COMPARATIVE ANALYSIS OF OFFSHORE AND INSHORE SOFTWARE DEVELOPMENT COST

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Abstract
Over the years, many organizations in Nigeria engage in various types of software outsourcing with the goal of competitive relevance in the global enterprise by maintaining balance between profitability and security risk mitigation management via value added services and sustainable cost savings. This paper performed a comparative analysis of inshore and offshore cost profiles as well as risk factors that affect software value. The parameters being considered as cost components are Development Cost, transportation and installation cost, transaction cost, and Cost of ownership. The result shows development cost and cost of ownership have most impact on Inshore Cost while development cost and transport cost have the most impact on Offshore Cost of software outsourcing. Therefore, to ensure sustainability of financial benefits of software outsourcing, companies in Nigeria must decide ahead of time the developmental aspect of the software to be kept in-house and those to be outsourced domestically or internationally.

Keywords: Software, offshoring, cost saving, inshore, sustainability, value creation

Introduction
The current rapid increase in offshore IT software development outsourcing has sparked a debate on the costs and benefits of this trend on the IT industry in Nigeria and its economy. The debate is to ascertain whether increased use of offshoring as a value management strategy by firms globally has actually led to sustainable financial benefits (cost savings and profitability) without value compromise (Andersson & Pedersen, 2010). In reality, the success of offshoring can only be determined by close review of pre and post business case with focus on cost savings and value creation as critical success factors (Ebiringa and Lasis, 2014).

Although “lower cost” is the most commonly cited reason in the choice of offshore software development outsourcing vendor destination (Siffat and Rashid 2010), intense global competition in an environment of slower growth and low inflation demands constant vigilance over costs (direct or indirect).

Beyond the cost incentive, global software development outsourcing provides several other practical benefits including:
- ability of multinational organizations to efficiently stage 24x7 operations;
- opportunity to customize products and services to meet local needs; and
- means of geographically deploying workers and facilities to succeed in globally dispersed, highly competitive markets (Global Insight, 2004).
- Redistribution of business and commercial risk;
- Improvement of service delivery and control; and
- Transformation, modernization and innovation of businesses (Bertrand 2011).

Factors of IT software development outsourcing (offshore and inshore) and their impact have been at the forefront of several research works in the developed world (Siffat et al (2010; Awolusi, 2012; Oza, 2006; Minevich and Richter, 2005; Huang and Trauth, 2007; Khong, 2005; Chang and Gurbaxani 2012; Susarla et al, 2010; Novak and Stern, 2008; Nguyen et al, 2006; Iacovou and
Also, several case studies document cost savings associated with IT outsourcing (e.g., Lacity and Willcocks 2000; Levina and Ross 2003), these studies focus only on the costs directly related to IT (e.g., systems development costs) with little or no emphasis on software development outsourcing.

Nevertheless, there is very much limited published works that investigate the cost components of software development outsourcing in developing countries like Nigeria and other parts of the world. To date there has been very few such studies (Benoit et al. 2004; Jamie et al 2012; Sardar and Lee 2013; Mithun, 2015). A remarkable exception to this is Gartner, (2015) that considered the driving inputs to application development outsourcing cost model.

Despite the enormous benefits software development outsourcing offers, little effort has been made to critically examine in close detail the cost components of this synergistic enterprise practice to ascertain its economic and viability impact on organization and the development of IT industry in Nigeria by maintaining balance between profitability and security risk mitigation management via value added services and sustainable cost savings through cost reduction mechanisms.

This paper is therefore geared towards assessing comparatively the extent these cost components have contributed to inshore and offshore application software development cost for cost reduction decision making of IT services in Nigeria. The paper derived its software outsourcing costs components from Gartner (2015), Jamie et al (2012), and Sardar and Lee (2013).

Organizations engage in software development outsourcing in order to achieve specific objective, which includes costs reductions/savings (Levina and Ross, 2003; Al-Mashari and Zairi, 1999; Barthelemy, 2003; Feeny et al., 2005; Graf & Mudambi, 2005; Grimpe & Kaiser, 2010), product quality improvement and rebranding (Hatonen, 2009; Hagel and Brown, 2005; Bhatnagar & Madon, 1997), flexibility in operation (Hui et al., 2008; Sardar & Lee, 2013), expanding market coverage (Jensen, 2009; Crnkovic, 2001), or capacity expansion (Jensen & Pedersen, 2012; Siffat et al, 2010). Kedia and Lahiri (2007) insist that most firms set cost reduction targets as specific objective of offshoring, with actual savings coming from direct labor and variable costs. But the extent each of these cost components determines the total cost software development in the process of implementing inshoring and offshoring strategy remains a research issue. There is relatively little empirical inquiry into the cost components associated with software outsourcing especially in the Nigerian IT industry.

