

# Towards methodological adventure in cost overrun research: linking process and product

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## ABSTRACT

The continued adoption of singular paradigms in the study of construction phenomena has elicited dialectical debates in scholarly literature. Calls have been made for more adventurous research methods, beyond the positivist versus interpretivist philosophical divide traditionally embraced by the industry. This study analyses the extensive scholarly debates, advancing and advocating philosophical positions to understand construction phenomena, and further narrows down the argument to within the specific domain of cost overrun research. A systematic and chronological literature review of the methodological/philosophical underpinnings of 41 papers was carried out. The papers were selected by following a staged exclusion criterion. The study outcome reveals that similar dialectical debates and methodological conservatism are still evident, with the predominance of mono-paradigm studies in the bulk of the empirical literature. Most of the empirical literature either provides interpretivist theoretical explanations from qualitative data or positivistically analyses quantitative data to provide technical explanations. To this end, mixed paradigm examples are spotlighted, demonstrating the relevance of linking process and product via methodological adventure in cost overrun research. Transcending the paradigmatic divide is necessary to develop a more useful and contextually anchored view of practice, essential to mitigate and provide a holistic understanding of what drives cost overruns in public projects.

## KEYWORDS

Construction management;  
cost overrun research;  
mixed methods;  
mixed paradigms

## Introduction

The term 'Philosophy', as used in general premise, refers to a 'system of beliefs and assumption about the fundamental nature of knowledge, reality, and existences' (Oxford Dictionary 2014). Philosophy within the domain of academic inquiry provides the framework for how research is conducted, based on the researcher's beliefs and assumptions, concerning what is valid as knowledge, and what process should be used to attain that knowledge (Saunders et al. 2009). These underlying beliefs thus shape research paradigms and consequently the methods of academic inquiry typically adopted by various knowledge domains.

As an emergent field of research, Construction management, is challenged with the vital question of 'what philosophical orientation is adequate for enquiry about construction phenomena?' (Dainty, 2008; Fellows and Liu 2015). Chan (2020) observed that early research in construction management was largely influenced by the 'engineering style of thinking' (p. 2). Unlike more established research domains, Dainty (2008) was of the view that construction management is yet to have a standard philosophical/methodological orientation. Rather, construction research tends to build on the traditional singular philosophical assumptions of other related natural and social science research, resulting in the adoption of wide range philosophies and methods. This stance is reiterated by Chan (2020), who opined that:

*In a field like construction management and economics where researchers can and do often move between practical application and*

*theoretical work (and draw from theories or theoretical perspectives covering a variety of disciplines from the natural and physical sciences, engineering, and the social sciences), it is fair to say that the conventions that govern the field are still evolving (p. 3).*

Yet, 'Methodological purism', is evident in the bulk of construction management research. 'Methodological purists' continuously seek to adopt a single paradigm, considered as the only valid perspective to the study of construction phenomena (Heesen et al. 2019). This class of scholars are of the view that knowledge derivation for any given phenomenon, can only be attained via one method, to the exclusion of others (McEvoy and Richards 2006). Bryman (1989) noted that: 'different research paradigms will inevitably result in the generation of different kinds of knowledge about the industry and its organizations' (p. 34). The marked differences in the nature of knowledge generated have consequently elicited scholarly debates in construction management research. As Saunders et al. (2009) note:

*Our values can have an important impact on the research we decide to pursue and how we pursue it. This may not lead to any form of discord, but it may mean that some observers accuse us of untoward bias (p. 107).*

Within the domain of cost overrun research, several studies have identified technical, risk, and uncertainty related issues, which are prevalent in all forms of construction works, as the primary front-end factors that account for cost overruns in public projects. Older studies such as Tan and Wakmasha (2010), reiterated that early estimates for public projects were often

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This article has been corrected with minor changes. These changes do not impact the academic content of the article.

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based on judgment, expertise, and experience, and less on rigorous technical investigations. This often led to significant cost deviations in subsequent estimates. This group of technically inclined studies mostly touts the positivist logic in their explanations of cost overruns. However, other perspectives are evident in the literature, that challenge the existing precepts via the adoption of behavioral narratives. This class of explanations primarily seeks to disprove technical explanations and their canonical stand, based on suspicions of unethical practices, deception, delusion, and attitudinal issues of public officials (Wachs 1987, 1989; Flyvbjerg et al. 2002). The term ‘theoretical explanations’ is thus used in this study to tag the schools of thought, that mostly rely on applying existing theories on human behavior (Optimism bias/delusion, psychological stereotyping, the rationality of decision making with the goal of utility maximization, politics, institution, and governance), to understand why public projects significantly run over budget.

As such, similar to the broader view of construction management research, a dichotomy of paradigms is discernible in the myriad of explanations, seeking to elucidate the fundamental reasons why public projects consistently run over budgeted cost. This study reviews the extensive debates, advancing and advocating philosophical positions to understand construction phenomena. It further narrows down to methodologically spotlight the current argument pervading the specific domain of cost overrun research. The study thus seeks to reinforce the need for ‘breaking the mould’, with more methodological adventure and effort at mixing paradigms in the study of construction phenomena. Within the domain of cost overrun research, this will serve to provide a more holistic understanding of what drives significant cost deviations in public projects.

### The philosophical debate in construction management research

Several studies, including Fellows and Liu (2015), have noted that the positivist/reductionist approach to carrying out construction research, aligns more with the natural and engineering sciences. The engineering ontology/world view possibly explains why Construction Management research has a well-documented history of research primarily focused on identifying factors that impact project performance improvements (Chan, 2020). Panas and Pantouvakis (2010), investigated the various forms of positivist approach mostly deployed in construction productivity studies. These include the development of experimental frameworks- field experiments, laboratory tests, controlled experiments, and comparative evaluations based on statistical/probabilistic analysis. Data collection techniques were mostly archival sources and questionnaires aimed at eliciting quantifiable data, useful for verifying hypotheses.

Promoters of interpretivism, on the other hand, view construction management research as a form of social science research and espouse a socially contrived study of construction phenomena (Hartmann et al. 2010; Gajendran, 2011). Their stance was thus that to gain rich insight into human behavior, it is necessary to understand the actions of the key professional players in the construction industry. Hartmann et al. (2010), opined that Construction Management as a discipline should strive to solve sociotechnical problems by proactive engagement with socially driven knowledge. In line with this constructivist view, Hartmann et al. (2010), asserted that the social construction of knowledge offers a rich epistemological basis for carrying out construction research. A distinction was further made between cognitive and social constructivism, with the former alluding to knowledge gained through the dynamics of personal experience via social engagement, and the latter, referring to knowledge shaped by cultural influences.

Gajendran (2011) investigated philosophical orientations amenable to study the informal settings of construction projects and organizations. Typically, it was revealed that anti-positivist world views such as constructivism, critical theory, hermeneutics-emancipation, critical realism, and pragmatism present viable alternative paradigms, to study the complex interrelationships commonly enacted, as a consequence of a project team’s formal and informal activity. Because of the philosophically purist positions often taken by most researchers in the study of construction phenomena, rich insights into the complexity of social forces in organizations and projects are not captured (Seymour and Rooke 1995). This limits the depth of understanding provided. Gajendran (2011) thus asserts that:

*Multiple philosophical points of departure, matched to a range of alternative methodologies, is indicative of the desirability of blending to reflect the peculiarities of each context under investigation... presents opportunities to conduct rigorous in-situ investigations, leading to authentic and deep insights that would otherwise remain unseen (p. 90).*

Several derivatives of the interpretivist philosophy have however been applied to study the complexity of construction phenomena in a scant number of studies. Some studies have conceptualized complexity and systems frameworks (Baccarini 1996; Bresnen et al. 2005). Typically, Bresnen et al. (2005) used an ethnographic approach to study the complexity of internal administrative arrangements, uncertainties, and the interrelationships in construction organizations. Such complexity was described as stemming primarily from the client’s need for an integrated trajectory of the project organization and the contractor’s need to keep pace with the rapidly evolving technological setting of the construction industry. Others, such as Emmitt and Gorse (2009) delve in-depth into the socially contrived behavioral and linguistic underpinnings of the actors in projects, such as those relating to safety practices on construction sites and understanding invisible routes of communication by migrant workers. Emmitt and Gorse’s (2009) approach is thus more akin to phenomenology or symbolic interactionism. Yet O’Leary (2004) touts the philosophical logic of the critical theorist, stating that:

