior risk management. Key to shared responsibility is that ‘ownership’ of specific aspects to the project remain with the party that can best resource its delivery. Shared responsibility also means that that the private sector is given an appropriate level of freedom to make decisions in areas of PPP that it is only it that will have expertise or control. These may include areas such as commissioning, phase transition and operations. In particular, such freedom is essential for the generation of new design and operational ideas which is often key to PPP (Nisar 2007).

*6.2.9 Innovation:* PPP has been construed as a source/driver for innovation in projects. Cantarelli and Genovese (2021) and Cantarelli (2022) point out that using PPP as a procurement route serves as two drivers for innovation in projects. For example, as an ‘*Internal’* driver for innovation, PPP allows for both the public and private sectors to achieve knowledge gains derived from the pooling of capital and human resources (particularly, expertise) and the sharing of risks. On the other hand, as an ‘*External’* driver of innovation, PPP provides the platform for the public sector to clearly set out innovation and performance expectations. Cantarelli and Genovese (2021) observe that the private sector is more likely to be more motivated to drive innovation where it has clear indications that there are financial gains to do so. There are a number of ways innovation can be driven in PPP projects. One example being the drawing up of the contract to incentivize innovation by paying the private sector for the delivery of specific services and assets.

*6.2.10 Private sector:* Strong private participation has been considered as one of the most critical factors for the successful implementation of PPP projects (Cheung et al. 2012). A key attribute of private participation in PPP projects is the financial strength, quality of leadership and the existence of complementary capabilities within the private contracting partner (Cheung et al. 2012). These qualities are particularly important as they generally exercise some element of discretion in terms of the approach to be adopted to implement and complete the project (Boyer et al. 2016). Scholars have examined the relative costs and associated benefits of private sector involvement in the delivery of public services/infrastructure projects (Spackman 2002; Koppenjan and Enserink 2009; Muleya et al. 2020). In particular, the private sector plays a major role in mitigating against the uncertainties of PPP projects (Hart 2003).

*6.2.11 Risk management:* PPP projects are particularly vulnerable to risks (Nisar 2007; Chou and Pramudawardhani 2015; Xiong et al. 2017; Wang et al. 2019; Aladağ and Işik 2020, 2022). Most of the risk in PPP projects are particularly difficult to assess and allocated because of the complex (and often incomplete) nature of their contracts. Thus, an emphasis on allocation in PPP risk management. When risks are allocated to the contracting party best positioned to manage it, it is incentivized to minimize associated costs (Nisar 2007). PPP projects are generally regarded as ‘incomplete’ contracts because of their associated uncertainties (Hart 2003; Iossa and Martimort 2016). Therefore, the management of risk in PPP projects should focus on risks that exist before and after contract signing. Xiong et al. (2017) observes that a ‘complete’ risk management philosophy espouses the notion that it is possible to competently forecast and specified all risks within a contract. The alternative notion of ‘incomplete’ risk management acknowledges that it is generally not possible to identify and address all risks prior to contract formation.

*6.2.12 Social environment:* Many challenges faced by society (such as poverty and employment) can be influenced by and do have an influence on public sector projects (Yuan et al. 2018). PPP projects often serve as a source of public policy implementation (AlRaeesi and Ojiako 2021). They are also employed in organizing the relationship between the government (state) and the public (society). For this reason, when improperly managed, PPP projects can create social tensions exposing private sector contracting parties to instrumental action by the society (Chipulu et al. 2016b, 2018) and the government (state) to public protest/confrontations (see Rwelamila et al. 2015; Shi et al. 2015; Xue et al. 2015). For these reasons, PPP projects are less likely to deviate from social interest if the public (society) is afforded a greater role in having a say in the shaping of PPP policy, design, and implementation (Xiahou et al. 2022).

### *6.3 Lifecycle mapping the emergent CSFs*

The second outcome of the Delphi involved the mapping of the extracted 24 CSFs for PPP projects over individual phases of the lifecycle. Doing this will facilitate an understanding of the importance of individual CSFs along the lifecycle of PPP projects. The findings based on the Delphi exercise are shown in Table 5.

