

Overrun causations under advance payment regimes

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Abstract

Purpose – Evidence suggests project owners could use advance payments to prevent cost escalations. The purpose of this paper is to elicit the relationships between causations of overruns when advance payments are issued to contractors.

Design/methodology/approach – In total, 97 responses from a questionnaire survey were analysed. Additional data on 51 projects, completed between 2000 and 2014 under different advance payments regimes, were also obtained and analysed.

Findings – Project owners issue advance payments to contractors so as to avoid delays. However, statistical correlation between advance payments and overrun causations are not significant. Although cost overruns were higher in large projects than in small projects, schedule overruns were more in small projects than in large projects. Schedule overruns were caused most significantly by contractors' site management approaches. Design and documentation issues were identified as the most prevalent cause of cost overruns. Regression models are proposed to elicit overruns when advance payments are issued.

Practical implications – Extant debates on project overruns in construction and project management literature are robust. Nonetheless, the study elicits considerable knowledge gaps regarding the roles of advance payments in fostering project performance.

Originality/value – This pioneering work indexes the relationship between advance payment and project overruns in Nigeria. It is also the first attempt to document the probability distribution of overruns in Nigeria, particularly under specific advance payment regimes.

Keywords Costs, Construction, Capabilities, Business strategy, Cash flow, Capital projects

Paper type Research paper

Introduction

An efficient payment mechanism is a vital necessity to stimulate performance in construction projects. If a project is funded poorly, it is not likely to succeed greatly. How then are payments supposed to help achieve project success? The many sides to this have been elucidated variously in construction management literature. For example, Motawa and Kaka's (2008) work articulates payment methods in construction projects to include open-book accounting, stage payments, incentive contracting, direct payment, trust accounts, mobilisation and advance payment and mechanic's lien. The overarching principle underlying these methods is that owners make payments to contractors in two ways. One approach is by making payments to contractors in advance, before work is executed (e.g. mobilisation and advance payment). The other approach is the practice of making payments for works which contractors have completed satisfactorily. Each of these principles implies different cashflow scenarios, and could be debated in various ways. Nonetheless, the aim of this research study is to examine whether advance payments prompt project performance by exploring causations of overruns when contractors are paid in advance.



Rationales for advance payment

Researchers have debated many justifications to advance payments variously (Ofori, 1991; Jagboro, 1998; Motawa and Kaka, 2009). Amortisation of advance payments is yet another debate (Quercia *et al.*, 2007; Halpin and Senior, 2011). Project finance literature has put both advance payment and amortisation methods as key factors in project success (Yescombe, 2002; Elazouni and Gab-Allah, 2004; Li *et al.*, 2005; Sorge, 2004). An overarching premise of extant studies on these is that it is crucial that owners and contractors understand and design the appropriate rationale and expectations regarding their approach to advance payment and amortisation. According to Abeyssekera (2002) and Rameezdeen *et al.* (2006), contractors and subcontractors are paid in advance by project owners to assist the former to initiate and maintain healthy cashflows at one stage of project contracts or the other. Apparently, considerable evidence in other studies suggests advance payments are both strategic and statutory practices that facilitate project success. For example, Jagboro's (1998) work on the net present value of payments made in advance for construction materials in Nigeria underlines the strategic importance of advance payments in the Nigerian construction business environment. This is because payments made for materials in advance help to avoid price fluctuation, a common cause of cost overruns in construction. Additional evidence presented in the studies of Talagala (1997) and Chen (1998) shows how advance payments are used in Sri Lanka and China, respectively. Berends and Dhillon (2004) have also explained how advance payments are administered on large engineering projects in different parts of the world. In all these studies, the goal of advance payment is clear. Through advance payment, contractors are able to establish client's commitment to project finance, and clients are able to commit contractors to prompt performance.

Rationales underlying advance payments are in two perspectives. One of project owners' strategic goals in paying contractors in advance is to forestall surges in resource prices such that contractors are able to pay for critical resources before associated prices rise. Thus in a way, advance payments are meant to prevent overruns that may arise due to price escalations. Second, although advance payments do not yield significant increase to owners by a calculable rate of interest, certain benefits accrue to owners as advance payments become amortised. For example, it is an advantage to project owners, and contractors too, when a project's start-up capital is not sourced externally. In such instances, advance payment makes it possible for contractors to avoid accruable cost of finance that could ultimately add up to owners' project costs (Spackman, 2002). In such a process, advance payment could be described as a strategy to lower projects' outturn costs.