*Without an appreciation of how attributes, positions of power and privilege, and worldviews conspire to create subjectivities, researchers in the construction industry, can easily fall into the trap of judging the reality of others in relation to their own reality (p. 47).*

The use of such interpretative methods is however not without flaws and criticism. Such criticism stems primarily from their high dependence on the articulate skills of the participants, who provide the information, and the interpretative value-laden posture of the researcher, as well as issues of generalizability. Whether due to criticisms or unfamiliarity with the intricacies of interpretative methods, Dainty (2008) reported that only 19 of 107 sampled research papers in ‘Construction Management and Economics’, used qualitative strategies. Out of the 19 papers, most deployed single and focus group interviews, three used observation/visual data, while another three carried out textual analyses of documents. Hammersley and Gomm (2005) critiqued the sole adoption of qualitative methods, particularly interviews. Results obtained from Interviews were described as having limited methodological validity, due to the likelihood of eliciting responses geared towards promoting self-preservation, rather than the objectivity of facts being sought. Unabating criticism thus surrounds the sole use of interpretative philosophies in construction industry research, with some authors dismissing it as inappropriate for scientific inquiry, by being ‘too subjective’ and ‘journalistic’ (Runeson 1997, p. 300); ‘more akin to consultancy’ and ‘not rigorous’ (Raftery et al. 1997, p. 293). Others, however,

**Table 1.** Articles obtained from Journal Databases.

Journal	Number of Articles
Construction Management and Economics	7
Journal of Construction Engineering and Management	11
IEEE Transactions on Engineering Management	12
International Journal of Construction Management	11
Journal of Financial Management of Property and Construction	8
Journal of Infrastructure Systems	9
Journal of the American Planning Association	14
International Journal of Project Management	9
Transport Policy	12
Public Works Management and Policy	5

accept that it is the only feasible and practical means to access contextual meaning and form to social processes, within projects and organizations in the construction industry (Seymour and Rooke 1995; Seymour et al. 1997; Hartmann et al. 2010; Gajendran 2011).

Against this backdrop, several arguments promote the need to transcend the dichotomous divide, between the positivist versus interpretative philosophical realms. Barrett and Sutrisna (2009) espoused the adoption of critical realism, to afford the use of multi-methodologies, for instance within the context of a case study, with grounded theory incorporated as a further strategy. This was idealized to maintain both the objective and subjective realities of the constructs associated with a study. Others embrace the view that pragmatism offers a viable respite and practical solution, which enables construction researchers to focus more on the practicalities of providing answers and solutions in the study of construction phenomena. Hughes and Sharrock (1997), devout promoters of pragmatism, are thus of the view that: ‘*There is certainly no reason to feel bound by stipulations about a unified method or a unified ontology for science, for on these arguments no such creature exists*’ (p. 94). Hughes and Sharrock (1997) further added, that most modern-day realists have adopted variants of the pragmatist philosophy, by relegating philosophical arguments to the background, and rather focus on the specifics of the problem being investigated and the relevant methods to tackle them. Triangulation of multi-method inferences, that incorporate mixed philosophical orientations has thus been promoted as the only valid alternative, to escape such methodological dilemmas (Yin 2014).

Yet, Dainty (2008) noted the reticence of construction management researchers, towards adopting mixed-method studies, unlike research in the management sciences. Dainty (2008) reported that only 12 out of 107 sampled published papers used mixed methods, with limited reference made to using in-depth interviews, while 76 were purely quantitative papers. Consequently, Dainty (2008) concluded that only a scant number of studies: ‘*Draw upon a greater diversity of methods to enrich their understanding of the actuality of practice from the perspectives of those who work in the sector*’ (p. 2). Dainty (2008) thus queried the ability of construction management research to provide ‘*a rich and nuanced understanding of industry practice*’ (p. 7).

More recently, Chan’s (2020) editorial reported that the majority of 350 manuscripts received by ‘Construction Management and Economics’ were primarily based on ‘*self-perception and self-reporting questionnaires surveys*’, and as such rarely made it through to peer-review (p. 2). These figures indicate that construction industry researchers continue to tow the positivist logic, to understand the complexity of socially derived organizational issues. Mingers (1997) more practical analogy can be used to illustrate this point:

*Adopting a particular paradigm is like viewing the world through a particular instrument such as a telescope, an X-ray machine, or an electron microscope. Each reveals certain aspects but is completely blind to others... Thus, in adopting only one paradigm one is inevitably gaining only a limited view of a particular intervention or research situation ... it is always wise to utilize a variety of approaches (p. 9).*

## Method of study

Given the wide array of studies on cost overruns, the study carries out a systematic literature review, to highlight the paradigmatic divide. Brereton et al. (2007) emphasize the necessity of adopting systematic methods to evaluate and aggregate existing research outcomes, as a prerequisite to ‘*a balanced and objective summary of research evidence for a particular topic*’ (p. 571). In construction management research, literature reviews are commonly adopted as a form of methodology (Hong and Chan 2014; Osei-Kyei and Chan 2015; Asamoah et al. 2019; Odeck 2019). Within the realm of cost overrun research, several studies including Cantarelli et al. (2012), Odeck (2004, 2019), and Asamoah et al. (2019) have used systematic literature reviews to preview and draw conclusions on specific aspects of the cost overrun literature. Cantarelli et al. (2012) as well as Odeck (2004), examined the geographical variability and sizes of cost overrun reported in the literature, while Odeck (2019) and Asamoah et al. (2019) focused on their econometric determinants. Previous studies have thus focused more on the more practical/tangible characteristics/determinants of cost overruns reported in the literature and less on the philosophical/methodological issues underlying their investigation.

This study adopted the staged approach evident in several construction management studies including Ke et al. (2009), Yu et al. (2018), and Asamoah et al. (2019) to provide a preview of the theories/paradigms underlying the wide proliferation of explanations, seeking to elucidate why cost overruns of significant proportions continue to plague public infrastructure projects. A literature search was carried out by electronically searching for the terms ‘cost overrun’, ‘cost performance’, and ‘cost escalation’, used alongside the terms ‘infrastructure’, and ‘public works’. Google and its affiliate extension, Google Scholar, and Google Scholar Advanced Search, which are more specific to academic inquiry were used as the primary search engine. The search returned 1365 articles, scattered in various fields including construction, engineering, management, and economics. A review of the articles’ abstracts was carried out to identify the most related content. This initial screening filtered the articles down to 167. The articles were then cross-searched via Scopus indexing platform/database. This further scaled down the number of articles to 99. Scopus was chosen due to the comprehensiveness/wide reach of its literature sources/datasets in comparison to other databases such as PubMed and Web of Science (Falagas et al. 2008; Yu et al. 2018). This also served as a measure for quality assurance. This is given the fact that most top-ranking research papers/journals in engineering, management, and construction are indexed in Scopus (Hong and Chan 2014; Osei-Kyei and Chan 2015; Darko et al. 2017).

Also, a careful systematic literature search was carried out via manual searching in key construction/engineering management journals, due to the possibility that some articles, particularly earlier volumes may not be indexed in Scopus. Table 1 is a summary of articles obtained from each journal, most of which had been reached in the Google Scholar keyword search and were already indexed in Scopus.