In addressing the specific objectives of the paper, answers were provided to the following research questions:

- What are the cost components contributing to total cost of software development outsourcing in relation to value added services?
- To what extent do all these cost components collectively affect total cost of software development outsourcing?
- To what extent does each of these cost components influence total cost of software development outsourcing in relation to transaction cost of organization?
- How can these cost components be ranked in relation to their influence on total cost of software development outsourcing?

**Theoretical review**

**Cost theories**

This study is limited to two of the theories most often referred to in relation to outsourcing namely: Transaction Costs Theory and Resource-based view (Penrose, 1959; Richardson, 1972; Williamson, 1985). These theories predict that under the right conditions, outsourcing reduces operating cost (Lampel & Bhalla, 2011).

**Transaction cost theory of software development outsourcing**

Transaction cost economics holds an assumption that Business Process Re-engineering (BPR) is implemented in order to lower the transaction costs. Transaction Cost Analysis (TCA) is another widely used IO based theoretical perspective in
supply chain management (Busi and McIvor, 2008). The approach seeks to identify the environmental factors that together with a set of related human factors explain how companies can organize transactions to reduce the costs associated with these transactions.

The main research question that transaction cost theory (TCT) seeks to address is why economic transactions are organized in the way that they are in the modern society (Williamson, 1994). Specifically, why are some economic transactions internalized within the boundaries of firms while others are procured to external parties?

TCT claims that these transaction costs driving economic organization are as important as production costs, or perhaps even more important. While production costs are easier to assess than transaction costs, transaction costs are an important part of the total costs of a firm. Transactions costs comprise the ex-ante costs of (1) searching and information, (2) drafting and negotiating an agreement, and (3) costs of safeguarding the agreement. The ex-post costs entail the costs of (1) evaluating the input, (2) measuring the output, and (3) monitoring and enforcement (Williamson, 1985).

Assumptions of Transaction Cost Theory on Software Outsourcing rest upon several key assumptions about human behavior and environmental characteristics (Williamson, 1979; Williamson & Ouchi, 1981; Williamson, 1985). These assumptions elucidate why firms may face superior costs for market-based transactions and why firms may be relatively more efficient than markets at organizing transactions. The firm will select the governance form, from the various alternatives amongst the organizational menu, that minimizes transaction and production costs.

There are two (2) assumptions on which transaction cost theory operates upon namely:

(a) Assumptions about human and human behavior

(b) Assumptions about environmental characteristics

While the first assumption is based on opportunism, with guile and bounded rationality, the latter is centered on asset specificity and uncertainty.

Software applications vary in complexity, skills required and area of application. No matter how unique a firm’s business operations are, it still needs certain standard information systems, e.g. financial accounting or inventory control, which may be outsourced. Outsourced software applications thus might not necessarily reflect a firm’s overall firm-specific information requirements. As the unit of analysis here is application software projects, it is appropriate to assess asset specificity at the project level rather than at the firm level. Asset specificity then is defined by the uniqueness of skills, functions and business knowledge required for completing the particular outsourcing projects.

Like asset specificity, a firm’s overall level of uncertainty experienced in business, technology and information requirements does not necessarily translate into a particular project being outsourced. Consequently, uncertainty is defined as the inherent characteristics of specific software outsourced in terms of the difficulties of prescribing specifications, scheduling delivery dates and estimating costs at the contracting stage.

**Resource-based theory of software development outsourcing**

The main idea of resource-based theory is geared towards enhancing the core competence of the company in order to develop sustainable competitive advantage, which outsourcing is positioned to achieve. This theory suggests that valuable firm resources, comprising tangible and intangible elements are usually scarce, imperfectly imitable, and lacking in direct substitutes; It is about producing the most value from one's existing capabilities and resources by combining these with others’ sources of advantage and, in this, ensuring complementarity is paramount (Richardson, 1972; Williamson, 1985).

**Cost models**

In software development outsourcing, cost is viewed from both the software development and project management perspective. Both outsourcing vendors and clients deploy various models in determining the cost of any software to be outsourced. One of the most popular models vendors consider prior to engaging in software development outsourcing is Software Outsourcing

Choosing a cost model depends on several factors both from the client perspective, the nature of work/project involved, risks to be shared and as well the capabilities/competencies of the outsourcing company. Some of the popular software outsourcing cost models include: Gain-Sharing Pricing Model, Incentive-Based Pricing Model, Consumption-Based Pricing Model, Shared Risk-Reward Pricing Model, Fixed Price Model, Revenue Sharing Model, etc. Each of these cost models has its pros and cons and applicability.