Research problem

Overruns are still rife in construction procurements (Love *et al.*, 2015; Flyvbjerg, 2011). It is unclear how advance payment impacts this; however, it is possible to accrue wisdom from a range of perspectives. First, expected cost benefits of advance payments hardly account for depreciation (Elazouni and Metwally, 2005; Jagboro, 1998). Advance payments do not control time value of contractors' production costs either (Dayanand and Padman, 1997). These two factors are critical. They mean the amount in advance payment is not of the same value as the amount in amortisation; numerical figures could be the same, real values are different – due to time value of money. In addition, the trade-offs underlying benefits of advance payment as anticipated by both project owners and contractors can diminish without influencing projects' performance goals significantly. Discussions on reasons and possible risks underlying why clients pay contractors in advance are not in short supply in management literature. However, not much of empirical evidence is available on the impact of advance payments on projects' outturn costs. This knowledge gap triggered the aim of this study: to explore the overrun causations under advance payment regimes. First, the study identifies the causations of overruns when advance payments are issued. Second, the study explores the relationships

between advance payment, outturn costs and project durations; and causation of cost variations and advance payments. Finally, it develops regression models that predict actual outturn costs and contract durations when an advance payment is issued.

Advance payment administration

According to Talagala (1997), cash-flow issues are a perennial problem with local contractors in developing countries. For this reason, an important aspect of government support for the local construction industry is to pay contractors in advance at least once, most commonly at the beginning of a contract. It is not often an optional obligation to issue payments to contractors in advance. Such practice is supported strongly by legislations (e.g. the Manual of Nigeria's Bureau of Public Procurement (2011) and crucial policies of international agencies – e.g. World Bank's (2011) Guidelines on Procurement of Works). The percentage of advance payments to initial estimated cost varies from one project to another and from country to country. More importantly, advance payment is an express component of most underlying conditions of construction contracts. For example, Clauses 4.8 and 4.17.4 of the Joint Contracts Tribunal (JCT) (2011) Condition of Contract recognise advance payment and the administration of sureties that associate with it (also Chappell, 2014 for commentaries on these clauses). Clause 14.2 of the Federation Internationale Des Ingenieurs-Conseils Conditions of Contract also recognises advance payment as an interest free mobilisation, the administration of which must outline its securitisation and amortisation (e.g. total amount in advance, rate and timing of recovery, and surety arrangements). Secondary Option X14 of the New Engineering Contract's Engineering and Construction Contract and the Engineering and Construction Subcontract has similar provisions also.

These clauses support the administration of advance payment. Nonetheless, is there any evidence as to whether advance payments influence project outcomes, and whether they improve contractors' financial capabilities? Simply put, do advance payments reduce projects' susceptibility to overruns? Extant literatures have espoused construction estimating as complex processes. As argued by Skitmore and Patchell (1990), contractors' bids are often not based on realistic expectations regarding actual construction costs; rather to enable cost projections get through the bidding stage. Ogunsemi and Jagboro (2006) have corroborated this by using empirical data of the Nigerian construction industry. The authors concluded that the true costs of construction projects are largely uncertain until after projects' actual completion. Should advance payments be based on preliminary estimates which are usually inconsequential? Flyvbjerg (2011), Flyvbjerg *et al.* (2013), Cantarelli *et al.* (2012) and Odeck (2004) have decried this as opportunistic behaviours. More importantly, there is abundant understanding in literature regarding causes of cost overruns in construction. In particular, Love *et al.* (2015) argued that contract costs are likely to vary because of variations to prescribed work and price escalations. Evidence is rare in published empirical studies to suggest that advance payments prevent work variations, or that they alleviate cost escalations definitively.