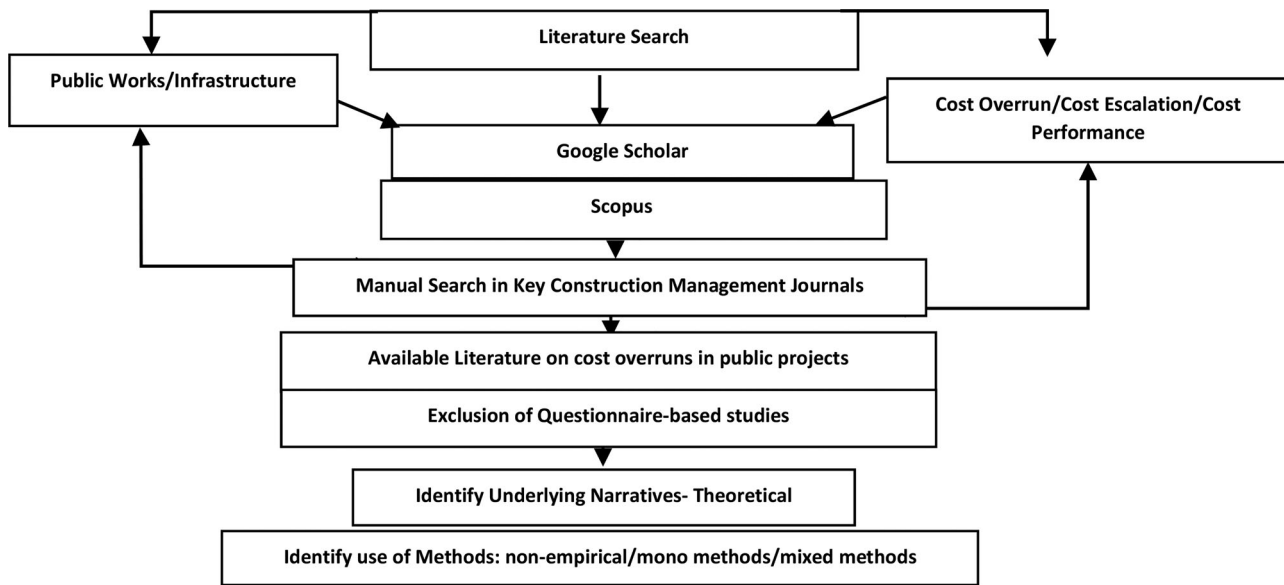


Figure 1. Method of study.

From the combined series of literature search/screening, 118 studies that sought to explain why cost overruns are endemic in public projects were identified. However, it was noted that a greater majority (65%) of the studies were primarily questionnaire-based studies, already established as the most common form of studies on cost overrun. These studies mostly source the general opinions of clients, contractors, and professionals, for subsequent ranking/analysis. This group of studies was further excluded. As Figure 1 shows, the selection criteria in the systematic literature search were as follows: (1) The studies are of acceptable quality and are reported in recognized journals/outlets (2) the studies sought to explain the rifeness of cost overruns in public infrastructure projects (3) the studies are not primarily or solely based on questionnaire surveys of respondents. Following the outlined criteria, a total of 41 studies published between 1980 and 2019, fulfilled the study requirements. Not all the selected papers presented empirical evidence on cost overrun causation in public projects. This limited the identification of their philosophical orientation. They were however included because they are seminal works that have largely shaped the theoretical discourse in cost overrun research. They are useful to showcase the pattern of studies that have promoted the scholarly debate. The sample size of 41 studies, conducted over a 40-year span, was considered adequate to assess the methodological inclinations that historically underly the discourse addressing the pervasiveness of cost overruns in public infrastructure projects.

The primary purpose underlying the systematic literature search was therefore to gather a compilation of older and more recent studies, that sought to explain why cost overruns were such a pervasive culture of public projects. To this end, seminal works that have advanced strong technical and theoretical arguments in the field as less-routine (Non-questionnaire based) studies were scrutinized. The underlying narratives- theoretical/technical were identified, as well as the use of methods i.e., non-empirical/mono methods/mixed methods. The specific nature of the qualitative/quantitative methods of analysis carried out was also outlined.

Subsequent discussions sought to identify the level of methodological adventure i.e., whether both positivist and interpretative paradigms were adopted. The discussion further highlights the methodological underpinnings of mono-paradigm studies as

to whether they offer conclusive causal inference (statistically establish cause-effect relationships) based on empirical data, as well as show context i.e., describing the project environment in the organizations that commissioned the projects and project-specific details. The discussions are thus centered around assessing whether mono-paradigm studies on cost overrun provide an in-depth narrative of the network of causal events explaining 'how' and 'why' cost overruns build up in projects, and their level of usefulness to tackle real-life project management issues.

To conclude the extensive methodological discussions, the study addresses its core concern i.e., 'can adopting mixed paradigms yield richer insights into the phenomenon of cost overruns?' To this end, selected studies explaining cost overruns that adopted mixed paradigms, are spotlighted as examples, to demonstrate the relevance of methodological adventure in cost overrun research.

### The debate in cost overrun research

Various events occurring from the initial phase, to the subsequent phases of construction projects, provide explanations about a budget's dynamic history (Love et al. 2012; Ahiaga-Dagbui et al. 2015). An extensive range of articles have addressed this issue, by listing causal factors, and offering various technical/theoretical explanations for the significant dynamism of project costs in public projects (Hall 1980; Wachs 1987; Morris 1990; Flyvbjerg et al. 2002, 2004; Baccarini 2004; Odeck 2004; Ahiaga-Dagbui et al. 2015). Some studies have attempted to generate a typology of explanations and domains for classifying cost overrun factors, and rightly labelled issues of inaccurate estimates, geotechnical factors, and errors under the umbrella term of 'Technical Explanations' (Cantarelli et al. 2010a). This is relative to 'Theoretical explanations- politico-economic and psychological motives', which have proliferated in the literature, based on the pioneering works of both Kahneman and Tversky (1979a, 1979b), and Wachs (1989).

Three interwoven theories: planning, decision-making, and forecasting theories, have lent credence to technical explanations (Cantarelli et al. 2010a). These theories are rooted in the cognitive dynamics that play out during estimation, planning, decision, and policy-making by people in institutional settings, under

high levels of uncertainty, and how this leads to the various successes and failures of projects. Technical explanations are also founded in the fundamentals of best practice, which emphasize the need for adequate pre-contract preparation, via planning by clients before the execution of projects (Brunes and Lind 2014). The levels of the initial preparation for projects is therefore logically inferred to be inversely correlated with cost overruns (Tan and Wakmasha 2010). Technical explanations thus primarily rely on forecasting theories to explain cost overruns, given the uncertainty implicit in predicting costs into the future via the extrapolation of present values and occurrences (Cantarelli et al. 2010a). Since project attributes are often un-identical, experience and judgment will therefore have to play a significant role in approximating future occurrences. Forecasting-related theories thus seek to explain the build-up of errors unwittingly made due to inappropriate forecasting (Mackie and Preston 1998; Cantarelli et al. 2010a). As Al-Tabtabai (1998) asserts, cost overruns are a result of:

*The assumption that the future is indistinguishable from the past, except for the specific variables identified as affecting the likelihood of a future outcome. Accordingly, a forecast should only rely on past performance predictions as long as the pattern of changes in the environment is steady (p. 259).*

However, several other studies have argued that technical explanations are insufficient to account for the level of cost overruns often experienced in publicly funded projects. This has given rise to a plethora of theoretical explanations in the literature (Wachs 1989; Bruzelius et al. 2002; Flyvbjerg et al. 2002, 2004, 2008; Cantarelli et al. 2010b). Most of these explanations relate to non-technical factors, conceived as having a domineering influence on the occurrence of cost overruns. Cantarelli et al. (2010a), examined the embeddedness of theoretical explanations, within existing theories of human behaviour/management. The authors expounded that these classes of explanations are derived from planning and decision-making theories. Decision and planning theories idealize how political and economic considerations affect the allocation of financial resources, and sway the outcomes of decision-making processes (Wachs, 1989; Cantarelli et al., 2010a). Cantarelli et al. (2010b) cited such terms as ‘*entrapment*’, ‘*sunk-cost effect*’ ‘*knee-deep-in-the-big-muddy effect*’, and the ‘*too-much-invested to-quit effect*’ (p. 793). These terminologies used in theoretical discourse, describe the ‘*over-commitment of decision-makers to an ineffective course of action*’ (Cantarelli et al. 2010b, p. 793). Path inefficiency and dependency is thus induced due to deliberate or optimistic decision or policymaking, implying the presence of an outcome that would have paid off better. Along this line of logic, two distinct arguments can be discerned: psychological uncertainty/optimism bias and deliberate deception/strategic misrepresentation, which are argued from economic and political realms. Theoretical explanations emphasizing strategic misrepresentation focus on the conscious manipulation of power and influence to foster self-interest and adopt Machiavellian or agency theories. Psychological explanations, on the other hand, build on the sub-conscious aspects of human behaviour during decision making for public projects (Hall 1980; Kahneman 1994; Mackie and Preston 1998; Flyvbjerg et al. 2002; Cantarelli et al. 2010a, 2013).