Table 5: Mapping CSFs groups (and sub-groups) to phases in the PPP project’s lifecycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CSFs groups** | **CSF sub-groups for PPP projects in construction** | **PPP project’s lifecycle phase** | | | |
| **Initiation and conceptualization** | **Planning** | **Execution** | **Benefits realization** |
| **Financing** | Available financial market | \* |  |  | \* |
| Government guarantees | \* |  |  | \* |
| Realistic financial study | \* |  |  |  |
| Value for Money (VFM) assessment | \* |  |  |  |
| **Economic environment** | Availability and organizing resources | \* |  |  |  |
| Promising economy/ economic growth | \* |  |  |  |
| Economic stability | \* |  | \* | \* |
| **Public sector** | Engage a team of advisers |  | \* |  |  |
| Good and effective governance structures |  | \* | \* | \* |
| Picking the right project | \* |  |  |  |
| **Effective project management** | Project performance monitoring |  |  |  | \* |
| Understanding and respecting the goals of the main PPP parties |  |  |  | \* |
| **Legal** | Available policies and regulations |  | \* |  | \* |
| Favorable contracts and agreements |  | \* | \* |  |
| **Political environment** | Political stability | \* |  | \* | \* |
| Well-organized host government | \* |  |  |  |
| **Procurement** | A fair evaluation team |  |  | \* |  |
| Transparency in the procurement process |  |  | \* |  |
| **Shared Responsibility between partners** | Commitment and responsibility of project parties |  |  |  | \* |
| Open and constant communication among stakeholders |  |  | \* | \* |
| **Innovation** | Innovation in delivering public services |  |  | \* | \* |
| **Private sector** | A strong and good private consortium |  |  | \* | \* |
| **Risk management** | Appropriate risk allocation and risk-sharing | \* |  |  | \* |
| **Social environment** | Supportive and understanding community | \* |  |  | \* |
| **Total of frequency within the project’s lifecycle** | | **12** | **4** | **9** | **14** |

*6.4 Summary*

On the basis that the number of citations of specific CSFs in the literature represents an indication of their importance, mapping of the 24 CSFs across the four ontogenesis-inspired PPP project lifecycle phases showed that none of the identified CSFs were determined to be of importance across all phases of the PPP project lifecycle. However, three CSFs, namely: ‘*Economic stability’*, ‘*Good and effective governance structures’* and ‘*Political stability’*, appeared in three of the four PPP project phases, suggesting their importance. Most CSFs appeared in two of the four PPP project phases while six, namely, ‘*Engage a team of advisers’*, ‘*Project performance monitoring’*, ‘*Understanding and respecting the goals of the main PPP parties*’, ‘*A fair evaluation team’*, ‘*Transparency in the procurement process*’ and ‘*Commitment and responsibility of project parties*’ appeared in only one phase of the PPP project lifecycle.

**7.0 Discussions**

While our findings were generally in line with lifecycle literature (Westerman et al. 2006; Arnett et al. 2018), it differs slightly from those of prior findings in studies which have sought to articulate variations in CSFs of projects over lifecycle phases. These studies are specifically, the Pinto studies (Pinto and Slevin 1988, 1989; Pinto and Covin 1989; Pinto and Prescott 1987, 1988, 1990) and Liu et al. (2015). Our findings also differ slightly from other relevant studies which have undertaken a review of literature relevant to either the project lifecycle (e.g., Bao et al. 2018) or CSFs of PPP projects (Osei-Kyei and Chan 2015; Zhang et al. 2020; Almeile et al. 2023a, 2023b). We discuss these differences.

*7.1 Observations against the Pinto and related studies*

A key conclusion from the Pinto studies (see Pinto and Prescott 1987, 1988, 1990; Pinto and Slevin 1988, 1989; Pinto and Covin 1989) was the finding of ‘*Project Mission’* as the most important CSF across all lifecycle phases of projects. In finding the prominence of ‘*Project mission’* across all phases of the project lifecycle, the Pinto studies suggest the criticality of what we had classified as the ‘*Effective Project Management’* CSF across all phases of the project lifecycle. Other studies which support this view (although they were not lifecycle focused), include Rolstadas (1994), Mir and Pinnington (2014) and Kafaji (2023). For example, Rolstadas (1994) points out that the importance of project management to projects is that it encompasses a definition of control baselines.