Causations of overruns

Opinions on causes of overruns are not in short supply. Some researchers think overruns are shaped by project environments. For example, Mansfield *et al.* (1994), Memon *et al.* (2012) and Ezeldin and Abdel-Ghany (2013) have looked into the causes of overruns in Nigeria, Malaysia and Egypt, respectively. Conclusions from these studies seem to emphasise the peculiarity of the project environment as a dominant issue in overrun causations. Other researchers have had a slightly different opinion: there is a mixture of opinions as to whether overruns are caused by factors within and outside project control (irrespective of project environment). For example, Flyvbjerg (2011) thinks overruns can be triggered by estimators' deliberate intention to mislead clients, while Love *et al.* (2015) are of the view that

overruns are systemic issues, the chaotic manifestations of which are triggered by factors outside projects' exclusive control. In addition to these, there is another school of thought whose opinion is that extant studies on overruns are simplistic, superficial and replicative; as such an appropriate view on overruns should focus on issues from outside the box (e.g. Ahiaga-Dagbui *et al.*, 2015). By thinking from outside the box, the authors conclude that overruns causations are best understood by considering a project as a holistic system. A way to look at this is to consider how causations are triggered by several dynamic factors and how these factors interact with each other to manifest as overruns.

From these opinions, it is considerably useful to explore normative literature on pressure points that trigger overruns within the culture of advance payment. For example, studies have underlined design and contract documentation issues as a major cause of overruns (Mansfield *et al.*, 1994). When designs are incomplete, incorrect or misleading, it is often common that they lead to rework, delays and extra costs (Love *et al.*, 2015). When designs are complete, accurate and credible, but are documented inappropriately, studies have shown then these have often led to disputes, delays and extra costs (Love *et al.*, 2010). In addition, studies have shown that projects are only a success if the different parties involved in the project manage their finance effectively (Yescombe, 2002). There are many sides to this. As captured aptly by Olatunji (2012), a key to this is in the reconciling the varying views on project price and cost. A contractor's cost is a client's price: overruns can be triggered both by symmetrical and asymmetrical relationships between these two. Along this line of thought, some studies have elicited relationships between overruns, and project management and contract administration approaches (Frei *et al.*, 2013). There is no shortage of ideas in project management and contract administration literature on how to manage projects to cost and schedule (Walker, 2015; Herbsman *et al.*, 1995). Crucial amongst ideas suggested in literature is for clients to incentivise innovation and performance, and to share in contractors' risks.

Contractors' human resource management is another key issue in overruns. For example, highly motivated staff are less likely to trigger rework than highly dissatisfied staff (Love and Li, 2000). In Nigeria particularly, clients often attempt to ensure their contractors have credible human resource, and that they also have appropriate protocols in managing their workers (Olatunji, 2008). The same principle also applies to material and plant resources used by contractors: Nigeria's public procurement guide (2011) mandates the assessment of contractors' plants and equipment, and the use of advance payment to prevent cost escalations in the early stages of a contract. In addition, in the work of Akanmu *et al.* (2016), findings show how site management issues could trigger cost escalations, and how to prevent these. The authors proposed the combination of several analogous technologies that can capture data on site in real time to facilitate quick and proactive decision making by clients and contractors in relation to managing cost variabilities.

Additional evidence has shown that there are several external factors that could cause overruns. According to Love *et al.* (2015), these include political interference in projects, e.g. instances where projects costs are engineered to political undertones. Baloi and Price (2003) and Olatunji (2010) also report on the impact of macro-economic variables such as national income, inflation, exchange rates, cost of finance and monetary policies that could trigger variations to project costs and schedules.

Research method

In Nicholl's (2009) work on research methodologies, the author argued on the different philosophies that justify the choice of methods in empirical research. The author elicited considerable evidence to conclude that quantitative research methods are most appropriate in cases where observed variables are hard (i.e. well defined, e.g. measure degree of change in clearly defined variables such as body weight or temperature). On the other hand, according to Nicholl, qualitative research methods best explore soft variables and their descriptors. In the

case of this current research, the variables being explored are well defined. Key variables such as cost overruns, advance payment regimes and schedule overruns are already established. The goal of the research is to explore the relationships between these.

