OFFSHORE OUTSOURCING: A MIXED METHOD CASE STUDY OF THE QUALITY OF SOFTWARE DEVELOPMENT

by

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ABSTRACT

Outsourcing software development offshore enables companies to benefit from the large pool of skilled workers in other countries for a fraction of the local labor rates. The major reason for outsourcing was to save companies money, concentrate on their core competencies, and sustain long-term strategic goals to remain competitive. The outcome of outsourcing may vary among companies, but one out of five outsourcing projects was satisfied the user requirements. The purpose of the study was to examine the factors that affected the quality of software outsourced from Nigeria. The mixed methods case study instruments were sent to IT professionals in Lagos, and Port Harcourt, Nigeria. Descriptive statistics was employed to analyze the quantitative data. The statistical tool included Cronbach's alpha which determined the reliability of the instrument, and revealed the perspective of the participants on factors that affected the software quality. The themes that emerged from the qualitative date revealed factors that affected the quality of outsourced software, and supported the quantitative findings. The study demonstrated that a relationship existed between outsourced software quality, communication and culture, business requirement, project management, developers' experience and education, and vendor selection. Consensus emerged that outsource vendors may have used trained or experienced resources, the software made the company operation easier, but the project duration was longer than expected, the software required a lot of re-work, and the quality was below expectation.

DEDICATION

To my parents Mama, Mrs. Regina Chinyere Nwaogwugwu Ibe and Papa, Late Godwin Metuka Nwaogwugwu Ibe for all their encouragement, support, and love for education and pursuit of excellence. You encouraged me to aim for the sky.

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Introduction

Information Technology (IT) is integral to the economies of both developing and developed countries (Dedrick, Kraemer, & Shih, 2014). The broad range of IT functions includes software development (Hijazi, 2012). Outsourcing software development generated savings for companies in developing and developed countries, such as Canada, Ireland, Germany, Great Britain, and the United States because offshore labor costs were lower than in the respective countries (Vaxevanou & Konstantopoulos, 2015). A developing country like Nigeria engages in outsourcing for the same reason.

Managers who move software development work overseas may be worried about the quality when measured by reliability, functionality, maintainability, and usability (Kannabarin & Sankaran, 2011). Prior research about the outsourcing of software development indicated concerns about quality (Setterwall, 2013). Such concerns reflected the focus of the present investigation into aspects of outsourcing that companies in Nigeria and other countries overlook during offshore outsourcing that may affect the quality of the software product.

This mixed method case study explores factors that may influence the quality of offshore outsourced software and strategies that can improve the quality. Results of the study may help companies in Nigeria or other countries make informed decisions during software development outsourcing phases. Additionally, companies may use the results of this study to evaluate the viability of offshore outsourcing.

Chapter 1 consisted of a synopsis of the background of the problem associated with outsourcing of software development. The purpose of the study aligned with the

intention to help solve the problem explained in the chapter. The research questions supported the reason of the study, and the nature of the research encompasses details about the research process and design. The theoretical framework, definitions of terms, assumptions, limitations, and delimitations are important parts of the chapter that add to the perception of the subject, and scope of the study.

Background of the Study

Outsourcing software development offshore enables companies to benefit from the large pool of skilled workers in other countries for a fraction of the local labor rates (Abdul-Halim, Che-Ha, Geare, & Ramayah, 2016). For some organizations, the purpose of outsourcing is not just to save cost but also sustain long-term strategic goals to remain competitive (Lahiri, 2015). The result of the research conducted by AMR Research (2003) showed that between 1989 and 1995, the IT outsourcing market grew by $76 billion.

By 2006, more than 50% of United States companies outsourced some of its products and services, with global software market growth of 50.5% between 2008 and 2013, equivalent to about $457 billion (Edara, 2011). Lee (2016) reported that in 2013, the outsourced market size was almost $83 billion. Outsourcing software development generated savings for companies in developed and developing countries, largely because of savings in labor costs (Merino, 2015). There are no statistics on the quality of these software products.

Human resource expenses account for 70% of software development costs, which companies reduce by outsourcing (Xin & Li, 2013). The Salaries Report (2012) included the average salaries of an Indian software developer ($6,353 per annum) and a Chinese

developer ($18,640 per annum), compared to workers in similar positions in the United States and Britain, who earned an average of $76,000, and $46,736 respectively.