As shown in Table 6, our findings differ from Pinto studies in that we found the ‘*Effective Project Management’* CSF as critical only within one phase (the *‘Benefits realization’* phase). Our findings are however not in complete contrast to the Pinto findings. The reason being that as a discrete/independent CSF, we expect to see elements of project management within a substantial number of CSFs. Earlier, Dixon et al. (2005) had identified ‘*Good project management’* as a CSF for PPP projects. Thus, a reasonable explanation for this finding (i.e., its situatedness within Benefits realization) is that as a process of organizing and managing, effective project management practices are essential to the ability of project sponsors to (i) ensure their return on investments (ii) meet strategic project goals and (iii) ensure that project outputs are fully integrated into the strategic business requirements to create value; thus (iv) ensuring that they realize desired benefits from PPP projects (Varajão et al. 2022). We argue based on the literature that project management practices are fundamental to any efforts to ensure that expected benefits are realized (Chih et al. 2015; Zwikael et al. 2018, 2019). Taking this into account, the identification of ‘*Effective Project Management’* as a discrete CSF manifest in the *‘Benefits realization’* phase appears to reflect not only their interrelatedness (Badewi 2016), but also the heightened role project management plays at this phase of the PPP project.

Table 6: Mapping differences in findings: Pinto studies versus Present study

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Conventional/‘Standard’ projects** | | | | | **PPP projects** |
|  | **Pinto and Prescott 1987** | **Pinto and Prescott 1988** | **Pinto and Slevin 1988** | **Pinto and Slevin 1989** | **Pinto and Covin 1989** | **Findings from present study** |
| **Initiation and conceptualization** | Mission Client consultation | Mission Client consultation | Mission Client consultation | Mission Client consultation Personnel Urgency | Mission | Financing Economic environment Public Sector Political environment Risk management Social environment |
| **Planning** | Mission Top management support Client acceptance | Mission Top management support Client acceptance | Mission Top management support Client acceptance Urgency | Mission Environmental events Schedule Monitoring and feedback Client acceptance | Mission Power and politics Technical tasks | Public Sector Legal |
| **Execution** | Mission Trouble-shooting Schedule/plan Technical tasks Client consultation | Mission Trouble-shooting Schedule/plan Technical tasks Client consultation | Mission Leadership Trouble-shooting Schedule/Plans Technical tasks Client consultation | Mission Technical tasks Top management support | Mission Schedule Client consultation Client acceptance | Economic environment Public sector Legal Political environment Procurement Shared responsibility between partners Innovation Private Sector |
| **Benefits realization** | Technical tasks Mission Client consultation | Technical tasks Mission Client consultation | Technical tasks Mission Client consultation | Mission Schedule Client acceptance Technical tasks Personnel | Technical tasks Mission Communication Trouble-shooting | Financing Economic environment Public sector Effective project management Legal Political environment Shared responsibility between partners Innovation Private sector Risk management Social environment |

Our view is that the differences in findings between the more ‘generic’ CSFs from the Pinto studies may be explained by the granularity of the CSFs we employed. For example, the Pinto studies employed between 10 and 14 CSFs while in our study, 24 CSFs were employed. As relates to the differences we found between our study and Liu et al. (2015a), this can possibly be explained by the fact that Liu et al. (2015a) did not employ the four phased ontogenesis. For example, there is substantial literature (see Carter 1991; Slaughter et al. 2004; Lee and Nowell 2015; Navimipour et al. 2018; Ojiako et al. 2023b) which tells us that differences in the level of analysis may change the perceived outcome of an organization’s effectiveness or performance. On this basis, the importance attached to the CSFs over the project lifecycle were likely to differ between our findings, and the findings from prior studies.