Using field survey techniques, the study explores its primary data through structured questionnaires administered to project stakeholders, namely owner organisations, construction companies, consultancy firms and public administration agencies. Data were also collected on projects, completed within the 15 years between 2000 and 2014, where advance payments have been issued to contractors in varying percentages. Moreover, the target project environment is where price fluctuation is frequent and advance payment is a legal requirement on projects in line with the rationales stated above. Nigerian construction environment meets these conditions. However, of all the different levels of government in Nigeria, projects executed by the Ondo State Government were selected because the government has experimented with three different percentages of contract sums as advance payments within the range of years selected for this study. In total, 60 per cent of initial contract sums were paid out to contractors on projects between 1999 and 2003, and 50 per cent from 2003 to 2009. The 30 per cent is in use currently started in 2009. Within the same state, from 2003 to 2015, 15 per cent of contract sums are paid in advance to contractors for projects owned and financed by the Federal Government of Nigeria. Also, there are instances (e.g. in public-private partnership projects) government and private establishments within the state do not pay contractors in advance. Price regimes of construction resources within these periods have also varied (Olatunji, 2010). These nuances make it possible for the study to explore the impact of varying advance payments conditions on projects of similar characteristics, e.g. institutional and private projects. In the instance of the research, variations in advance payments were considered between 15 and 50 per cent.

The first part of the questionnaire survey sought to determine the validity of respondents' views through their professional background and experience. Another part of the questionnaire collected data on the need and use of advance payments on projects, and on critical successful factors regarding the impact of advance payment on overruns. On the overall, data were retrieved from a total of 51 projects, executed in government departments and parastatals. In addition, out of a total of 127 questionnaires administered, data were also collected from 65 (51 per cent) respondents who are top management personnel in owner organisations, 20 (31 per cent) respondents from construction firms and 12 (18 per cent) respondents from consultancy firms. This gives a response rate of 76.4 per cent. Only 15 per cent of the respondents have had less than five years of cognate experience on construction projects, 71 per cent of the respondents have worked in the Nigerian construction industry for between six and 15 years. In total, 14 per cent of the respondents have worked for more than 16 years in the construction industry, while all the respondents have had at least a first degree or its equivalent in construction management disciplines.

Data analysis

Advance payment was used to mobilise all the contractors on all the 51 projects surveyed, at least once. In all cases, single or multiple layers of bonding arrangements were required before advance payments were issued. In total, 85 per cent of the projects surveyed in this study required the combination of performance and advance payment bonds. The latter indemnifies the client such that if the contractor defaults in mobilising to site or in making appreciable progress within 90 days, the advance payment becomes recoverable from the underwriter. Performance bond enables the recovery of up to 50 per cent of the contract sum should the contractor default in performance. Advance payments were issued to contractors only when they have possessed project sites and have completed at least 10 per cent of the work, and were amortised in at least four instalments.

Through the questionnaire, respondents were asked to use a five-point Likert-scale to rate the reasons why clients consider advance payment necessary. In the Likert scale

5 represented “strongly agree/very important”, 4 represented “agree/important”, 3 represented “somewhat agree/moderately important”, 2 represented “disagree/lowly important” and 1 represented “strongly disagree/not important”. As shown in Table I, the three groups of respondents – owners, contractors and consultants – strongly agreed that the most important reason why clients pay contractors in advance is to avoid execution delays. They also agreed that advance payments are used to buy materials ahead of price escalations. Amongst other critical reasons rated most important by respondents were the need to help contractors out of financial burdens in relation to the projects, and to avoid payment delays on the part of the clients – perhaps due to bureaucratic bottlenecks in public administrative processes. The study found that advance payments are used such that contractors were able to complete work ahead of schedule – largely in lieu or in addition to added costs of schedule crashing, and to compensate the contractors for positive variations made to an existing contract. Respondents also agreed that such variations are only considered if they are not based on design or construction errors for which contractors should have prepared (e.g. while bidding).

The 51 projects were analysed further so as to elicit the relationship between the advance payments and projects’ outturn costs and schedules. A total of seven projects have had 15 per cent advance payments, four of which are medium-sized projects that cost over 100 million naira (equivalent to US\$500,000)[1]. The other three projects are relatively small (their outturn costs were between 35 and 38 million naira (equivalent to US\$170,000-US\$190,000). Preliminary analyses show the indicators of project performance were not distinguishable by project size in this instance due to the small number of samples used ($n = 7$). The range of cost variations is relatively similar in both small (–1.0-40 per cent) and medium size (0-59 per cent) projects. However, time performance indicators show a slightly different phenomenon: time overruns on small projects have ranged from 75 to 950 per cent;