Outsourcing may be responsible for other costs. According to Brecher and Chen (2014), and Merino (2015), labor cost savings for companies means lost wages for workers in the company's country of origin. For example, by 2007, outsourcing cost American workers $135 billion in lost wages, 3.3 million American jobs, and salary reductions for existing IT work in the United States (Hirschheim, 2009).

Some companies embraced outsourcing for cost reduction purposes only (Bordoloi & Powell, 2013). Companies with leaders who ignored quality software performed poorly in comparison to firms that emphasized both cost reduction and quality of products and services (Gopal & Koka, 2010). Because outsourcing software development is a complex process requiring an elevated level of coordination, control, and monitoring, the added cost of poor-quality outsourced software to the economies of countries around the world can be high but difficult to quantify fully (Khan & Khan, 2013).

Laporte, Berrhouma, douCet, and Palza-Vargas (2012) showed that the costs of fixing poor-quality software errors after the application is in use could be 100 times higher than work performed during the development stage. The ability of software developers to meet quality requirements determines the quality of software (Eveleens, Kampstra, & Verhoef, 2015). A measure of software quality is the adherence to functional and performance standards expected of professionally designed and developed software (Khan & Khan, 2013).

Laporte et al. (2012) reported that software development specialists often spend about half of the work time on avoidable rework to satisfy quality requirements, taking time away from productive work. Measuring and reducing avoidable rework should be one of the most important objectives of software development process improvements (Laporte et al., 2012). Despite ongoing concern about software quality and associated costs, there was relatively little rigorous research about conditions or characteristics that affect the quality of software outsourced to various countries (Eveleens et al., 2015).

Lee (2016) noted that most outsourcing research focused on motivation and risks, fundamentally ignoring a needed focus on performance and quality improvement. Other researchers (Haried & Ramamurthy, 2010) blamed poor communication for most outsourced software development failures and suggested that lack of understanding of customer requirements, wrong software development tools, and misuse of proprietary information, are examples of outsourcing blunders that companies must consider.

Eveleens et al. (2015) focused on changes to the development process that can address software quality metrics to reduce costs of software outsourcing. Canfora, Dalcher, and Raffo (2012) noted that outsourced software development must depend on the evolution of methods and processes to manage the phases of software development and reduce poor quality costs. This involved continuous improvements in the processes, capabilities, and practices required to develop, manage, and govern both the products and relationships (Canfora et al., 2012).

The managers responsible for outsourcing software development should consider the impact of quality on profit margins, not exclusively cost and revenue (Everleens et al., 2015). According to Laporte et al. (2012), management can contribute to or help

reduce costs associated with the quality of outsourced software development, based on the adequacy of quality appraisal, problem prevention, and planning processes. While Poor management may translate into higher costs for poor quality software, better quality products will help companies increase revenues, reduce service delivery costs, and continue to justify the benefits of outsourcing (Eveleens et al., 2015).

Problem Statement

Outsourcing enables some companies to benefit from access to technologies and human resources for fractions of the costs of the local rates (Kakumanu & Portanova, 2006; Lee, 2016; Pedersen, Bals, Jensen, & Larsen, 2013). Outsourcing can reduce expenditures for needed products and innovations, thereby improving a firm's competitive advantage (Bordoloi & Powell, 2013; Pedersen et al., 2013). Research showed that approximately 29% of IT projects were successful, and 71% failed to satisfy expectations, such as meeting quality goals (Edara, 2011).

The general problem is that some companies that engaged in outsourcing receive poor quality software that may be a result of some risks and challenges associated with outsourcing software development, leading to a global failure rate of 50% of outsourcing relationships (Islam & Houmbe, 2011). Prior research about software development success revealed that the probability of offshore projects failing to meet quality business specifications was between 55% and 75% (Khan & Khan, 2013).

Outsourcing software development generated savings for companies in developed and developing countries, largely because of savings in labor costs (Merino, 2015). Companies in Nigerian lacked adequate resources to design complex processes to meet their business requirements. Given that outsourcing is expected to save cost and help the

company sustain long-term strategic goals to remain competitive, companies in Nigeria that want to compete continue to outsource software development jobs and services. The specific problem was the frequent poor quality outsourced software delivered to Nigerian companies by foreign experts.

Purpose of the Study

The purpose of this mixed methods study was to explore the factors that affected the quality of offshore outsourced software products in Nigeria, and strategies that may be used to improve it. A gap existed in the literature about the quality of outsourced software development work. As companies continued to invest heavily in IT projects to improve business processes, research showed that only 10% to 20% of those projects met customer and quality needs (Edara, 2011).

