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POSITIONING COST OVERRUN RESEARCH IN THE PHILOSOPHICAL DEBATE: A CASE FOR CRITICAL REALISM

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Abstract: Construction management research, as a form of social research is confronted with the fundamental paradigmatic dilemma of determining a core philosophical orientation, to be considered adequate and best suited to enquiry about construction phenomena. The underpinning argument being that, the differences in world views, will yield marked differences in the type of knowledge generated. An empirical profiling of cost overrun research reveals the predominance of mono-method studies based on questionnaire survey methods, correlative analysis and archival data modelling techniques, all of which are underlain by positivism. Such positivist philosophies, although methodologically valid, cannot adequately explain and provide in-depth understanding of the contextual drivers in construction organisations, that trigger the more tangible technical constructs, leading to the phenomena of cost growth in projects. Joining in the chorus call for methodological pluralism in construction industry research, this study makes a case for critical realism specifically in the context of cost overrun research.

Keywords: Cost Overrun, Critical Realism, Methods, Research Philosophy.

1. INTRODUCTION

Construction management research, as a form of social research is confronted with the fundamental issue of determining a core philosophical orientation, to be considered as adequate and best suited to enquiry about construction phenomena (Dainty, 2008; Fellows and Lui, 2015). Dainty (2008) stated that construction management, as an emergent field of research, is yet to have a recognised methodological orientation, characteristic of other more established domains, and therefore builds on the traditional philosophical assumptions of related natural and social science research. The term “*Methodological pluralism*”, was thus used to describe the use of multiplicity of philosophies and methods, compatible with the study of construction phenomena (Dainty, 2008). The underpinning argument being that, the differences in world views, will yield marked differences in the type of knowledge generated. As Bryman’s (1988:34) espouses “*different research paradigms will inevitably result in the generation of different kinds of knowledge about the industry and its organizations*”.

2. AIM OF THE RESEARCH

This study narrows down the philosophical argument in construction management to within the specific domain of cost overrun research, with a view to systematically articulate the shortcomings in the methodological/philosophical tradition embraced by previous studies.

3. LITERATURE REVIEW

The cost performance of construction projects is often identified as a fundamental measure of success for project sponsors. Yet against this, a large number of construction projects documented in the public domain, have been censured for notoriously running over their original budget estimate. Cost overrun in construction projects remains a topical issue, with the media, technical press, and scholarly literature, rife with publications analysing cost overrun trends, identifying their primary causes, and offering broader explanations for this pervasive trend. This section reviews the nomenclature of the empirical literature on the problem of cost overruns in construction projects.

Studies Analysing Structured Responses

An analysis of the literature on cost overruns reveal a predominant leaning towards the use of survey researches, mostly based on analysis of questionnaire surveys which sample the opinions of construction professionals. See for example Mansfield *et al.*, 1994; Chang 2002; Aibinu and Odeyinka, 2006; Kaliba, *et al.*, 2008; Memon *et al.*, 2011; Ubani, 2015. These studies often generate a long list of factors, which are sometimes subsequently ranked. Aibinu and Odeyinka, (2006) identified 44 factors, prioritising the 39 factors on a ranked profile, as a source of useful information for construction industry stakeholders, in curbing delays and cost overruns. Some authors including Cantarelli *et al.* (2010); Allahahium and Lui (2011) and Brunes and Lind, (2014) have taken the evidence one step further, by seeking to categorize and classify the myriad of causative variables identified, into a typology of causes, on the grounds that generating a long list of factors, without tracing their fundamental defining characteristics, was insufficient. For example, Allahahium and Liu (2011), analysed 90 causes of cost overruns, identifying five major triggers for cost overruns including: (1) Market volatility principally due to micro and macro-economic variations; (2) novelty/unpredictable events such as unexpected ground conditions; (3) estimate distortion; (4) time pressures and finally (5) project complexity.