*7.2 Observations against prior PPP studies*

The study by Liu et al. (2015a) went only as far as identifying, based on the literature, CSFs that will be engaged only one point in time over the lifecycle of PPP projects. A key difference with our study is that their study did not employ the four phased ontogenesis-inspired project phase articulated in project management literature which we have adopted in this study. Instead, they framed their study around a three-phased delivery structure; ‘*Initiation and planning*’, ‘*Procurement*’ and ‘*Partnership’.* They identified eight CSFs specific to the ‘*Initiation and planning*’ phase, five CSFs specific to the ‘*Procurement*’ phase and ten CSFs specific to the ‘*Partnership’* phase of PPP projects. Furthermore, although not discussed in their study, our examination of their study shows that broadly framed, their two identified CSFs, that is ‘*Effective evaluation’* and ‘*Effective interface management’* appeared across all phases of their delivery structure while two CSFs appeared across two phases. That is, ‘*Effective procedures’* appeared in both the ‘*Initiation and planning*’ and ‘*Procurement*’ and ‘*Partnership’* phase while ‘*Good governance’* appeared in both the ‘*Procurement*’ and ‘*Partnership’* phase. Despite the fundamental conceptual difference in the framing of the project phases between their study and ours, the findings appear slightly similar in that it could be argued that ‘*Good and effective governance structures’* is a precursor to both effective evaluation (Molas-Gallart 2012) and interface management (Filatotchev and Nakajima 2010).

In Osei-Kyei and Chan (2015), a review of CSFs studies published from 1990 to 2013 was undertaken. Their findings suggest key CSFs for PPP projects were ‘*Risk allocation and sharing’*, ‘*Strong private consortium’*, ‘*Political support’*, ‘*Community/public support*’ and ‘*Transparent procurement’*.

While Liu et al. (2015a) did not find political considerations of importance to PPP projects, findings from Osei-Kyei and Chan (2015) suggested that ‘*Political support’* was a CSF for PPP projects. In appearing within three phases of the lifecycle (it did not appear in ‘*Planning’*), our findings are similar to Osei-Kyei and Chan (2015).

We argue that as in Liu et al. (2015a) and Bao et al. (2018), all these CSFs appear to be *macro*-level CSFs and therefore, not particularly different from our findings (we also highlight findings on the importance of political support/environment). One may be tempted to construe ‘*Risk allocation and sharing’* which appeared in Osei-Kyei and Chan (2015) but not our findings as a *meso*-level CSF. However, the reality, as observed by Nisar (2007), is that the primary focus of PPP projects is not necessarily to procure a specific asset, but to deliver value for money. On this basis, risk allocation/management is not in reality, controlled within PPP projects. Instead, the allocation and management of risks in PPP is a *macro*-level CSF dependent on (i) the public sector creating incentives for contracting parties to be motivated towards effective/efficient management of risks and (ii) the public sectors being willing to insure/provide guarantees to contracting parties against risks they (the contracting party) are either unwilling or unable to bear (see Iossa et al. 2007).

As mentioned earlier, Bao et al. (2018) did not specifically examine CSFs from the project lifecycle perspective. What is of relevance to our study is that they identified based on a review of PPP literature published between 1996 to 2016 the CSFs impacting upon PPP projects as: ‘*Strong and good private consortium*’, ‘*Appropriate risk allocation’*, and ‘*Available financial markets*’, ‘*Approval and negotiation process’*, ‘*Clear project brief and client outcomes’*, and ‘*Increased competition during the tendering process’* were the most critical. Our findings share some similarities with their findings.

While focused on PPP in developing countries, the study by Almeile et al. (2023a), a review of the academic literature published between 1997 and 2021 found the three most commonly reported CSFs in PPP projects *‘Appropriate risk allocation and risk-sharing’*, *‘Political support’*, and *‘The private sector’s financial strength’*. This study was further developed in Almeile et al. (2023b). Findings in this study which were based on a questionnaire survey of PPP practitioners, found ‘*Economic stability’* to be the most important CSF impacting upon PPP projects. The major difference between our present study and that of Almeile et al. (2023a, 2023b) being in the emergence of ‘*Good and effective governance structures’* as a CSF for PPP projects.

**8.0 Conclusion**

In this study, rooted in lifecycle theories, we engaged in a two staged study to explore the variation in criticality of the CSFs of PPP projects over their lifecycle stages. The findings from our study discursively emphasizes that for PPP projects, the importance of CSFs varied depending on the lifecycle phase the project resided within any one point in time. Our study makes contributions to both theory and practice.