It is thus probable, that cost overruns in public projects, have wider-reaching underpinnings, rooted in a variety of causes (Table 2):

- Technical explanations, that point out how projects fall short of the requirements of best practice, along with how

unintentional errors in forecasting, coupled with uncertainties/unpredictable events, can invariably lead to cost growth.

- Theoretical explanations, that attribute the prevalence of high levels of cost overruns to the inherent internal behavioural dynamics of public agencies, which tend to deliberately or subconsciously downplay technical requirements.

### **Cost overrun research: methodologically conservative? useful?**

As Table 2 shows, older and more recent studies have adopted different underlying technical and theoretical narratives, as explanations to cost overruns. The discussion in this section seeks to analyze ‘*how well these studies have drawn upon a greater diversity of paradigms and methods to provide a rich and nuanced understanding of the phenomena of cost overruns, useful to practice*’. However, a closer look at their methodological underpinnings, reveals the predominance of non-empirical and mono-paradigm studies, which either adopt an interpretivist viewpoint to provide qualitative theoretical explanations or positivistly analyze data to provide technical explanations.

From the critical analysis, it was discerned that within the plethora of the empirical literature offering technical explanations, there is an apparent group of survey type studies that carry out correlative and descriptive trend analysis of large samples of cost overrun data in projects, to make sweeping generalizations (Flyvbjerg et al., 2002, 2004; Odeck, 2004; Cantarelli et al., 2012; Sarmiento and Reeneboog, 2017; Heravi and Mohammadian, 2019; Catalão et al., 2019; Cavalieri et al., 2019). Characteristically, Heravi and Mohammadian (2019) analyzed the estimated versus actual time and cost performance on 72 urban construction projects, grouped into small, medium, and large urban construction projects to offer descriptive statistical evidence underlying the pattern of cost overruns. Flyvbjerg et al. (2002, 2004) drew conclusions on cost overrun causation, primarily based on exploratory statistical trend analysis of the distribution of project data sourced from 258 transportation infrastructure projects. Similarly, Odeck (2004) analyzed 620 projects, while Cantarelli et al. (2012) analyzed 78 projects, using a similar methodology. Even with the exclusion of questionnaire-based studies, this pattern of studies, which reflects the wider construction management research, continues to populate the methodological trajectory in cost overrun research. The leaning towards the sole use of survey methods thus constitutes a concern in cost overrun research, as such studies can best be described as exploratory, useful to give pointers in the general direction of where the problem may lie, but cannot adequately explain and provide a more in-depth understanding of the processes that culminate in cost overruns.

Yin (2014) evaluates the types of research questions that can typically be answered by in-depth studies as opposed to surveys. ‘How’, ‘why’, ‘when’, ‘what’ and ‘where’ research questions can thus be related to the nature of the study being conducted: exploratory; explanatory; or descriptive. ‘What’ questions are predominantly exploratory, ‘How’ and ‘why’ questions are mostly linked to explanatory studies while ‘when’ and ‘where’ research questions are more descriptive. Surveys cannot adequately answer how or why questions relevant for studying what goes on in practice, rather are more amenable for initial exploration or descriptive studies that ask ‘what’, ‘when’, and ‘where’ research questions. Chan (2020) revealed that due to the trend that the majority of manuscripts in the study of construction phenomena are survey-type research, editors take the view that surveys are

**Table 2.** Dichotomous explanations for cost overruns in public projects.

Reference	Technical explanations	Theoretical explanations	Methodological underpinning
		Poor value judgment public proprietorship of public projects is inherently challenging	CROSS- PARADIGMIC Positivist Analysis-exploratory statistics) with Interpretivist Interpretation
		Deliberately flawed nature of the forecasting techniques adopted	NON-EMPIRICAL
	Technical neglect in project formulation and management.	Thinly spread government budget A vicious cycle of delays and intentional short funding	MONO-PARADIGM (Interpretivist) Qualitative case study
		unrealistic land use forecasts and optimistic ridership forecasts	NON-EMPIRICAL
		Strategically promoted unviable projects chosen over competing less capital-intensive options	NON- EMPIRICAL
		Deliberate Deception due to self-interest or political motives; Physiological delusion due to economic motives	CROSS-PARADIGMIC Positivist Analysis (exploratory statistics) Interpretivist Interpretation
		<i>Rent-seeking behaviour of special interest groups, and the tendency to underestimate tenders to get proposals accepted”.</i>	NON-EMPIRICAL
		Strategic ignorance feigned by project sponsors under imperfect market conditions	NON-EMPIRICAL
	Technical project factors		MONO-PARADIGM Positivist Analysis – Regression Modelling of cause-effect
	Impact of Project variables		MONO-PARADIGM (Positivist) Regression Modelling of cause-effect
	Length of project implementation, geographic location		MONO-PARADIGM (Positivist) Trend analysis of project data
	larger cost overruns linked to smaller project size		MONO-PARADIGM (Positivist) -Correlation/Trend analysis
	Poor estimating methodologies and incomplete technical details used in generating estimates		MONO-PARADIGM (Positivist) -Trend/correlation analysis
	The inaccuracy of initial estimates due to reliance on judgment, expertise, and experience.		MONO-PARADIGM (Positivist analysis)- Neural network modelling of cause-effect
	design-error induced rework	embedded behavioral inefficiencies: “time boxing and costly consultants’ complacency	MIXED-PARADIGM Mixed Methods Case study
	re-work leading to cost overruns	Delusion and deception by planners	NON-EMPIRICAL MONO-PARADIGM (Positivist) Statistical analysis of mixed data.
		Physiological and Political bias leading to lock-in	MONO-PARADIGM (Interpretivist) Qualitative case study
		Unintentional pathogens in organizational practice that trigger an additive chain of costly errors	MONO-PARADIGM (Interpretivist) Qualitative case study
	Regional and country-specific peculiarities		MONO-PARADIGM (Positivist) Comparative trend analysis
		<i>Relay race between technical and nontechnical expertise and politics of megaproject governance</i>	MONO-PARADIGM (Interpretivist) Qualitative case study
		Strategic behaviour of principal actors in public projects	MONO-PARADIGM (Interpretivist) Qualitative case study
	Unreliable initial cost estimates non-linear interactions amongst project variables		MONO-PARADIGM (Positivist) Quantitative analysis of Mixed data Neural network modelling
		Strategic ignorance leading to the survival of the most unfit projects	NON-EMPIRICAL
	Technical risk exposure		MONO-PARADIGM (Positivist) Quantitative analysis of Mixed data- Regression /CBR modelling
	High level of unaccounted risks and uncertainties		MONO-PARADIGM (Positivist) Quantitative analysis of mixed data- Factor analysis/Regression Analysis
	Insufficient technical competence and expertise in cost forecasting	Corruption Political motives	CROSS-PARADIGMIC Positivist Analysis (exploratory statistics) Interpretivist Interpretation

(continued)

Table 2. Continued.