The methodology of listing factors, ranking, and categorizing causative variables, based on impersonal questionnaire surveys, which is the most rudimental and simplistic approach to explaining cost overruns, appears to have flooded the literature. Although this adds to the body of scholarly literature on cost overruns, and are methodologically valid, the researchers believe that these forms of empirical analysis cannot be used as a basis for inferring specific cause-effect relationship. With Ahiagu Dugbai *et al.* (2014:868), describing the bulk of cost overrun research, as replicative, stating:

“It is argued that questionnaires alone may not be suitable for investigating complex and systemic problems like cost overrun on construction projects... It is no surprise that the same factors seem to come top of the list most of the time ...”.

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.

However, a scant number of studies based on questionnaire surveys, are methodologically more robust (Memon and Rahman, 2013; Sharma and Goyal, 2014). These studies have gone a step further to develop explanatory relationships amongst the identified costoverrun factors. For instance, Memon and Rahman (2013) investigated the effect of cost overrun factors based

on survey responses of client, contractor, and consultant representative involved in handling small scale projects in Malaysia. A total of 54 survey responses were analysed using the Partial Least Square Structural Equation Modelling, a form of factor analysis, to model the relationship amongst various factors. The outcome of the analysis revealed latent factors which triggered the highest variance: contractor's site management related factors, had the most significant effect on small scale projects. Whereas Sharma and Goyal (2014) developed a fuzzy logic model for assessing cost overrun, based on a preliminary questionnaire survey, conducted to judge the level of importance of the identified factors. A fuzzy logic model was then developed, and used in mapping out decision trees on an input and output basis, complemented by graphical representation of the variation induced by different combination of cost overrun factors, to understand their combined effect. Sharma and Goyal (2014) fuzzy model showed that the largest hypothetical variation in cost overrun will be largely due to inadequate planning and scheduling, followed by variation due to short bid preparation time and experience of contractor.

However, a discernible shortcoming of the models developed by both Memon and Rahman (2013) and Sharma and Goyal (2014) is that the data used in their analysis was not sourced in relation to specific projects or based of any form of project information. These studies relied solely on the general opinions of construction professionals, to infer abstract statistical inferences about the generality of factors that lead to cost overruns. It is thus probable that these models can explain the relationships amongst the cost overrun factors, but may have little explanatory power to account for recorded cost overruns on a project specific basis. This can be rationalised in lieu of the fact that technically projects are unique, which is in stark contrast to the underlying assumptions of the findings of these studies. Furthermore, matters of sensitive dependence arise, in the generalisability of the study by Memon and Rahman (2013) with respect to small scale projects in Malaysia, as the study assumes that projects of a similar size will experience similar issues.

Studies Advancing Spurious Correlations

In addition to the afore mentioned groups of cost overrun studies, few others provide and analyse cost overrun data, to test specific project variables in accounting for the trend in the data, as explanations for the cost overruns. Typically, Hinze and Gregory (1991), empirically tested for the effects of project size, location and complexity on the level of cost overruns experienced on projects executed by the Washington State Department of Transport. Flyvbjerg *et al.* (2002, 2004), conducted a similar study, from a sample of 254 transportation infrastructure projects drawn from countries in different regions, mostly located in the northern hemisphere. Akoa (2011) conducted a similar study on highway projects in Cameroun. These studies concluded that the bigger sizes and complexity of infrastructure projects are correspondingly reflected in the increased levels of cost overrun. Hinze and Gregory (1991), further inferred, that the simultaneous nature of projects execution by highway agencies, invariably implied lesser amounts of pre-and post-contract engineering hours available to each, thus accounting for the higher levels of cost overruns often induced in highway projects. Additional engineering, was thus stated as requisite, to overcome risks occasioned by the complex and simultaneous nature of highway project execution, which often creates a propensity for such projects to run over budget. Whereas, Flyvbjerg *et al.* (2004), asserted that the average length of implementation phase of transportation projects significantly impacted on the level of cost overruns recorded. This was inferred based on an analysis of cost overruns experienced on bridges, tunnels, and roads, which showed that cost

overruns varied in relation to project duration. Bridges and tunnels, with average duration of 6.6 years recorded higher cost overruns than rail and road projects with an average duration of 6.3 and 4.3 years. Flyvbjerg *et al.* (2004:15) thus concluded, sluggish planning and implementation of transportation projects had direct financial repercussions, stating: “*Sluggishness may, quite simply, be extremely expensive*”.