Jamie et al (2012), in their work on distributed and outsourced software engineering identified the driving inputs to Application Development Outsourcing Cost Model as illustrated in figure 1 below. The Application development sourcing cost model developed by Gartner in figure 1 views outsourcing cost from project management perspective. The model reveals that software outsourcing cost include; project sourcing cost factors and project sourcing cost adjustment factors, which are further broken down into sub-categories.

![Figure 1: Application Development Outsourcing Cost Model](Source: Gartner (2012))

However, according to Sardar and Lee (2013), outsourcing costs include; (a) Transportation and Material handling cost, and (b) Transaction and Training cost, and other hidden costs such as capital cost, labour cost, inventory holding cost, and maintenance cost.

They established that while transaction, training, material handling, and transportation cost increases with inshore outsourcing, capital cost, labour cost, inventory cost and maintenance cost decreases with inshore outsourcing. This implies that development/production cost is slightly higher for domestic outsourcing, but it
minimizes the risks associated with demand uncertainty, late and unreliable deliveries, capital commitment, upgrading and maintaining machinery, corporate social responsibility, and loss of customer. At the same time domestic outsourcing (inshore) have higher risks like threat of future competition, poor strategic resource development, and loss of control.

Therefore, combining the works of Jamie et al (2012) and Sardar (2013), with other software cost estimation models from previous works, the cost of outsourcing an application software development is the summation of:

- Development/production cost,
- Transportation/installation cost,
- Total cost of ownership (in the case of open-source software), and
- Transaction and training cost.

Development cost of any software to be outsourced has three (3) critical project dimensions namely: quality, project costs and schedule performance (Brooks 1995; Boehm 1981; Dey, Fan and Zhang, 2010). The cost of software development is also dependent on so many variables such as category, complexity/scope, size, number of developers/resources, timeline/schedule, etc. (Aggarwal, 2010).

Focusing on model-based Cost Constructive Model (COCOMO) and composite (COCOMO II) Software Development, the development/production cost of any software to be outsourced is expressed in equation 1.0 shown below:

\[ C = E + cm + Hm ... Equation 1.0 \]

where

- \( C \) = unit product cost
- \( E \) = effort (in person-month) = \( a \times EAF \times (KSLOC)^b \) as stated in Boehm (1981) theory
- \( cm \) = capital and maintenance cost
- \( Hm \) = inventory holding and other minor costs

We calculate total production/development cost by using equation 1.0

\[ C_f = D \times C ... Equation 1.1 \]

where

\( D \) = demand or capacity requirement (quantity of software to be produced)
\( C_f \) = total production cost for a future customer/client order.

Transaction costs of any software to be outsourced include costs associated with frequency of transactions, searching or switching, information collection, negotiation, contract enforcement, administration, monitoring, governance, and Opportunism (Sardar and Lee, 2013). According to Benoît et al (2003), the factors determining the importance of transaction costs are grouped into three broad categories: (1) the specificity of the assets required for performing the transaction, (2) the uncertainty surrounding the transaction, and (3) the origin of the critical investments associated with the transaction and their alignment with the allocation of residual rights.

For instance, transaction cost takes care of the outsourcing vendor’s accommodation allowance, feeding, security allowance and other minor costs incurred within the period of client’s staff training, installation and implementation of the developed software. Transaction cost for business process outsourcing (BPO) should range from 5 percent to 10 percent of the total contract value (Ashley, 2008).

Jongerius and Sie (2010), in their work created a framework of approximately 240 transaction costs that could theoretically be involved in the outsourcing process. The broad categorization of these transaction costs is a distinction between the analysis phase, the engagement phase, and the process phase.

A further breakdown of these stages reveals the constituent activities that are quantified in monetary terms which consequently reflect on transaction cost of any outsourcing process, Jongerius & Sie (2010). These costs are very small fraction of total investment, and cannot be measured directly. For analysis purpose, let \( Z_f \) represent transaction and training cost for a future customer order.

Transportation cost of any software to be outsourced entails the transit cost of vendor or its representative from point of software production to the client’s destination for the sole purpose of installing, configuring and smooth running of the developed
software across different platforms and terminals managed by the client organization.

Though transportation and installation cost are usually included in transaction cost, this practice however often generate disparity between outsourcing clients and vendors. While transaction cost takes care of the outsourcing vendor’s accommodation allowance, feeding, security allowance and other minor costs, transportation cost takes care of the air ticket (to and fro), visa arrangement (in the case of offshoring), and local transportation arrangement from hotel to client’s organization within the stipulated period of software installation, staff training and implementation phase (Sardar and Lee, 2013).