Reasons why stakeholders use advance payment	Owners	Consultants	Contractors	Average	F-statistics	p-value
To avoid delays in project execution	4.50	4.42	4.45	4.46	0.0717	0.9309
To assist in buying materials ahead of time, and in bulk, so as to avoid price escalations	4.08	3.82	4.05	3.98	0.4166	0.6611
To lessen contractors’ financial burdens	3.83	3.61	3.75	3.73	0.0298	0.7343
To avoid payment delay on the part of clients	3.25	4.00	3.20	3.48	8.2236	0.0007*
To ensure that contractors deliver high quality of work	3.33	3.18	2.80	3.10	1.6304	0.2041
As a risk management tool for both clients and contractors	3.17	2.70	3.25	3.04	1.7258	0.1865
To enable contractors complete projects ahead of their schedules	2.92	2.15	3.25	2.77	8.8406	0.0004*
To compensate contractors for additional work added to the contract	1.83	1.58	2.00	1.80	2.1455	0.0126**
To compensate contractors for variation in works due to errors or mistakes in designs, or construction processes	1.58	1.48	1.55	1.54	0.1262	0.8817
To protect the contractor against unforeseen site conditions	1.75	1.27	1.75	1.59	3.5250	0.0355**
For issues relating to corruption, e.g. gratifications	1.33	1.06	1.15	1.18	2.2440	0.1146

Notes: *Significant at 1 per cent critical value if p -value < 0.01; **Significant at 5 per cent critical value if p -value < 0.05

Table I.
Reasons why stakeholders pay contractors in advance

82 to 346 per cent in medium-sized projects. Nuances in the delay causations, and the attendant control mechanisms, are a subject for another research. Nonetheless, the analysis seems to suggest that small project contractors are generally less accurate on their time projections and/or perhaps have had less management capabilities to control project resources. Analysis also shows that where cost overruns were not evident, schedule overruns were considerably large (averaged 75 per cent).

A total of 39 projects have had 30 per cent advance payment. In total, 29 of them were between 20 and 99 million naira (US\$0.1-US\$0.5 million). Eight were between 100 and 500 million naira (US\$0.5-US\$2.5 million). The other two were between 550 million naira and 2.5 billion naira (US\$2.7-US\$12.5 million). More importantly, of the 39 projects surveyed in the 30 per cent advance payment regime, five projects (13 per cent) were completed below budget (-12--1 per cent). A total of 16 projects (41 per cent) were completed within marginal overruns (0-0.4 per cent), whilst the remaining 18 projects (46 per cent) overran their budgets by 3-140 per cent. Amongst the latter, 16 projects had less than 50 per cent overrun; a project has more than 100 per cent budget blow-out. When arranged into project sizes, analysis shows cost overruns were most prominent in large projects. The overruns they manifested had ranged from 11 to 140 per cent. In medium-sized projects, 50 per cent of the projects overran their budgets (with 12-31 per cent overrun). The other half was equally distributed between marginal overrun (which ranged between 0 and 0.4 per cent overrun) and below-budget completion (ranged -10 to -12 per cent below-budget completion).

Time overrun was more prevalent in the project samples than the cost overrun situations suggest. Only two of the projects were completed earlier than scheduled, -6 and -55 per cent of the initial contract schedule, and these were amongst small projects category. Unlike in the cost overrun situations, there seems to be an inverse relationship between project size and time overrun. Larger projects were completed within smaller schedule overruns than in medium- and small-sized projects. In the two large projects, one overran its original schedule by 32 per cent. The other had the contract expanded to twice the original size, but was completed within 198 per cent of the original schedule. Schedule overruns in the medium size projects were a lot larger (123-440 per cent). Small projects were between 20 and 763 per cent. A probability distribution of the advance payment regimes in relation to overruns was obtained through log-logistic analysis. The analysis suggests, under these advance payment regimes, the probability that a project will overrun its budget by at least 5 per cent is more than 50 per cent. There is also 22 per cent probability that a project under the same condition will overrun its schedule by 120 per cent.

Analysis on overrun causations and advance payment

The study further explored causations of overruns in the surveyed projects. Using a questionnaire survey, participants were required to rate the critical causes of overruns that they have observed on the projects surveyed for this study. As shown in Table II, design and documentation issue was the most prevalent cause of cost overruns in the surveyed

Table II.
Critical causes of
overruns in the
surveyed projects

Critical impact factors	On cost	On time
Design and documentation issues	2.95	3.78
Effectiveness of financial management approaches	2.69	3.77
Project management and contract administration approaches	2.35	4.17
Efficiency in human resource	2.37	4.11
Efficiency of materials and plant resources	2.32	4.11
Contractor's site management style	1.85	4.38
Information and communication technology tools	1.74	3.94
External factors	1.49	1.58

projects. Another critical cause of cost overrun indicated by participants is the effectiveness of stakeholders' approaches in managing project finance. Surprisingly, the study found the applications of innovations in information and communication technologies, and external factors, as the least important factors that affect cost overruns.