Reference	Technical explanations	Theoretical explanations	Methodological underpinning
	Low technical expertise, inadequate geotechnical risk management, and local geological parameters		MIXED-PARADIGM Mixed methods case study
	Geographic/regional peculiarities, the type of infrastructures, and time of project implementation		MONO-PARADIGM (Positivist) econometric meta- analysis
	Change orders leading to unintended consequences		MONO-PARADIGM (Positivist) Quantitative Case Study
	Geotechnical risks and uncertainties	Oppressive pressure on professionals, preferential practices of public agencies and unethical practices Subconscious attitudes of stakeholders	MIXED-PARADIGM Mixed methods case study
	Technical Knowledge Deficiencies in organizations.	Psycho-Social Constructs and	MONO-PARADIGM (Interpretivist) Qualitative case study
	unreliable contingency forecasts due to lack of reliable benchmarks and probabilities		MONO-PARADIGM (Positivist) Probabilistic analysis
	Deviations from Geotechnical best Practices	Organizational and institutional environment	Mono-method (Interpretivist) Qualitative Case study
		Salami tactics adopted politicians and planners in blame management	MONO-PARADIGM (Interpretivist) Qualitative Case study
		Risk aversion of contracting authorities and opportunities behaviour during project execution	CROSS-PARADIGMIC Positivist Analysis (exploratory statistics) Interpretivist Interpretation
	Level of accuracy associated with preliminary cost estimating models		MONO-PARADIGM (Positivist) Comparative modelling.
	Political, institutional, and governance peculiarities		MONO-PARADIGM (Positivist) Trend/econometric analysis
	Exogenous economic variables		MONO-PARADIGM (Positivist) Systematic literature Survey/content analysis.
	Scope creep, rework, construction delays, and lowest bidder contract award criteria		MONO-PARADIGM (Positivist) Quantitative analysis of Mixed data
	Size, nature, and type of project		MONO-PARADIGM (Positivist) Descriptive statistics/ Trend analysis

1. Hall (1980) 2. Wachs (1989) 3. Morris (1990) 4. Kain (1990) 5. Pickerel (1992) 6. Flyvbjerg et al. (2002) 7. Bruzelius et al. (2002) 8. Ganuza (2003) 9. Trost and Oberlender (2003) 10. Attala and Hegazy (2003) 11. Flyvbjerg (2004) 12. Odeck (2004) 13. Baccarini (2004) 14. Sodikov (2005) 15. Love et al. (2008) 16. Flyvbjerg et al. (2009) 17. Love et al. (2009) 18. Cantarelli et al. (2010b) 19. Love et al. (2012) 20. Cantarelli, et al. (2012) 21. Gil and Lundriganm (2012) 22. Cantarelli et al. (2013) 23. Ahiaga-Dagbui and Smith (2014) 24. Flyvbjerg (2014) 25. El-Kholy (2015) 26. Creedy (2010) 27. Sarmiento and Reeneboog (2017) 28. Amadi and Higham (2017) 29. Odeck (2019) 30. Love et al (2017) 31. Amadi and Higham (2018a) 32. Amadi and Higham (2018b) 33. Love et al (2018) 34. Amadi and Higham (2018c) 35. Hinterleitner (2019) 36. Cavalieri et al. (2019) 37. El Kholy (2019) 38. Catalão et al (2019) 39. Asamoah et al (2019) 40. Annamalaisami and Kuppuswamy (2019) 41. Heravi and Mohammadian (2019).

commonplace, and therefore do not constitute the significantly original contributions. The restrictive logico-deductive and highly structured nature of survey methods negate the wholesomeness relevant to investigate and understand the system dynamics of interrelated processes that lead to cost overruns in construction projects. As Ahiaga-Dagbui and Smith (2014) succinctly put it:

*Most studies on cost overruns only begin to scratch the surface of this complex phenomenon plaguing highway projects, often more generating questions than answers (p. 40).*

Chan and Raisanen (2009), similarly called for construction management research to shift its line of query from ‘what’ factors’ to ‘how and why’ things happen the way they do in practice. Amadi and Higham (2018a), reinforcing this stance, opined that

*This characteristic feature of questionnaire-based studies limits the usefulness of the output of such research, in generating context-specific explanations that can be relied on in practice (p. 219).*

The practicality of deploying the outcome of such studies to tackle real-life project management issues is thus put into question, as they may completely miss out on the contextual drivers specific to projects. Therefore, Ahiaga-Dagbui et al. (2015) espouse that:

*It will take more thoughtful research design, perhaps research conducted within the context of a particular project, to be able to*

*partly circumvent these default responses that have yet to help mitigate or contain cost overrun in construction (p. 41)*

A limited number of more robust studies positivistically analyzed mixed data types to assess the sensitivity of final cost to causal factors identified within the context of specific projects (Trost and Oberlender, 2003; Creedy, 2010; El-Kholy, 2015; 2019; Annamalaisami and Kuppuswamy, 2019). Such studies deploy modeling and logic-based techniques such as regression modeling, case-based reasoning, artificial neural networking as well as probabilistic simulations to understand cause-effect relationships that trigger cost overruns. Such analysis generates repeatable linear and non-linear patterns of risk factors interactions, which offer usefulness in decision making for future projects, at specified levels of confidence. Typically, Annamalaisami and Kuppuswamy (2019) developed a priority-based framework for assessing the impact of cost risk factors, in a project timeline along with the cost variances induced due to cost-risk factors dependencies. Data was deduced from project records, interviews, and survey data, sourced from small and medium scaled construction projects. These types of studies thus provide conclusive causal inference rooted in the specifics of the interrelationship between the project variables, as a necessary prelude to risk management and contingency planning of projects.

On the flip side of the argument, are the theorist, who offer theoretical narratives to explain the behavioural dynamics



underlying the propagation of cost overrun. As Barley (2006) asserts: ‘*authors can let us either see what we didn’t see before or see in a new light what we thought we already understood*’ (p. 18). However, several theoretical studies in cost overrun research resort to imaginative theorizing without the benefit of empirical data (Bruzelius et al. 2002; Ganuza 2003; Cantarelli 2013). Ironically, some older studies, such as Hall (1980) have positivistically analyzed quantitative project data to provide interpretivist theoretical explanations. These types of ‘*Cross-Paradigmatic*’ studies are now becoming more commonplace in theoretical discourse – (Flyvbjerg et al. 2002; Sarmiento and Reeneboog 2017; Cavalieri et al., 2019), lending credence to the assertion that:

*Adopting a positivist perspective to understand a complex issue like construction project governance, which usually involves a complex interplay of construction professionals, planners, business strategy, institutional framework, and politics, would merely be superficial at best and never actually provide substantial evidence* (Ahiaga-Dagbui et al. 2015, p. 41).

This limitation was similarly spotlighted by Love et al. (2018) stating that

*Researchers invariably sieve through the available evidence and look for fragments of information that seem to point to a common cause in developing a priori explanation. Moreover, details that are relevant to explaining the actions and behaviors of people can be overlooked and the information collated is meaningless outside the context where it originated* (p. 04018023-10).

These observations raise questions about the veracity of the explanations provided.

Only a scant number of theoretical explanations rooted in empirical data, provide context from case studies, reflecting the projects’ organizational settings, and can be described as generating significant revelatory theoretical insights explaining cost overruns (Cantarelli et al. 2010b; Love et al. 2012; Gil and Lundriganm 2012; Hinterleitner 2019). For this group of studies, project events are systematically relayed from an interpretivist viewpoint, based on collated primary and secondary qualitative data. Typically, Cantarelli et al. (2010b) studied the behavioural form of ‘*Lock-in*’, as used in managerial premise, which is the outcome of sub-optimal decisions made by institutions that set the pace for path dependency, irrespective of the availability of optimal alternatives. Two case-studies for large-scale rail projects, HSL-South and Betuweroute, in the Netherlands were used to test the assertions that optimism bias and lock-in often led to cost overruns in publicly funded projects. Following a similar trajectory, Hinterleitner (2019) builds on theories of appraisal optimism, lock-in, and blame management to critique the implementation of large-scale public projects. Hinterleitner (2019) described the strategically delayed announcement of cost overruns to deflect blame, termed ‘*salami tactics*’, which can induce self-undermining locked-in paths in projects. As such, rather than comprehensively assessing projects’ real benefit-cost ratio at the front-end, they are optimistically pursued, and later strategically communicated in smaller more manageable parts when significant cost deviations begin to manifest during the implementation. Two cases -the Swiss National Exposition Expo and the Berlin Brandenburg Airport in Germany were analyzed to demonstrate the effect of salami tactics adopted by image-conscious politicians to deflect blame for policy failure, in defense of overoptimistic projects, which failed to live up to expectation during implementation. Gil and Lundriganm (2012) conceptualized a ‘*relay race*’ framework for understanding cost growth, analogous to the dynamics of megaproject governance. This is amidst conflicting stakeholder interests and competitive strive for

leadership, which fosters design changes. Gil and Lundriganm’s (2012) framework was based on a study of three mega projects that experienced significant cost growth in the UK: the London 2012 Olympic Games project, London’s Crossrail project, and BAA’s Heathrow Terminal two. The cases were used as models of relay-races, wherein the transitory phases denote points of a handover of the baton of project leadership. The baton of leadership is passed from the project decision-makers with lower levels of technical competence, who approve initial budget outlays, to the managerial jurisdiction and technical expertise of the public agency, and latter to the contractor who executes the project from a position of practicality and financial self-preservation. This backdrop sets the stage for elasticity in the cost profile of public projects, with financial commitments continuously renegotiated, over the often-lengthy gestation periods. Although these commendable empirical studies in theoretical discourse generated systematic qualitative frameworks explaining cost overruns, emerging from sourced and triangulated qualitative data, a forensic quantitative evaluation of the projects into the more immediate and specific causes, is required to complement the findings, and practically demonstrate their applicability to solving real-life project management problems.