For analysis purpose, Let $T_{mf}$ represent transportation and installation handling cost for a future customer/client order. Thus, Transportation and Installation handling cost for software outsourcing is estimated as;

$$T_{mf} = a_t + v_c + l_c \ldots \text{Equation 1.2}$$

where:

- $a_t$ = represent air ticket;
- $v_c$ = represent visa arrangement cost; and
- $l_c$ = represent local transport arrangement cost.

Total cost of ownership (TCO) includes the initial costs to implement a project together with the continuing costs to maintain, modify, train staff, house, deploy, and provide infrastructure or any other cost associated with the project, including final decommissioning. TCO is an estimate which includes all direct and indirect costs over the useful life of the application which is commonly used in Full Cost Accounting systems. This Total Cost Analysis is also known as Life Cycle Cost Analysis.

In the case of Software Application, TCO is the usual conceptual model used in determining the cost of open-source/prepackaged software. TCO reflects a measure of all the costs of identifying and acquiring software, installing it and operating it, and finally the exit costs found in migrating away from the software. TCO reflects not just the balance of the direct qualities of competing software products (price, functionality, reliability etc.) but also the relationship of the software to the organization’s broader set of technology platforms, installed systems, culture and skills base, and strategic goals, as well as the ability to access market and community based services and support (Shaikh and Cornford, 2011). Based on research, most organizations do not use TCO as a decision making tool because there is no definitive formular used in determining total cost of ownership in relation to calculating the return on investment. Nonetheless, when people with experience apply their judgment to authenticate TCO, cost advantages–cost saving and cost avoidance have been achieved, and case studies support this contention.

TCO is less focused on what software costs per se to purchase or over its lifetime. TCO considers majorly questions of how software fits into the organization and relates to the other resources including legacy systems, technology platforms and infrastructures, skill sets and management style, as well as business strategy. According to (Shaikh and Cornford, 2011), TCO essentially addresses three domains from which costs are derived. First is the characteristics of the software itself, the second the resources of the organization, and third the environment (software ecosystem) they work within.

However, the value of the TCO model is that it allows some disaggregation of cost components. In doing so it allows consideration of a number of dimensions that influence choice and to some degree explicit cost. For the purpose of analysis, let Total Cost of Ownership by presented by $TCo_f$.

Therefore, in the search for cost-efficiency of software development outsourcing, all the cost variables form the various models were integrated to develop the general research model of this study. Hence; the following conceptual framework is developed to serve as a roadmap to analyze the entire study.

**Research cost model**

Figure 2 is the research cost model. In this research cost model, the cost of outsourcing an application software development can be viewed as the summation of development/production cost, transportation/installation cost, transaction and training cost, and total cost of ownership. This is expressed as the total investment (total cost $A_f$ spent or paid) for a future outsourcing customer/client order given by the equation 2.12:
Equation 1.3

\[ A_f = C_f + Tm_f + Z_f + TCo_f \]

where:

- \( A_f \): Outsourcing cost
- \( C_f \): Development/production cost
- \( Tm_f \): Transportation and installation handling cost for a future customer/client order
- \( Z_f \): Transaction and training cost for a future customer/client order
- \( TCo_f \): Total cost of ownership

This research cost model is unique in that it is comprehensive by integrating the most powerful theories and models that previous studies did not. Moreover, this research cost model consists of most of the factors (cost components) that influence cost of software outsourcing, and has constructs that are related to social, behavioral and technological issues derived from different theories and models previously developed in relation to the acceptance of a new technology. Hence, this study is different from previous studies in that it combines constructs from theories and models while previous studies focused only on the constructs from one model. Several related studies emphasis on one side of factors and ignore others.

Equation 3 reveals on the surface the various cost components that give rise to total cost of software development outsourcing. Hence, the need to ascertain empirically which among these costs has the most impact on total cost of outsourcing domestically or offshoring. These are reflected in the following research hypotheses which emerged from the research cost model.

**Research hypotheses**

The formulated hypotheses are as follows:

- **H\textsubscript{01}:** There is no significant effect of the collective cost components on total cost of software development outsourcing.
- **H\textsubscript{02}:** There is no significant effect of each cost component on total cost of software development outsourcing.
- **H\textsubscript{03}:** There is no significant difference between the cost components on total cost of software development outsourcing.