However, other studies, such as those by Odeck (2004) in Norway, revealed that larger cost overruns were experienced in smaller projects. Morris (1990) also arrived at a similar conclusion, as Odeck (2004), for 290 Indian projects analysed. Yet, contrary to the findings of these studies, both Love (2002) and Love *et al.* (2013) revealed that cost overruns do not vary by project type or size. The conflicting results, from various studies, further reinforces the discernible shortcoming of these studies, that conclusive inference is mostly drawn based on exploratory statistical analysis. Typically, the use of correlation analysis, which by virtue of reporting significant association between bivariate groups of variables, cannot be used to conclusively infer causality. These studies thus assume that the dependent variable (Cost overrun) changes solely because the independent variables (project size, project type complexity etc., change). Citing the popularly used phrase in statistics: ‘*Correlation does not necessarily imply causation*’.

Studies Analysing Causation Based on Project Data

Quantitative analytical techniques, which analyse cause-effect relationships, are generally grouped as Mathematical models (An *et al.*, 2007). Models are reductions of reality replicating an intricate system using variables within those systems (Ahiagu Dugbai, *et al.*, 2014). Mathematical models have however been scantily used in the literature to infer causality in relation to project cost overruns. The techniques which have been used to analyse cost overrun in a limited number of older and more contemporary studies include: Linear modelling techniques such as regression modelling, Networking and data mining techniques such as Artificial Neural Networks, Heuristics based models such as Case Based Reasoning /Reference Class Forecasting, Stochastic techniques such as Monte-Carlo simulations; and Logic based methods such as Binary Logistic modelling and Fuzzy Logic (Love 2002; Trost and Oberlender 2003; Attala and Hegazy 2003; Ahiagu Dugbai *et al.*, 2014; Lee and Kim 2015 and El-Kholy 2015):

Typically, older studies such as Trost and Oberlender (2003) as well as Attala and Hegazy (2003) have used linear modelling techniques, based on regression analysis, to analyse cause-effect relationships in explaining recorded cost overruns in projects, and further tested the validity of these models with respect to their use in decision making for future projects, at specified levels of confidence. A more recent study by El-Kholy (2015) generated a regression based model, while comparing its predictive capacity to a Case Based Reasoning (CBR) model for similar data sets derived from 30 projects. The outcome of the study showed that the regression modelling had higher levels of accuracy to predict potential cost overrun in projects. El-Kholy (2015) further applied a CBR model to predict the likely cost overrun given the degree of similarity of the project characteristics. El-Kholy (2015) used this method to analyse cost overrun factors, whose presence as part of a future project, is indicative of a potential to result in a similar degree of cost overrun, useful in reference class forecasting and decision making to minimise cost overruns for future projects. Ahiagu Dugbai *et al.* (2014) used data mining techniques based on artificial neural networks, to analyse the complexity of non-linear interactions amongst quantitative project variables such

as compensation events, project duration, as well as qualitative information on tendering method, location, project type, fluctuation measure and project's delivery partner. Lee and Kim (2015) used monte-carlo simulations to analyse the statistical distribution of change orders issued during the construction period, which lead to significant cost overruns. Love *et al.* (2013) developed a probabilistic Log-Logistic distribution of cost overruns for 49 road projects (new roads including upgrades and elevated highways) in relation to rework occasioned by errors and omissions in contract documentation, leading to cost overruns.

Although this class of technical studies on cost overruns which rely on modelling to understand cause-effect relationship, have a robust and methodologically valid underpinning, rooted in the specifics of project data, with a direct applicability useful in monitoring and reassessing future projects, there is a discernible lack of context.