*8.1 Theoretical contributions*

With most of our study related, at the very least subtly, to the concept of ‘*Success’*, we make contributions to advancing project success literature (see Ika 2009; Ika and Pinto 2022; Pinto et al. 2021, 2022). Our study further highlights that despite continued interest in project success and critical success factors, the topic arguably remains empirically under-studied from the lifecycle perspective (Ika and Pinto 2023). Our study also makes theoretical contributions specific to PPP projects. In addition to highlighting the specific CSFs of importance to PPP projects, by drawing upon lifecycles theories, we have demonstrated that these CSFs will vary in importance over the lifecycle of PPP projects. In identifying three CSFs, namely: ‘*Economic stability’*, ‘*Good and effective governance structures’* and ‘*Political stability’*, as appearing important in three of the four lifecycle phases, we highlight the critical importance of these three ‘*macro’* CSFs *specific* to PPP projects. As alluded to earlier, we are only aware of two prior studies (Liu et al. 2015a; Bao et al. 2018), that have been undertaken in this area. Our findings suggest that project stakeholders emphasized specific endogenous CSFs as being more important during initial phases of PPP projects (i.e., the ‘*Initiation and conceptualization’* and ‘*Planning’* phases), but these CSFs then gave way to the prominence of more exogenous CSFs that emphasized change and transformation as the PPP project moved along the lifecycle towards the ‘*Execution’* and ‘*Benefits realization’* phases. This finding makes contributions to CSF scholarship in that it amplifies a more elaborate description of CSFs. This description will be of interest to scholars seeking better means of evaluating, appraising, and understanding the specific ‘things [that] must go right’ (see Rockart 1979) on the side of project stakeholders interested in competitive performance of PPP projects.

*8.2 Practical contributions*

What appears to be the inability of scholars to agree on a settled framing and operationalization of ‘*Project success’* and ‘*Critical success factors’* (CSFs) is therefore, a matter of great concern for operations and project management practitioners as PPP projects represent the primary means of procuring major infrastructure projects. In the past 30 years following the initial launch and then expansion of PPP as a programme for financing capital assets, PPP arrangements (including other forms of private financing) have become more conspicuous and widespread encompassing various sectors of the economy in many countries. The focus of governments (i.e., the public sector) has been to engage in partnerships with a wide sector of private entities including businesses (such as banks) and non-governmental organizations (NGOs) and the wider civil society (Ungureanu et al. 2019). Doing this, the argument goes, allows the public sector to tap into the wide-ranging expertise, resources, and capabilities of a diverse group of ‘partners’ to provide users (the public), with assets and services that are not only competitively procured, but also likely to deliver substantial value for money. Thus, by noting how the CSFs of PPP projects differ from one phase to another over a period of time (the lifecycle), practitioners become more effective when engaging in the prediction of the decisions, challenges, and opportunities these extremely important set of projects may be faced with.

The inability of scholars to agree on a settled understanding and operationalization of CSFs for PPP projects creates ambiguity for practitioners (see Ojiako et al. 2023b), which can lead to substantial negative consequences. This can be exacerbated by the complex nature of PPP projects and the long duration of its project lifecycle. For example, lack of clarity on the importance of CSFs along the project lifecycle creates unnecessary risks to PPP projects as they prevent understanding among stakeholders (due to heterogeneity; see Ojiako et al. 2015; Chipulu et al. 2019). It may prevent the balancing of stakeholder concerns, allowing less for compromises to be more readily reached in a manner beneficial to the PPP project. An inability to reach compromises can impede effective risk management, especially when dealing with new/evolving risks not previously contemplated. Failure to agree on settled understanding and operationalization of CSFs also creates space for practitioners/managers set on advancing personal, professional, and organizational interests to potentially manipulate CSFs through an exploitation of resultant fluidity in resultant chains of decision. It is also likely to lead to difficulties in the operationalization of CSFs as PPP stakeholders will be unable to understand how causal structures and relationships impact upon individual CSFs.