The research cost costs model was developed based on Application development sourcing cost model developed by Gartner (ADSCM), Software Outsourcing Vendors’ Readiness Model (SOVRM) and previous empirical studies carried out in relation to perceived risk, value added and cost savings. Based on the conceptual framework of the study, the following research outsourcing cost model is developed. Hence, parameters for the following functional...
relationships were estimated using the cost outsourcing model of this study.

**Research methodology**

The research instrument used in the study was survey questionnaire. The location of the study was Owerri, Imo state. The study population comprised the Software development clients and vendors across six (6) major sectors namely Banking, Educational, Oil & Gas, Medical services, Manufacturing and IT services in Lagos, Port-harcourt, Owerri, Abuja who engages in software outsourcing (either inshore or offshore). These clients came from different backgrounds and were of different ages with other individual differences. A moderately representative sample was obtained by employing the use of a stratified sampling technique. A pilot survey of 40 questionnaires were randomly administered to software development outsourcing experts, collated and analyzed to ascertain the authenticity of the data before embarking on the main distribution of 400 questionnaires (192 for inshore and 151 for offshore).

The data collected on the cost components were subjected to multiple regression analysis as a widely used statistical technique in many of the studies in the software development outsourcing (Siffat et al, 2011; and Jongerius and Sie 2010). All the data were coded and entered in to SPSS version 15.0 and inferences were made based on the statistical results.

\[ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon_1 \]

where:

- \( Y \) = Outsourcing Cost
- \( X_1 \) = development/production cost
- \( X_2 \) = transportation and installation handling cost
- \( X_3 \) = transaction and training cost
- \( X_4 \) = Cost of ownership/patent ship
- \( \beta_0 \) = the intercept value of the regression surface.
- \( \varepsilon_1 \) = independent and normally distributed random error term with mean zero.

**Results and discussions**

This section presents the analysis, discussion and inferences made on the basis of the responses obtained.

### Table 1: Correlations between Predictors and the Dependent Variable (Inshore Software)

<table>
<thead>
<tr>
<th></th>
<th>( Y )</th>
<th>( X_1 )</th>
<th>( X_2 )</th>
<th>( X_3 )</th>
<th>( X_4 )</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Pearson Correlation</em></td>
<td>1.000</td>
<td>.473</td>
<td>.376</td>
<td>.378</td>
<td>.503</td>
</tr>
<tr>
<td>Correlation X1</td>
<td>.473</td>
<td>1.000</td>
<td>.391</td>
<td>.304</td>
<td>.443</td>
</tr>
<tr>
<td>X2</td>
<td>.376</td>
<td>.391</td>
<td>1.000</td>
<td>.287</td>
<td>.446</td>
</tr>
<tr>
<td>X3</td>
<td>.378</td>
<td>.304</td>
<td>.287</td>
<td>1.000</td>
<td>.498</td>
</tr>
<tr>
<td>X4</td>
<td>.503</td>
<td>.443</td>
<td>.446</td>
<td>.498</td>
<td>1.000</td>
</tr>
</tbody>
</table>

*a. Predictors: Development Cost \( (X_1) \), Transaction Cost \( (X_2) \), Transport Cost \( (X_3) \), Cost of Ownership \( (X_4) \).*

*b. Dependent variable: Cost of Inshore Software Development Outsourcing.*

*Source: SPSS Version 15.0*

### Table 2: Correlations between Predictors and the Dependent Variable (Offshore Software)

<table>
<thead>
<tr>
<th></th>
<th>( Y )</th>
<th>( X_1 )</th>
<th>( X_2 )</th>
<th>( X_3 )</th>
<th>( X_4 )</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Pearson Correlation</em></td>
<td>1.000</td>
<td>.567</td>
<td>.443</td>
<td>.553</td>
<td>.452</td>
</tr>
<tr>
<td>Correlation X1</td>
<td>.567</td>
<td>1.000</td>
<td>.374</td>
<td>.364</td>
<td>.219</td>
</tr>
<tr>
<td>X2</td>
<td>.443</td>
<td>.374</td>
<td>1.000</td>
<td>.284</td>
<td>.255</td>
</tr>
<tr>
<td>X3</td>
<td>.553</td>
<td>.364</td>
<td>.284</td>
<td>1.000</td>
<td>.393</td>
</tr>
<tr>
<td>X4</td>
<td>.452</td>
<td>.219</td>
<td>.255</td>
<td>.393</td>
<td>1.000</td>
</tr>
</tbody>
</table>

*c. Predictors: Development Cost \( (X_1) \), Transaction Cost \( (X_2) \), Transport Cost \( (X_3) \), Cost of Ownership \( (X_4) \).*

*d. Dependent variable: Cost of Offshore Software Development Outsourcing.*

Table 1 shows the correlation coefficients between the inshore independent constructs, which shows a normal correlation (less than 0.90) between the independent variables and this does not affect the results of multiple regression that is adopted in this study (see. Kennedy, 1985), that is, there is a higher correlation problem between the independent variables (multicollinearity) when the correlation coefficient is greater than 0.9.
Therefore, from the Table 1 the problem of higher correlation is not found between the two inshore independent variables of the study variables. The largest correlation coefficient between two independent variables of the study was found between Cost of ownership and Transportation Cost with a total power of link equal to 0.498.