A Case for Critical Realism

It is often argued that the selection of a research philosophy by the research community is mostly an intuitive decision, often in line with the researcher's ontological and epistemological stance and preference, which may not necessarily ensure the rigor and robustness of the research effort (Holden and Lynch, 2004). This argument clearly reflects a discernible shortcoming in the bulk of cost overrun research, which is the sole reliance of positivists philosophy to provide explanation for the poor financial performance of construction projects. This trend equally reflects the bigger picture in construction management research, which has been shown to exhibit a continuing adherence to positivism (Dainty, 2009). Such methods strip the context narrative, which is necessary to *elucidate the role of social action from the standpoint of project actors*. This is despite the wide array of research philosophies which can be compatible with the study of construction phenomena, by virtue of being technical as well as social constructs. As Dainty (2009:6) asserts:

“Researchers use the real-world context of the construction industry as sites for developing research questions ... It could be reasonably expected that their methodological positions and the methods adopted may have broadened and diversified to reflect the multiple traditions from which it draws upon.

It is thus the researchers' conviction that methodological pluralism, applied to cost overrun research, would yield less artificialized and more methodologically valid explanations for cost overruns, which describe context and show causality. Using a practical analogy Mingers (1997:9), illustrated the need for methodological adventure:

“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 reveal certain aspects but is completely blind to other... 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”.

Various opinions have thus been expressed on the criteria for choosing a research philosophy (Grix, (2001; Holden and Lynch, 2004; Rooke and Kaguoglo; 2007; Gajendran, 2011). Holden and Lynch (2004) argued: *“Research should not be methodologically led, rather that methodological choice should be consequential to the research philosophical stance and the social science phenomenon to be investigated*. Yet, Grix (2001:23) asserts *“methods*

themselves should be seen as free from ontological and epistemological assumptions, and the choice of which to use should be guided by the research questions". Some other researchers, for example Panas and Pantouvakis (2010:77), have predicated the selection of an appropriate methodology, by identifying those typically deployed in similar studies, with the ultimate objective of *"Preserving research validity and establishing of a seamless methodology that could be repeatedly applied"*.

The researchers build on the argument of Holden and Lynch (2004), and are of the view that the most appropriate philosophical orientation for cost overrun research should be objectively defined, devoid of personal or discipline based paradigmatic preferences, in relation to their merits for achieving the research aims and objectives. The researchers, believe stereotyping or basing methodological decisions, on existing philosophical traditions or trends in previous studies, would amount to methodological stagnation, which will ultimately stifle innovation and creativity in research. Rooke and Kagioglou (2007), further reinforce the researchers' stance by asserting that a fundamental requirement in research is its *'Unique Adequacy'*. Unique Adequacy, a criterion for adjudging reliability and validity in qualitative research, means that: *"the methods of analysis used to report, should be derived from that setting*". The implication of this logic for cost overrun research and academic enquiry in the construction industry is that the method of analysis should not necessarily be determined *a priori*, being *'transplanted in-situ'* from similar studies in the knowledge domain, but should rather emerge from the peculiarities of the problem and context under investigation.

In view of the significant gap in the cost overrun literature, the study posits that critical realism presents itself as a valid philosophical position, relevant to carry out rigorous and methodologically robust research on construction phenomena, which can withstand the critique plaguing the use of mono methods in construction management research. This is considering that construction phenomena, are social constructs, which can be also objectively studied. In conducting cost overrun research, the researchers thus adopt the philosophical stance of the critical realist, via the retention of ontological positivism, which rejects the view of multiple realities, with epistemological interpretivism/constructivism, which acknowledges the role that values and societal ideology play in the derivation of empirical knowledge.