These observations are different in the analysis on schedule overruns. Analysis shows that contractors' management of site conditions was the most prominent factor that influenced time performance of the surveyed project, although the factor did not affect outturn costs to project owners significantly. Participants also pointed out that discrepancies in the project management and contract administration approaches used by the different stakeholder often trigger project delays. Moreover, resource management issues (plant, human and material resources) were identified as critical and frequent causes of time overruns. Analysis also shows external factors (e.g. unforeseeable events) were the least important causes of both time and cost overruns.

The statistical relationships between these variables were explored further through Spearman's correlation analyses – the two domains (cost and time overruns) were analysed separately, however they were reported in the same table (Table III). Relationships between cost overrun causations are reported in the top rows whilst the analysis on time overruns is reported in the bottom rows. As the analysis shows, for causations of cost overrun, there are strong correlations between design and documentation issues and, the effectiveness of stakeholders' approaches to managing project finance, discrepancies in the different project management and contract administration approaches used by the different project stakeholders involved in a project, and contractors' site management styles. There is also a strong correlation between design documentation issues and contractors' efficiency in managing material and plant resources.

Furthermore, analysis suggests strong correlations between the effectiveness of stakeholders' approaches to managing project finance and contractors' efficiencies in managing project resources. The factor also correlates strongly with contract administration approaches used by the different project stakeholders, contractors' site management styles and contractors' deployment of innovative ICT tools. To influence cost variability, contractors' site management style also correlates strongly with ICT innovations, resource efficiency and external factors. Resource efficiency correlates with external factors, whilst external factors correlate only with resource efficiency and contractors' site management styles.

The correlation analysis on schedule overrun shows a different pattern to that of cost overruns. Analysis shows design and documentation issues correlate strongly with the effectiveness of stakeholders' approaches to managing project finance, and discrepancies in the different project management and contract administration approaches used by the different project stakeholders. Moreover, there is significant correlation between discrepancies in the different project management and contract administration approaches used by the different project stakeholders, and resource efficiency; but a negative correlation with external factors. Contractors' site management styles and ICT show no significant correlation with other variables.

Regression models

The observed relationships were further analysed, seeking a linear model that can predict cost overruns through the elicited factors. First, a regression analysis shows that project outturn cost is predictable by initial contract sum and the advance payment:

$$OC_{\text{Actual}} = 5,099,304.421 + 1.065x_1 + 127,701x_2 + 1,565,627.451x_3 \quad (1)$$

where OC_{Actual} is the actual outturn cost, x_1 the initial contract sum, x_2 the advance payment issued, and x_3 the estimated contract duration at contract commencement.

Table III.
Correlation analysis
on causes of time and
cost overruns

	Design and documentation issues	Effectiveness of financial management approaches	Project management and contract administration approaches	Contractor's site management style	Information and communication technology tools	Efficiency of materials and machinery resources	Efficiency in human resource management
Effectiveness of financial management approaches	0.517**						
Project management and contract administration approaches	0.330**	0.622***					
Contractor's site management style	0.401**	0.117	0.485**				
	0.329**	0.524**	0.141				
	0.408**	0.178	0.451**	0.462**			
	0.095	0.406**	0.082	0.064			
Information and communication technology tools	-0.154	0.009	0.400**	0.493**	0.754**		
Efficiency of materials and plant resources	0.294**	0.474**	0.363**	0.105	0.096		
Efficiency in human resource management	0.124	0.014	0.411**	0.632**	0.858**	0.173	
	0.237	0.401**	0.396**	0.077	0.243	0.803**	
External factors	0.065	0.077	0.225	0.488**	0.088	0.358**	0.309*
	0.025	0.089	-0.295*	-0.221	-0.075	0.172	0.011
	-0.100	-0.174					

Notes: ***Correlation is significant at the 0.05 and 0.01 levels, respectively (two-tailed)

With R value of 0.993, R^2 value of 0.986 and an adjusted R^2 value of 0.985, the strength of linear association between the dependent variable (actual outturn cost) and the independent variables (the estimated cost at contract commencement and Advance Payment) is statistically significant at 99.3 per cent. The model is also more than 98 per cent complete in terms of explanatory power and its fitness for purpose.