Nonetheless, it can be discerned that the bulk of theoretical research on cost overruns has witnessed a greater engagement with the related management and organizational literature from the social sciences, which Volker (2019) argues, is critical to the construction domain. Such studies, as Chan (2020) reiterates, ‘*...lookout and widen our knowledge horizon so that we can better look within our field*’ (p. 4). Typically, cost overrun explanations promoting optimism bias and appraisal optimism, are rooted in theories largely developed by Kahneman and Tversky (1979a, 1979b), and later Kahneman (1994), based on experimental psychological research in the field of economics, wherein risks are subconsciously downplayed, while potential benefits were overblown. Such optimism was argued as constituting a hindrance to the need for thorough planning in project preparation. These theories have gained momentum in cost overrun research, having been adopted by several studies to explain cost overruns in public projects. Such studies seek to problematize the positivist way of thinking mostly adopted in the study of public infrastructure projects cost overrun. They provide texture and context, required to understand project history, and thus add depth to understanding the phenomena of cost overruns in public projects, which would have been overlooked in an archetypical reductionist positivist study.

### **Spotlight on mixed paradigm examples**

Given this methodological trajectory evident in cost overrun research, this study reinforces the call for more adventurous research, transcending the paradigmic divide. As Ahiaga-Dagbui et al. (2015) posit:

*Existing theories on causes of overruns... from an engineering and technical perspective... and an economic/psychological/strategic perspective are views both critical to holistically dealing with the problem of cost growth, and therefore should be seen as complementing, rather than opposing sides of the same issue* (p. 52).

Only a sparse number of studies sourced from the systematic literature review, incorporated and linked both strands (process and product) to the argument on cost overruns (Love et al. 2008; Amadi and Higham 2017, 2018a). Although several studies in the empirical literature allude to collating mixed data-qualitative and quantitative, such qualitative data are oftentimes



positivistically analyzed e.g., using content analysis, ranking, transformation. It was observed that, even where interviews are conducted, they are often structured to generate quantifiable attributes, which are positivistically analyzed and impersonally reported. Bryman (1989) described qualitative studies in terms of the 'level of emphasis on interpretations of individuals working in the organizations' (p. 25). On the other hand, quantitative studies may collate qualitative data but model the research process to closely mimic a scientific approach. Data on organizational attributes are collected and analyzed with the researcher's impersonal detachment typical of experimental or survey research. As a consequence, Chan (2020) draws attention to the wide-spread notion that the qualitative versus quantitative divide, translates into the positivist vs interpretive distinction, citing Schweber (2015) who noted that, 'authors can be qualitative and yet be positivistic in the ways data is collected and analysed' (p. 7).

In cost overrun research, project events can be systematically relayed from both an interpretivist and positivist viewpoint. A distinction is thus made between 'Mixed Methods' and 'Mixed Paradigms'. Amadi and Higham's (2018a) article 'Putting context to Numbers-A geotechnical risk trajectory to cost overrun extremism', published from a Ph.D. thesis (Amadi 2016) in Construction Management and Economics, can be used to illustrate this point. This study is selected for detailed commentary because the theory on cost overrun was generated via the concomitant adoption of positivist and interpretivist philosophies, using a unique mix of adventurous methods.

In Amadi and Higham's (2018a) study, the cause of the unusually high-cost overruns experienced in highway project delivery in a tropical wetland setting was investigated, using a mixed-methods case study. The study geospatially analyzed the difficult predominantly wetland geologic configuration of the study area and statistically explored its geotechnical undertone as a potential trigger that creates a propensity for cost overruns in highway projects. Statistically significant relationships were then sought between the cost overruns recorded on the highway projects and the geotechnical index properties of the subgrade soils, averaged along the highway routes. The objective of this preliminary analysis was to establish a spatial association between the levels of geotechnical risks inherent in the geologic setting of the study area and cost overrun trends evident in the highway projects, as a form of quasi-experimentation. Interviews were subsequently conducted with project participants from the three highway agencies that commissioned the projects. Documentary data for the 61 highway projects sampled, were also collated. The collated qualitative data was analyzed deductively and inductively. The findings from the deductive analysis demonstrated the link between poor geotechnical practices and cost overruns reinforcing the study's presupposition that a lack of adequate geotechnical risk management was fundamental to the extreme cost overruns recorded on the highway projects. The inductive analysis unearthed a 'can of worms', which uncovered an array of festering social constructs underlying the propensity for extreme cost overruns. These were conceptualized as: Psychological Traps- subconscious attitudes of construction stakeholders, largely defined by their level of enlightenment on the financial implications of technical risks, as well as social conditioning, which may effectively serve as mental traps: *Pressure Emitters*-stakeholders in public agencies, which radiate influence over professionals, thereby impacting adherence to best practice; *Organizational Catalysts*- the adverse non-project specific 'organization' and 'people' related variables in the agencies which represent the deficient institutional arrangements within the

public agencies; *Dichotomies*- inequalities and preferential practices of public agencies, which result in uneven management of technical risks in projects; *Unethical Facilitators*- the subtle unprofessional and unethical practices of the key actors in highway projects, primarily geared at personal gains. These were spotlighted as the contextual drivers in the highway organizations that actively triggered the geotechnical deviations from best practice, and which had trickled down to result in the unusually high levels of cost overruns experienced on the highway projects (Amadi and Higham 2018a, 2018c). To conclusively establish a cause-effect relationship between ground conditions, geotechnical practices, and cost overruns, in an allied publication (see Amadi and Higham 2017), regression analysis was carried out. A log-regression model of cost overrun drivers was developed to quantify the variance induced by the compressibility of the subsoils at the project locations, along with dummy variables to incorporate transformed qualitative data on the geotechnical aspects of risks on the projects. To further tie up the findings from the qualitative strand of the analysis, a cognitive map was conceptualized, to graphically relay a complex web of causal connections (Amadi and Higham 2018b).

The extensive series of evidence from Amadi and Higham's analysis provided context-specific interpretivist and positivist explanations to the extreme cost overruns recurring on the region's highway projects. Particularly, inadequate geotechnical risk management was statistically shown to exhibit a cause-effect relationship with the extreme cost overruns, consequently escalating costs on the highway projects. In addition to the presence of geotechnical drivers, an emergent theory from the study, was that project approval and execution for the highway projects had no definite criteria and were largely determined by the urgency induced from political quarters and heightened fear of violence by local communities:

...Pressure-induced urgency, due to political and community catalysts, which creates psychological traps and a repressive atmosphere for highway officials, leading to an Adhoc, preferentially dichotomized and dictatorial type of project planning, with evidence of unethical practices in project execution and governance (Amadi and Higham 2018c, p. 65).

This was reported as an emergent strand of theoretical explanation to cost overruns in the highway projects, which complemented the presence of geotechnical pathogens triggered by a predominantly low level of technical-know-how and neglect. The study showed that the combination of these technical and social vices led to a vicious cycle of short funding and delays, which resulted in extreme cost overruns on the highway projects.