A major concern related to the absence of an understanding and operationalization of CSFs is the potential for the accumulation of dysfunctional decisions being made by practitioners/managers over the PPP project lifecycle. The accumulation of dysfunctional decisions may lead to project disruptions with a knock-on impact on escalating project costs and ultimately, project failure (Eden et al., 2000). This idea is further elaborated upon ideas of vicious decision circles discussed initially in Eden et al. (2000) and later advanced by Ungureanu et al. (2019). The core of the idea being that the accumulation of indecision will result in the propagation of “…*halfway solutions*” (p. 1333). These are not necessarily partial decisions in the sense that they do not entail any specific progress towards a desired position being achieved by the relevant decision-maker. Instead, the framing of halfway solutions suggests the state of persistent chaotic decisions that are rarely overcome. Left unmanaged, these cycles of vicious decisions can further spiral out of control creating the appearance of a chaotic project environment resulting in consequential delay and severe project disruptions (Eden et al., 2000). Furthermore, controlling and potentially mitigating against vicious decision circles emerging due to accumulated dysfunctional decisions being made over the PPP project lifecycle will require practitioners to (i) engage/commit to a focus on ‘*macro’*-level CSFs and (ii) drive the alignment of project competencies with these ‘*macro’*-level CSFs (see Robson et al. 2023). We arrive at this view taking into consideration recent work by Ika and Pinto (2022, 2023) and Pinto et al. (2021, 2022) which has highlighted the need for an emphasis on stakeholder-driven dynamic accounts of the notion of ‘*Project success’*.

*8.3 Limitations*

As expected, the study does have a number of limitations, which also present opportunities for further studies. The first limitation relates to the framing of the study within lifecycle theories. For example, the deterministic view of project lifecycles which retains the key characterization of temporal ‘*Birth’* and ‘*Decline’,* can be challenged on a number of fronts. One such criticism being that if projects are expected to precisely go through these phases, then it stands to reason that it can be claimed that an overwhelming number of projects will be expected to follow the identified phases with little or no constraints; with the few that deviate from the ‘standard’ lifecycle requiring some form of adjustment. However, we are aware that Sydow et al. (2004) had observed projects representing a useful means by which organizations “…*circumvent traditional barriers to organizational change*” (p. 1475). On the notion that the lifecycle represents a traditional approach to change, noting that not all projects conform to the model of phased sequential lifecycles (Wynn and Clarkson 2018), then the usefulness of the lifecycle to emergent project forms, may be questionable. Recently, we have observed the rise in concepts such as iterative and incremental developments (Larman and Basili 2003) and agile management (Arefazar et al. 2022). Further studies specifically examining the variation of CSFs in boundaryless, cellular, modular, self-managing and virtual emergent project forms requires examination.

It is also worthy to highlight that the notion of the project lifecycle has been criticized (see Hodgson 2002; Lenfle and Loch 2010). Among these criticisms is the suggestion that the lifecycle could potentially (i) reinforce disciplinary stove-piping of project phases (for example between users and systems design professionals) and (ii) stifle communication among project stakeholders, especially at the transition between individual phases of the project. The use of lifecycle for (iii) predicting when variations are likely to happen and a phase will follow another, may also forestall consideration of alternative organizing of project phases. Also, noting that most organizations promote specific lifecycle phases, (iv) imposition of specific lifecycle frameworks create the potential for conceptual rigidities potentially leading to projects being unresponsive to rapid changes and uncertainties.

Considering value (see Milfont et al. 2016; Vecchione et al. 2016; Foad et al. 2021) and lifecycle motivations and goals theories (see Eccles and Wigfield 2002; Schulz et al. 2003), which suggest that individuals alter their value systems and goals as they mature, future studies exploring how the value system and motivations/goals of project managers influence changes in perception of CSFs over the lifecycle should be of interest. Foad et al. (2021) for example highlight that it is likely that the context within which individuals assess their values will be impacted by time. Thus, future studies could focus on examining the extent to which project practitioners report on the cognitions underlying their perceived CSF trajectories.