Also, Table 2 shows the correlation coefficients between offshore independent constructs, which shows a normal correlation (less than 0.90) between the independent variables. Therefore, from the table above the problem of higher correlation is not found between the two independent variables of the study variables. The largest correlation coefficient between two offshore independent variables of the study was found between Cost of ownership and Transportation Cost with a total power of link equal to 0.393.

In this study, multiple regression analysis was carried out to get the predictive value of the constructs considered. Since the model is developed in such a way that each construct is being affected by other constructs, it is necessary to carry out a separate regression analysis against the variables considered to be affected by other variables. This was basically made to determine the linear combination of the constructs. Tables 3, 4 and 5 present the results from the multiple regressions carried out using the four constructs: development cost, transaction cost, transportation cost, and cost of ownership as the independent variables and cost of outsourcing software development as the dependent variable. This was done to determine the best linear combination of the constructs for predicting total cost of outsourcing software development.

Table 3a: Model Summary for Inshore Software Development

<table>
<thead>
<tr>
<th>Mode</th>
<th>R</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.595(a)</td>
<td>.355</td>
<td>.341</td>
</tr>
</tbody>
</table>

Predictors: Development Cost ($X_1$), Transaction Cost ($X_2$), Transport Cost ($X_3$), Cost of Ownership ($X_4$).
Dependent variable: Cost of Inshore Software

Table 4a: Multiple Regression Analysis on all the independent variables on Inshore Software Outsourcing

ANOVA for the Constructs

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>442.958</td>
<td>110.73</td>
<td>25.67</td>
<td>.000(a)</td>
</tr>
<tr>
<td>Regression</td>
<td>806.495</td>
<td>9</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Residual</td>
<td>1249.45</td>
<td>3</td>
<td>191</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>3</td>
<td>191</td>
<td></td>
</tr>
</tbody>
</table>

Predictors: Development Cost ($X_1$), Transaction Cost ($X_2$), Transport Cost ($X_3$), Cost of Ownership ($X_4$), Dependent variable: Cost of Inshore Software Development Outsourcing.
Table 5a: Relative contribution of the Independent Variables (Inshore Software Outsourcing)

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standard Coeff.</th>
<th>Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
</tr>
<tr>
<td>1(Constant)</td>
<td>4.817</td>
<td>0.943</td>
<td>0.270</td>
</tr>
<tr>
<td>Development cost</td>
<td>0.287</td>
<td>0.072</td>
<td>0.270</td>
</tr>
<tr>
<td>Transaction cost</td>
<td>0.114</td>
<td>0.068</td>
<td>0.113</td>
</tr>
<tr>
<td>Transport cost</td>
<td>0.155</td>
<td>0.081</td>
<td>0.130</td>
</tr>
<tr>
<td>Cost of ownership</td>
<td>0.269</td>
<td>0.076</td>
<td>0.269</td>
</tr>
</tbody>
</table>

Source: SPSS 15.00 Version output

From Table 3a, it can be seen that 35.5% of the variance in the model can be predicted using the independent variables (for cost of inshore software). Table 4a presents the ANOVA report on the general significance of the model. As p is less than 0.05, the model is significant. Thus, the combination of the variables significantly predicts the dependent variable (F=25.677; p < 0.05). Table 5a showed the standardized Beta Coefficients that present the contributions of each variable to the model. The t and p values showed the impact of the independent variables on the dependent variable. From Table 5a, it is clear that the construct development cost had the highest influence on cost of inshore software (the dependent variable). The large t value (t=3.977) and corresponding low p value (p< 0.01) supports the result for development cost which had the highest beta coefficient. On the other hand, transaction cost had the least significant impact on total cost of inshore software development in Nigeria. These results imply that increasing the development cost and cost of ownership will inherently influence total cost of inshore software development outsourcing in Nigeria. The resulting multiple regression equation is as below:

$$Y_{\text{inshore}} = 4.817 + 0.287X_1 + 0.269X_4 + 0.155X_3 + 0.114X_2$$

The equation can thus be readily used to predict the cost components contributing to the total cost of inshore software development outsourcing in Nigeria.