Similarly, attempts were also made to develop a model that could predict schedule variability on the bases of initial contract durations, cost variability and advance payments. Outcomes were not as statistically significant as Equation (1): R , R^2 and adjusted R^2 values were 0.548, 0.300, 0.239, respectively:

$$\text{SchVa} = 627.163 + 0.000003127x_1 + 0.904x_2 - 2.085x_3 - 14.320x_4 \quad (2)$$

where SchVa is schedule variability, x_1 the cost estimate at contract commencement, x_2 cost variability, x_3 advance payment and x_4 the schedule projection at contract commencement.

Discussion

The findings elicited above are vitally critical. First, the study did not find significant relationships between cost performance and advance payments. Projects that were completed within budget could have had the same outcome if the contractors were not paid a part of the contract monies in advance. Those that had overruns could not have influenced the overruns significantly irrespective of the percentage of the advance payment to the original contract price. This finding is consistent with previous studies on cost performance. According to Baloi and Price (2003) and Aje *et al.* (2009), achieving success in project cost performance depends on contractor's ability to manage own finance, rather than transferring the same to project owners. Another finding of this current study further confirms this. Whilst exploring causes of overruns and their logical correlations with advance payments, participants indicated the significance of combined effectiveness of stakeholders' approaches to managing project finance. Understandably, different stakeholders are confronted with a wide range of distractions at different stages of a contract. However, each party's approach to project finance must add value to the cost performance of the project. This must happen independently but the collective outcome must be significant. For example, when contractors have obtained clients' unwavering assurances regarding finance, contractors' discretions are best if they are able to manage routine risks and variability of own cost. These can only be mutually complementary; advance payment neither prevents the ability of cost elements to vary nor secures availability of fund to owners.

The straightforward interpretation of the findings above cannot be trivialised. As the culture of advance payment is a popular incentive in developing countries, it is crucial that empirical evidence is used to situate clients' expectations regarding advance payments in actual project outcomes. No significant statistical relationship between overrun and advance payment is found in this study; rather projects are more likely to perform to expectations when contractors and project control stakeholders improve their processes. Moreover, contrary to the work of Odeck (2004), this study found cost overruns were smaller in small projects than in medium size and large projects. Using transport projects, Odeck (2004) concluded that it is illogical to distinguish overruns in small and large projects because both are impacted by the same causations. Instead, evidence put forward in this current study is that overruns depends on project size, and that advance payments should recognise this. In particular, as frequency and significance of cost overruns diminish with project size, it is worth exploring whether all project sizes actually do require the same percentage in advance payments. Furthermore, as analysis shows smaller projects had experienced schedule overruns more frequently and more severely than large projects, it is surprising that this seldom impact outturn costs. Thus, rather than predicting project's outturn costs on the basis

of project duration, the implication of this finding is that, if measurable, the degree of project complexity could be considered as a factor for predicting cost variability (Baccarini, 1996; Cicmil *et al.*, 2009).

Conclusion

Overruns are rife in construction. This study explored their causations based on data from situations where advance payments have occurred in varying percentages of contract prices. Although evidence from the study shows the desire to avoid delay is a key incentive for advance payment, this is no significant evidence in the study to conclude advance payment impacts overruns. Rather, cost overruns are caused most significantly by design and documentation issues, and how project stakeholders manage their finances (e.g. rework and improper planning by contractors, and client's cashflow issues). Contrary to findings from extant studies, overruns in the observed projects were not triggered significantly by factors outside the project environment (e.g. macro-economic variabilities such as inflation, robustness of economic activities within the construction industry and political issues). Rather, most delays were caused by contractors' own management imprudence. Timely completion is best facilitated when contractors manage their human, plant and material resources appropriately. Thus, instead of seeking to control external factors with advance payments, projects are likely to benefit when contractors are incentivized and supported for their management prudence. Further research will assist in this by focussing on issues that help contractors grow through zero vision, i.e. learning through incremental process improvement models which are developed from objective observation that are specific to contractors' own business environments.

Note

1. All conversions were made at March 2015 price – @US\$1 = 200 naira.

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