The second potential limitation is that we had drawn on a generic project lifecycle consisting of four phases (i.e., *‘Initiation/conceptualization’,* ‘*Planning’*, ‘*Execution’* and ‘*Benefits realization’*), to conduct our study. However, given that PPPs are developed to provide infrastructure upon which services can be derived from (e.g., hospitals, schools, etc.) and at the same time do have continuing requirements for maintenance (PricewaterhouseCoopers, 2010), the adopted lifecycle framework appears to omit the ‘*Operations’* phase of PPP projects (see Alexander et al. 2019). In our study, relying on an assumption that the bulk of PPP work will be undertaken at the ‘*Implementation’* or ‘*Execution’* phase (Bao et al. 2018), we had conceptualized ‘*Operations’* to be part of the ‘*Execution’* phase of our four-phase ontogenesis-based project lifecycle. Adopting a broad conceptualization of the ‘*Execution’* phase was deemed beneficial as it allowed us to situate the present study within existing CSF variations/project lifecycle discourse (see Pinto and Prescott 1987, 1988, 1990; Pinto and Slevin 1988, 1989; Pinto and Covin 1989; Liu et al. 2015a; Bao et al. 2018). However, we acknowledge that our use of this lifecycle framework raises questions of practical appropriateness/relevance to PPP projects. Alexander et al. (2019) for example, highlight that the problem is that most generic project lifecycle frameworks do not explicitly account for operations which should be an inherent attribute of PPP projects. Alexander et al. (2019) also argue that the ‘*Execution’* phase is in fact, distinct from an ‘*Operations’* phase. For these reasons, generic project lifecycle frameworks may be unsuitable for studying variations in CSFs of construction PPP projects over lifecycle phases. Thus, to address this limitation and in the process, extend and strengthen how we understand CSF variations, future studies should be conducted using lifecycles specific to PPP projects. The challenge however with this is that PPP projects can differ greatly in terms of contractual arrangements (due to a number of factors including the involved sector, dominant legal and regulatory landscape etc.). This has led to a plethora of PPP contract procedures, guidelines and lifecycle being developed by national governments (e.g., Department of Infrastructure and Regional Development- Australia, 2015), and institutions and organizations such as the Asian Development Bank (2008), the European Investment Bank (2012) and the World Bank (2014).

The third limitation is methodological. They are three parts to this limitation. Some of these limitations have been highlighted in prior studies (Nandhakumar, 1996; Belassi and Tukel, 1996; Larsen and Myers, 1999; Fortune and White, 2006; Tuan, 2020).

One relates to the search and identification of the CSFs from the literature. It is noted that the selection and application of keywords did not include Boolean connectors such as ‘*AND’*, ‘*OR’* and ‘*NOT’*. Specifically, since our search and identification of the CSFs was in effect, qualitative in nature, there is a potential that the identified CSF were subject to interpretive bias. Future studies may therefore consider the use of bibliometric analysis, a mathematical and statistical method of analyzing large volumes of scientific content within publications (Donthu et al. 2021; Mukherjee et al. 2022), to extract and identify relevant CSFs. In particular, bibliometric analysis can be employed to examine the occurrence of topics and keywords (Donthu et al. 2021), identify main clusters of disciplinary research (Dhiaf et al. 2021) and determine the influence of specific subjects within a determined knowledge area (Chang et al. 2015). Although, none are lifecycle focused, there are several recent PPP related studies that have employed bibliometric analysis, and therefore serve as a reference point for future studies (see Narbaev et al. 2020; Shi et al. 2020; Pu et al. 2021; Sun et al. 2023).

Another methodological limitation is that as in prior variation/lifecycle studies (see Pinto and Slevin 1988, 1989; Pinto and Covin 1989; Pinto and Prescott 1987, 1988, 1990; Patanakul et al. 2010; Liu et al. 2015a; Bao et al. 2018), the present study did not take into consideration the dynamic nature of the CSFs and its potential impact upon CSF variations over lifecycle phases (Larsen and Myers, 1999). Neither did the current study take into consideration how interrelationship among the CSFs could also potentially impact upon CSF variations (see Nandhakumar, 1996; Ika and Pinto 2023). It therefore appears that “…*the CSF approach does not provide a mechanism for taking account of [these] inter-relationships*” (Fortune and White, 2006; p. 54). However, such understandings are of importance and requires futher scholarly attention. For example, as observed earlier by Nandhakumar (1996), “…*a better understanding of the relationship between key success factors…is required if success factors are to be of any guidance to [the] practitioners*” (p. 62). Thus, the impact of the (i) dynamic nature of the CSFs and (ii) their potential interrelationship on CSF variations, both require further exploration.