Adopting a different theoretical trajectory, Love et al. (2008) problematized the issue of design error-related rework, considered to be alarmingly high in Australian infrastructure projects. The interpretivist analysis was carried out from the perspective of consultants who become complacent at the expense of additional cost to the client while resorting to 'timeboxing' tasks and using a mostly inexperienced staff. Timeboxing according to Love et al. (2008) refers to the allocation of fixed times for the completion of work tasks, irrespective of the level of completeness of documentation. Love et al. (2008) gathered and triangulated qualitative and quantitative data from multiple sources: Nonparticipant observation of the projects from the date commencement of construction to the date of practical completion; Textual analysis of the contract documentation including change order requests, site instructions, requests for information, and drawings changes; Interviews with site foremen, contractor's project managers, and contract's administrators. A quantitative summary log of cost increments incurred on the project, due to

rework from design-related errors as well as from defects, was kept and analyzed to infer causality. The collated qualitative data were inductively analyzed to identify fundamental management issues underlying the process of project designs in consultancy firms. These included: the ‘*process of inducting and recruiting design personnel*’, the ‘*process of design tasks*’, ‘*degree of error proneness*’, and ‘*redesigning of previously completed tasks*’ (Love et al. 2008, p. 240). These constructs were used to model the systemic causal behavior of design-Induced rework. Several practice scenarios were then simulated to further elucidate the dynamics of design-error-induced rework in project systems. Based on the outcome of the simulation, it was inferred that scenario 3, which required a ‘*Reduction of design time, with the engagement of experienced design personnel*’, was the best option (Love et al. 2008, p. 240). While, scenario-5 involving ‘*A combined policy incorporating a design fee reduction, short design delivery period, and reliance on an external supply of design personnel*’—was considered the most inappropriate policy intervention, as it may coerce design firms to produce contract documentation with minimum enthusiasm and further ‘*time boxing*,’ and as result, trigger more errors (Love et al. 2008, p. 240). Scenario-3 was recommended based on its potential to reduce the design and documentation period by 30%. Love et al (2008) concluded that

*‘Construction projects are extremely dynamic and complex and consist of multiple interdependent “components,” which have multiple interacting feedback processes, and numerous nonlinear relationships ... In addition, they are essentially “human” enterprises, and cannot, therefore, be fully understood (or conveniently represented) solely in terms of technical relationships among these components (p. 241).*

Although the cost overrun explanations provided by Amadi and Higham (2018a) and Love et al (2008) were contextual to their respective study projects, they have direct theoretical, academic, practice-based policy implications, which contribute to the wider body of knowledge. Typically, Amadi and Higham’s study raises the question of value for money to the client, as the highway projects delivered may not necessarily conform to established standards. While Love et al.’s narrative call for a sober rethink, introspection, and re-examination of work practices and methods by consultancy firms. The views of practice uncovered show how the poor risk management culture within the organizations has resulted in cost escalation, which necessitates adherence to best practices by qualified technically skilled staff. This however is only conceivable whereby the human, organizational, and institutional environments are made technically conducive.

Adopting mixed paradigms thus blurs the boundaries of the debate in the literature, between the theoretical and technical schools of thought, competing as explanations for cost overruns in public projects. The findings from both Love et al (2008), as well as Amadi and Higham (2018a), show that the level of technical competence, the socio-psychological manifestations of project actors, as well as the distinct organizational and institutional settings in construction organizations, matter in providing a holistic understanding of what drives cost overruns in public infrastructure projects. These studies demonstrate the plausibility of incorporating both strands of the argument (Theoretical and Technical), to link process and product in the cost overruns discourse.

In making significant contributions to theory, these studies deployed a thoughtfully designed mix of methods and collated and analyzed unique datasets. As Barley (2006) in Chan (2020) submits, a remarkable contribution to knowledge can be made because: *‘unique methods or combination of methods have been developed, and/or interesting or unique datasets have been collected and analysed’* (p. 5).

Typically, Figure 2 shows the phase-wise configuration in the mix of methods deployed by Amadi (2016), whereby quantitative/qualitative methods/datasets feed into each other to yield a holistic understanding of the network of causal influences triggering cost overruns.

The richness of the findings from the aforementioned studies amplifies the relevance of mixing methods in cost overrun research, which as Chan and Raisanen (2009) espouse, should constitute a platform to gain meaningful insights that ‘*draw the best out of both worlds*’ (p. 910).

Despite a large number of published papers in the area of cost overruns, it would appear that most explanations for cost overruns, which requires a clear narrative of the network of causal events (process) that lead to cost overrun (product), are in a state of ‘*lock-in*’. Providing details of how events unfold in a counterfactual path-dependent analysis, useful to provide a history to projects, is mostly lacking. These issues, coupled with methodological inertia in artificialized opinion/trend survey, lack of rigor, and imaginative theorizing without concrete facts, thus constitute the argument of some more contemporary scholars researching on cost overruns (Ahiaga-Dagbui et al. 2015; Love 2018; Amadi and Higham 2018a). These studies describe the bulk of existing research on the phenomena of cost overrun as ‘*superficial, replicative and stagnated*’, ‘*generating questions than answers*’, ‘*just managing to scratch the surface*’ (Ahiaga-Dagbui et al. 2015, p. 863), ‘*looking for fragments of information*’ (Love, 2018, p. 04018023-10) and ‘*only giving general pointers*’ (Amadi and Higham 2018a, p. 220). These more current arguments thus advocate for cost overrun research to factor-in process and product.

### **Linking process and product**

To constitute significantly original and useful contribution in the cost overruns knowledge domain necessitates a shift in the methods used, via linking process and product. Linking process and product in cost overrun research requires cost overrun research to be carried out as in-depth studies ‘*that increasingly feature thick descriptions of practice*’ (Chan 2020, p. 2). To link process and product in cost overrun research dictates that studies seeking to explain the build-up of cost overruns in projects, provide context by relaying the project history/organizational environment, using in-depth qualitative narratives. This should be complemented by a conclusive cause-effect statistical analysis of the more immediate project variables that have culminated in cost growth. The complementary technical and managerial views of practice, which can be uncovered via the adoption of both positivists and interpretative philosophies, are vital to understanding the bigger picture. The adoption of single paradigms, therefore, means the segregation and reporting of bits and fragments of what drives cost overruns in projects. As the preceding discussions show, a project’s outturn cost is defined by the front-end processes and uncertainties, the organizational risk management culture as well as the insider relationships within the project environment.

The focus of case study research, on relationships and processes within the context of the project setting, makes it applicable for carrying out cost overrun research. A case study is the study of a specific phenomenon using singular or multiple settings to describe and provide an account of the events, experiences, and processes occurring within each setting (Yin 2014). Yin (2014) attributes the wide-spread use of case studies to the distinctive need to unravel and understand complex social phenomena and its ability to retain the wholesomeness of the real-life contextual background. Where the depth of information rather than breath