Table 3b: Model Summary for Offshore Software Development

<table>
<thead>
<tr>
<th>Mode</th>
<th>R</th>
<th>Adjusted R Square</th>
<th>Std. Error of Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.731(a)</td>
<td>.534</td>
<td>.521</td>
</tr>
</tbody>
</table>

Predictors: Development Cost (X_1), Transaction Cost (X_2), Transport Cost (X_3), Cost of Ownership (X_4).

Dependent variable: Cost of Offshore Software
Table 4b: Multiple Regression Analysis on all the independent variables on Offshore Software Outsourcing

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Regression)</td>
<td>442.958</td>
<td>4</td>
<td>110.73</td>
<td>9</td>
<td>25.67</td>
</tr>
<tr>
<td>Residual</td>
<td>806.495</td>
<td>187</td>
<td>4.313</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1249.45</td>
<td>191</td>
<td>191</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Predictors: Development Cost (X₁), Transaction Cost (X₂), Transport Cost (X₃), Cost of Ownership (X₄), Dependent variable: Cost of Offshore Software Development Outsourcing.

Table 5b: Relative contribution of the Independent Variables (Offshore Software Outsourcing)

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standard Coeff.</th>
<th>95% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
</tr>
<tr>
<td>(Constant)</td>
<td>2.029</td>
<td>1.025</td>
<td>1.979</td>
</tr>
<tr>
<td>Development cost</td>
<td>0.384</td>
<td>0.070</td>
<td>0.348</td>
</tr>
<tr>
<td>Transaction cost</td>
<td>0.183</td>
<td>0.066</td>
<td>0.174</td>
</tr>
<tr>
<td>Transport cost</td>
<td>0.334</td>
<td>0.074</td>
<td>0.292</td>
</tr>
<tr>
<td>Cost of ownership</td>
<td>0.263</td>
<td>0.076</td>
<td>0.217</td>
</tr>
</tbody>
</table>

Source: SPSS 15.00 Version output

Table 3b shows that the independent variables combined were in relationship with the dependent variable of 0.731 which is a strong positive relationship, in addition to the contribution of all independent variables to the dependent variable with R-square of 0.534. This indicates that the independent factors combined to explain the rate 53.4% of the change in the behavior of the dependent variable, which considered a high percentage, while the statistical independent constructs amounted to the impact of these variables combined on the dependent variable through the adjusted R-square 0.521.

Table 4b presents the ANOVA report on the general model for Offshore Software development outsourcing cost. As Probability value (P) is less than 0.05, the model is significant. Thus, the combination of the variables significantly predicts the dependent variable (F=41.864; P=0.000<0.05). The table shows that the collective influence of some aspects of offshore software outsourcing cost variables (development cost, transaction cost, transport, and cost of ownership) have significant influence on total cost of offshore software development outsourcing in Nigeria. It indicates that the specified model and data are well fit in explaining the effect of offshore software development cost variables on total cost of offshore software development outsourcing in Nigeria.

From Table 5b, it is clear that the construct development cost had the highest influence on cost of offshore software (the dependent variable). The large t value (t=5.469) and corresponding low p value (p< 0.01) supports the result for development cost which had the highest beta coefficient. On the other hand transaction cost had the least significant impact on total cost of offshore software development in Nigeria. These results imply that increasing the development cost and transport cost will inherently influence total cost of offshore software development...
in Nigeria. The resulting multiple regression equation is as below:

\[
Y_{\text{offshore}} = 2.029 + 0.384X_1 + 0.334X_3 + 0.263X_4 + 0.183X_2
\]

Theequationcan thus be readily used to predict the cost components contributing to the total cost of offshore software development outsourcing in Nigeria.

Summary of hypotheses testing

In this study, Linear Regression was used to test the research hypotheses. The table below shows the summarized results of the hypotheses tested.

Table 6: Summary of hypotheses tested

<table>
<thead>
<tr>
<th>Software outsourcing type</th>
<th>Inshore</th>
<th>Offshore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost Component</td>
<td>$R^2$</td>
<td>$\beta$</td>
</tr>
<tr>
<td>Development cost</td>
<td>0.503*</td>
<td></td>
</tr>
<tr>
<td>Transaction cost</td>
<td>0.378*</td>
<td>53.4%</td>
</tr>
<tr>
<td>Transport cost</td>
<td>35.5%</td>
<td>0.450*</td>
</tr>
<tr>
<td>Cost of ownership</td>
<td>0.504*</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

Table 6 above depicts the result of the regression analysis of each model. For inshore software development, the result show that individually development cost ($\beta = 0.503, P<0.01$), transaction cost ($\beta = 0.378, P<0.01$), transport cost ($\beta = 0.450, P<0.01$), and cost of ownership ($\beta = 0.504, P<0.01$). These variables together explains the 35.5% variance in the total cost of inshore software development in Nigeria.