The final methodological limitation relates to the project management practitioners/experts who participated in the classification and mapping of the emergent CSFs being only Saudi nationals. On this basis, we acknowledge that national cultural imperatives may have an impact on how the variations ascribed to the different CSFs (see Chipulu et al. 2014; Ojiako and Chipulu, 2014). We also take this idea forward to acknowledge that demographic differences could also account for the variances (see Ojiako et al. 2014). In effect both Saudi national culture and the demographic nature of the respondents may have impacted on the CSF variations. Bearing this in mind, future studies could be undertaken utilizing a more diverse set of project management practitioners/experts (in terms of nationality/national culture and demographic heterogeneity).

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Appendix 1: Delphi Technique detailed results

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CSFs/Groups** | **Economic environment** | **Effective project management** | **Financing** | **Innovation** | **Legal** | **Political environment** | **Private sector** | **Procurement** | **Public sector** | **Risk management** | **Shared Responsibility between partners** | **Social environment** |
| A fair evaluation team |  | 0.17 |  |  | 0.17 |  |  | 0.67 | 0.17 |  |  |  |
| A strong and good private consortium |  |  | 0.33 |  |  | 0.33 | 0.67 |  |  | 0.17 | 0.17 |  |
| Appropriate risk allocation and risk-sharing |  | 0.33 |  |  |  |  |  | 17% |  | 1 |  |  |
| Availability and organizing resources | 1 |  | 0.5 | 0.17 | 0.33 | 0.33 | 0.33 | 0.17 |  | 0.33 | 0.33 | 0.17 |
| Available financial market |  |  | 1 |  |  | 0.17 | 0.17 |  |  | 0.33 |  |  |
| Available policies and regulations |  |  |  |  | 1 |  |  |  | 0.33 |  | 0.17 |  |
| Commitment and responsibility of project parties |  | 0.33 | 0.17 |  | 0.33 |  |  |  |  | 0.33 | 1 |  |
| Engage a team of advisers |  | 0.33 |  | 0.17 |  | 0.17 |  |  | 1 |  | 0.17 |  |
| Favourable contracts and agreements |  | 0.17 | 0.33 |  | 1 | 0.33 | 0.17 | 0.33 |  | 0.33 | 0.16 |  |
| Good and effective governance structures |  |  |  |  |  |  |  |  | 0.67 |  |  |  |
| Government guarantees | 0.33 |  | 0.67 |  |  | 0.33 |  |  |  |  |  |  |
| Innovation in delivering public services |  |  |  | 1 |  |  | 0.17 | 0.17 |  |  |  |  |
| Open and constant communication among stakeholders |  | 0.50 | 0.33 |  | 0.33 |  |  |  |  |  | 0.67 | 0.33 |
| Picking the right project |  |  |  |  |  |  | 0.17 |  | 0.83 | 0.33 | 0.33 | 0.17 |
| Project performance monitoring |  | 0.83 |  |  |  |  | 0.50 |  |  |  | 0.50 |  |
| Promising economy/economic growth | 1 |  | 0.33 |  | 0.17 |  |  |  |  | 0.33 |  | 0.17 |
| Realistic financial study | 0.33 |  | 0.67 | 0.17 | 0.17 | 0.33 | 0.33 | 0.33 |  | 0.33 | 0.17 | 0.17 |
| Stable economic condition | 1 |  | 0.33 |  |  |  |  | 0.17 |  | 0.33 |  |  |
| Stable political condition |  | 0.33 | 0.17 |  | 0.17 | 0.67 |  |  |  | 0.33 |  |  |
| Supportive and understanding community |  | 0.33 | 0.17 |  |  |  |  |  |  | 0.17 | 0.17 | 1 |
| Transparency in the procurement process |  | 0.33 |  |  | 0.50 |  |  | 0.67 |  | 0.17 | 0.17 |  |
| Understand and respect the main PPP parties each other’s goals | 0.17 | 0.83 |  |  |  | 0.33 | 0.17 | 0.17 |  | 0.33 | 50% | 0.17 |
| VFM assessment |  |  | 0.67 |  |  | 0.17 | 0.17 |  | 0.33 |  |  |  |
| Well-organized host government | 0.17 | 0.33 | 0.33 |  |  | 1 |  | 0.17 |  | 0.17 | 0.17 | 0.17 |
| The percentage means the degree of agreement between the panel members | | | | | | | | | | | | |