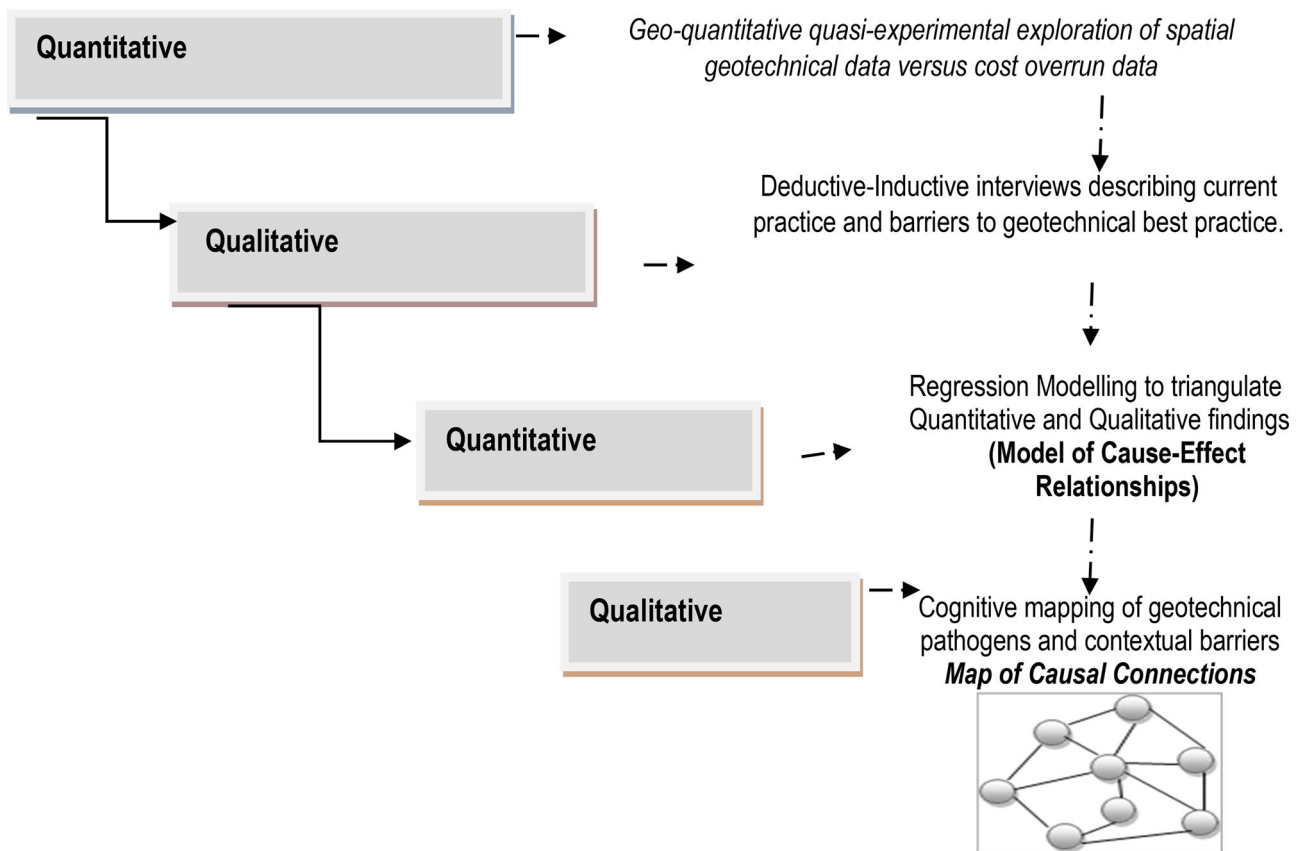


Figure 2. A typically adventurous mix of methods in cost overrun research (Amadi 2016).

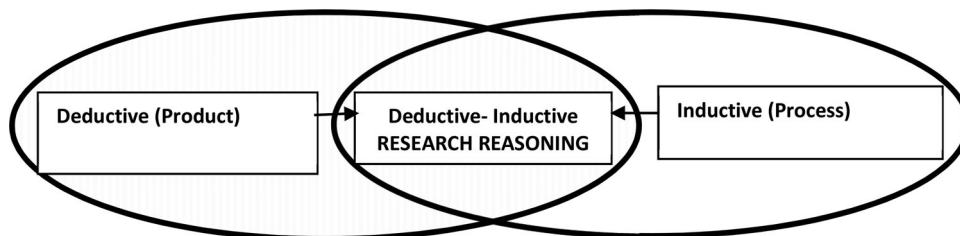


Figure 3. Deductive/inductive based research reasoning.

is emphasized, Robson (1993:98) opined that case studies offer a distinct advantage, ‘To illuminate the general by looking at the particular’.

The case study research strategy further possesses the ability to incorporate multiple data sources, mixed research techniques, and paradigms, that are philosophically, technically, and practically compatible with studying construction phenomena. A mixed-paradigm case study on cost overruns should therefore be a hybrid merger of the requirements of interpretivist and positivist research, incorporating both inductive and deductive reasoning (Figure 3).

Both deductive and inductive reasoning is necessary to establish causal connections, by providing descriptive accounts as evidence to back up the plausibility of explanations (Huberman and Miles, 1985; Miles and Huberman 1994).

Following this line of logic, the pragmatist philosophical assumptions can be asserted to underly mixed-methods case studies. Cresswell and Clark (2011) referred to pragmatism as ‘the third major philosophical movement’. Pragmatism as the name implies is philosophically practical in nature. It thus

relegates the methodologically purist debates, in terms of epistemology and ontology, to the background. To the pragmatist, therefore, the epistemological and ontological debates take a backseat to the more cogent issue of the research problem, and how best to provide an understanding of it (Saunders et al. 2009). Construction management research shares common ties with pragmatism and has a trajectory that is similarly rooted in practice. It should ideally be devoid of the distractions of philosophical arguments. Therefore, irrespective of the ongoing philosophical arguments, the core principle/logic underpinning mixed-methods case studies, which is the potential to better illuminate the research problem, should be prioritized.

Yet Schweber (2015) argues that the striking epistemological differences between positivist versus interpretative philosophies make it practically implausible for them to be embedded in a single research design. Others (Greene and Caracelli 1997; Kelle 2005) are of a similar view, asserting that different research methods are logically based on wildly differing presuppositions, consequently, any attempt to juxtapose them, will inevitably culminate in mischief or confusion. Greene and Caracelli (1997)



argued that the use of multiple world views gives rise to irreconcilable differences in research, and rather emphasized the need for differentiation of world views for specific parts of a study.

As a consequence, it is suggested that cost overrun research should seek to deploy a multi-staged mixed-methods case study research framework whereby findings generated by one approach are used to pose questions, which can be answered with the other. This staged approach to theory building, within case studies, advances the ideology of Yin (2014), whereby level-1 inferences (positivist and interpretivist), which are lower-order theories generated from the different sources (which by extension can also mean different paradigms), corroborate each other to yield a level-2 inference. A level-2 inference is an analytically generalizable theory, at a conceptual level higher than the case/cases studied.

## Conclusion

This study has taken a critical outlook at construction management research, particularly the trajectory adopted to explain the phenomena of cost overruns in public projects, to establish the robustness of the methodological lenses through which past studies have been conducted. The outcome of the critical analysis has revealed a paradigmatic divide in cost overrun research and the paucity of methodologically robust and useful analysis which provides both case histories and quantitative results. To this end, the study outlined key learning points for making significant contributions to the knowledge domain, using practical examples. Particularly, the study has shown that adopting a mix of paradigms promotes the view that the phenomenon of cost overruns in public projects is multi-hydra headed, driven by a complexity of technical and contextual social variables, and not the simplistic methodologically purist explanations implied by the dichotomous arguments in the literature. Incorporating and linking both strands to the argument on cost overruns is therefore relevant to provide more comprehensive and contextually valid explanations.

Against this backdrop, the study espouses the use of multi-staged mixed-methods case study frameworks. This case study approach offers an avenue for conducting more methodologically robust in-depth studies on cost overrun, which provide valid interpretivist narratives outlining the causal events in the project's history (process), as well as the complementary positivist analysis of the backend view i.e., how specific project variables interact to account for the cost variance (product). To tackle real-life problems, cost overrun research should seek to move beyond making abstract assertions or generating sweeping broad-based generic conclusions, to providing more bespoke case study research, rooted in the specifics of the project and the project environment. This will help to furnish a more holistic picture of what drives cost overruns in projects, that can serve as a basis for designing containment measures for future projects.

Future research on cost overruns should thus strive to link process and product by providing context describing the project and organizational environment, backed by conclusive cause-effect analysis of the network of the more immediate project variables impacting on cost. Such analysis is more useful in practice for tackling real-life project management problems and is necessary to trigger a sober rethink, introspection, and re-examination of work practices and methods by the construction Industry.

Outside the confines of cost overrun research, this study serves as a lead for carrying out further empirical research in construction management, to explore the links between the social

and technical risk aspects of construction projects. This research has thus pointed out directions for further in-depth mixed-methods case studies, needed to investigate the technical dynamics of public projects, as products of the social settings prevailing in public agencies. This present study thus resounds the call for less methodological conservatism, supporting the argument that the research methods used by the construction management community should be more adventurous and seek to incorporate a more diverse mix of methods, beyond the positivism versus interpretivist philosophical divide traditionally embraced by the industry. Methodological adventure is relevant to promote theoretical advancement and engender more provocative insightful contributions to the wider body of knowledge on construction phenomena.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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