Also, for offshore software development, development cost ($\beta = 0.625, P<0.01$), transaction cost ($\beta = 0.464, P<0.01$), transport cost ($\beta = 0.633, P<0.01$), and cost of ownership ($\beta = 0.549, P<0.01$) and these variables put together gives rise to the 54.5% variance in the total cost of offshore software development. Based on the results above, collectively the cost components has significant effect on the total cost of outsourcing. Hence, hypothesis 1 is not supported. Also, each of the cost components has a significant effect on total cost of outsourcing. Hence, hypothesis 2 is not accepted.

Table 7 Pearson Correlation of Sample Data of Inshore Software Outsourcing Cost

<table>
<thead>
<tr>
<th>Y</th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>X4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.47</td>
<td>.37</td>
<td>.37</td>
<td>.50</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 8 Pearson Correlation of Sample Data of Offshore Software Outsourcing Cost

<table>
<thead>
<tr>
<th>Y</th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>X4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.56</td>
<td>.44</td>
<td>.55</td>
<td>.45</td>
</tr>
<tr>
<td>0</td>
<td>7</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X</th>
<th>1.0</th>
<th>.39</th>
<th>.30</th>
<th>.44</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>X</td>
<td>.37</td>
<td>1.0</td>
<td>.28</td>
<td>.44</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>X</td>
<td>.37</td>
<td>.30</td>
<td>.28</td>
<td>1.0</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>4</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>X</td>
<td>.50</td>
<td>.44</td>
<td>.44</td>
<td>.49</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>X</td>
<td>.55</td>
<td>.36</td>
<td>.28</td>
<td>1.0</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>X</td>
<td>.45</td>
<td>.21</td>
<td>.25</td>
<td>.39</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>9</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>
From Table 7 and Table 8 above, the Pearson correlation of the model revealed that the level of correlation between the outsourcing cost components is not the same both in inshore as well as offshore software Development outsourcing. Hence, we reject hypothesis 3 since there is a significant difference between the effects of the cost components to total cost of software development outsourcing.

Conclusion
Most of the findings of this study are conformity with previous empirical studies. The findings reveal that the cost components contributing to total cost of software development outsourcing be it inshore or offshore (in order of ranking importance) are development costs, transport cost, cost of ownership and transport cost. Though these four (4) cost components above affected the Total cost of software development outsourcing collectively, it was also found out that in domestic (inshore) outsourcing; only two components namely Development cost and Cost of Ownership were more significant going by the results of the t-test. While in offshore software development outsourcing; Development cost and Transport cost were more significant going by the results of the t-test. Therefore, development cost has the highest significant impact on total cost software development outsourcing.

"Technology needs" and not "cost reduction" is the most reason why organizations embark on software development outsourcing be it inshore or offshore. However, cost reduction is still the second most significant factor for embarking on software development outsourcing. Development cost is critically examined by most outsourcing clients in Nigeria prior to any software development outsourcing deal. This is due to the fact that the development cost of any software development project is dependent on so far many variables such as category, complexity/scope, size, number of developers/resources, timeline/schedule, market demand, amongst others. Collectively, all the cost components have significant impact on the total cost of software development outsourcing (inshore or offshore) but individually only development cost and cost of ownership have impact on the Inshore software outsourcing cost while development cost and transport cost have the most impact on Offshore software outsourcing cost in Nigeria.

Transport cost has the least impact on the Inshore Software development outsourcing cost while Transaction cost has the least impact on the Offshore Software development outsourcing cost in Nigeria.

Recommendations
Based on the above conclusions the following recommendations are made:

- Client organizations in Nigeria intending to embark on Inshore software development outsourcing should place close attention to development cost and cost of ownership as any slight increase in any of these will affect the total outsourcing cost. Therefore, for a proper cost reduction decision making must be taken by companies in Nigeria prior to engaging in inshore software outsourcing by deciding ahead of time the developmental aspect of the software to be kept in-house and the aspect to the outsourced.

- Organizations in Nigeria intending to embark on Offshore software development outsourcing should properly examine the four cost components with more emphasis on development cost, and transport cost as this will enable such organization to take knowledge-driven cost reduction sensitive decision thereby ensuring that the software outsourcing project as an IT investment returns maximal profit and enhance the global competitiveness of such organization.

References