However, in advocating for critical realism, the researchers are not unaware of its criticism, mostly accused of being *'logically contradictory'* (Nune, 2013). From the physical and social sciences, proponents and advocates of the critical realist philosophy have erected categorical philosophical defences in readiness for such criticism, (Frazer and Lacey, 1993; Campbell, 2002). To the constructivists, such justification was provided by Frazer and Lacey (1993:182): *"Even if one is a realist at the ontological level, one could be an epistemological interpretivist . . . our knowledge of the real world is inevitably interpretive and provisional rather than straightforwardly representational"*. Critical realism was thus further conceived by Lawson (2003) as a methodologically valid lens for the social sciences, on the issues of ontology, as it relates to the nature of the study phenomena (sensory abstractions or real/tangible?). To the positivist, it was contended: *"all scientists are epistemological constructivists and relativists in the construction of scientific knowledge"* (Campbell, 2002: 29). More specifically in the engineering sciences, Panas, and Pantouvakis (2010) noted that quantitative experimental frameworks and models require scientific data, which are primarily sought through human subjects, who are inherently subjective in their representations.

Philosophical flexibility in cost overrun research is thus warranted. Ontologically the reality of cost overruns is a tangible construct that can be measured precisely. However,

epistemologically, factors leading to cost growth, has a wide range of differing explanatory perspectives, and has been established in the literature to be closely linked to subjectivity of project players in organisations. To understand the phenomena of cost growth therefore requires that an interpretivist epistemology is necessary, while retaining the singular ontology of the reality of cost overruns in highway projects, typical of critical realism (Figure 1).

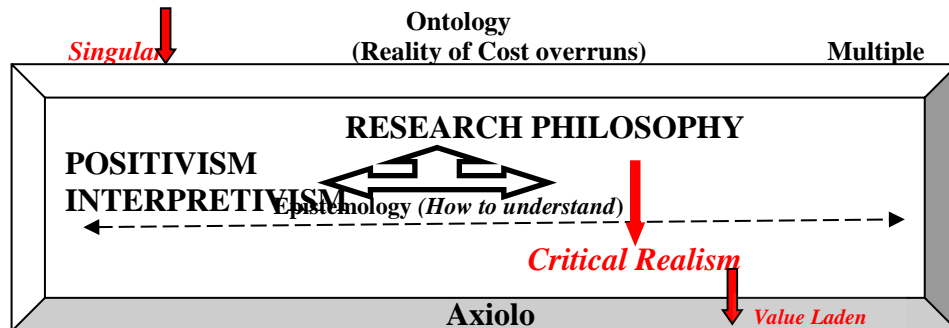


Figure 1: Philosophical Position of the Critical Realist in Cost Overrun Research

The philosophical appropriateness of relying more heavily on the interpretative world view as opposed to the positivist view at an epistemological level, is defined by the need to gain knowledge on the propagation of cost overruns through human subjects, who are the executors of projects, as well as the need to factor in the organisational dynamics surrounding construction projects.

The ability of the critical realist to infer causality within a predominantly interpretative epistemology, further defines its appropriateness to provide contextual explanations for the propagation of cost overruns in projects, which is fundamentally driven by actions/inactions of the human actors in construction organisations. According to Huberman and Miles (1985:21), critical realism is an “an approach designed to yield verifiable knowledge of human group life and human conduct”. This is predicated on the critical realist assumption that there are ‘reasonably stable law-like links of causality’ amongst social constructs, whereby human actors in social and historical setting have always exhibited ‘sequences and regularities that link phenomena together’ (Miles and Huberman,1994:429). This unique feature of critical realism, its terms its ability to retain objectivity, while incorporating multiple perspectives derived from the interpretative understanding of the human factors in organisational practice, that drive the more technical concerns, is thus a core requirement, necessary to infer causality in cost overrun research.

4. CONCLUSION

The study has examined the methodological and philosophical leaning of cost overrun research, highlighting the predominance of mono-method studies, which are mostly based on questionnaire survey methods, correlative analysis and archival data modelling techniques, all of which are underlain by positivism. The study argues that such positivist philosophies, although methodologically valid, cannot adequately explain and provide in-depth understanding of the contextual drivers in construction organisations, that trigger the more tangible technical constructs, leading to the phenomena of cost growth in projects. The study thus advocates for critical realism, which affords the use of multi-methodologies, and as well as maintain both objective and subjective realities of the constructs associated with a cost

overruns in projects. The study posits that critical realism lends itself as potential lenses to study construction phenomena.

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