Software quality is important to an outsourcing organization, and this study fulfilled the purpose of informing leaders who sought for useful information to make quality improvements during outsourcing of software development. Outsourcing registered sustained growth, and countries like India grew into recognizable destinations for outsourcing (Bordoloi & Powell, 2013; Kannabarin & Sankaran, 2011). Primarily driven by cost savings, companies should consider balancing the gains with quality (Laporte et al., 2012; Lee, 2016; Setterwall, 2013).

The research conducted by Kannabarin and Sankaran (2011) suggested that, in light of the questionable cost advantages, additional research work was needed to help offshore software development change focus from costs to quality-related measures of the software provided. This research intended to provide helpful information that will enable companies to focus more on the quality rather than cost benefits of outsourcing.

Significance of Study

Outsourcing software development offshore may be less expensive than software development in the country of origin (Bordoloi & Powell, 2013). Some companies discovered that unexpected problems might force overall outsourcing costs to exceed in-house budgets (Hanna & Daim, 2009; Lee, 2016). When a software project overruns its budget, some factors may be responsible, including poor product quality that necessitates additional efforts to correct defects before the product can perform as expected (Batada & Rahman, 2011; Laporte et al., 2012).

More than two-thirds of IT projects failed to satisfy project goals such as quality, cost, suitability, and delivery; Khan and Khan (2013) reported a 43% failure rate specifically for offshore software outsourcing. Although reduced labor cost is a benefit of outsourcing, companies expect the most experienced developers to manage the software development work, which should result in a better success rate. Various studies conducted on software development showed that the probability of offshore projects failing to meet business specifications could be as high as 75% (Khan & Khan, 2013).

These dim statistics have not discouraged companies from continuing offshore software development outsourcing. Leaders recognized the benefits of outsourcing, but also continued to look for the research-driven solutions to the problems the leaders encounter (Christ, Mintchik, Chen, & Bierstaker, 2015; Hrušecká, Macurová, Juřičková, & Kozáková, 2015; Lahiri, 2015; Lee, 2016). By expanding the body of knowledge about the quality of outsourced software products and strategies that can improve the quality, leaders could implement plans to control failure or poor quality, and reduce unnecessary expenses.

According to Kannabarin and Sankaran, (2011), software quality pertains to reliability, functionality, maintainability, and usability. Defects cause software to malfunction, thereby producing incorrect results. The costs of poor quality software may be tangible or intangible, but because companies do not track them, the overhead cost is hard to consider (Hanna & Daim, 2009; Khan & Khan, 2013).

Khan and Khan (2013) claimed that growing costs due to the decline in quality of software products had become even more pronounced amidst cycles of global recessions and economic sluggishness. Khan and Khan (2013) noted the need to focus on quality assurance, quality control, and additional research to manage quality software production cost effectively. This mixed methods study contributes to the reduction of tangible and intangible quality costs.

Results of this study will provide organizational leaders the opportunity to appreciate new ways to appraise the quality and associated tangible and intangible costs of software development services delivered by offshore resources. Information technology leaders may apply the findings of this study to process controls that may reduce outsourcing software development problems, and improve product quality. Consulting companies may use the results of this study to implement strategies to identify, intervene, and control the quality of its software products to ensure the projects are within budget, do not fall below standard, and meet customer expectations. Implementing study recommendations will reduce the percentage of companies with failed project, costly outsourcing relationships, or poor-quality results from the offshore outsourcing partner (Lee, 2016).

Nature of the Study

This mixed methods study pertained to the population of IT consultants located in Lagos and Port Harcourt, Nigeria. This research recruited about 500 IT consultants for the quantitative study. All 500 IT consultants received invitations to participate in the study, based on the contact information that Accenture Nigeria and Kabo Nigeria agreed in writing to provide (See Appendix A). At least 23 individuals were recruited to participate in the qualitative study.

These people opted into the study and were accepted according to the order in which they expressed interest to participate. Participants were at least 18 years of age, signed an informed consent form, had at least two years working experience as an IT consultant involved in the outsourcing of software development, and were willing to complete online surveys or participate in the interviews.

Data analysis of this mixed methods study consisted of both a qualitative and quantitative component, including data preparation, and data importation into Statistical Package for the Social Sciences (SPSS) and NVivo 11. NVivo 11 Qualitative data analysis software was used to identify themes in the data that helped to answer the research questions, identified response rates and biases, analyzed actual data collected and reported the findings.

The discussion of the result included a comparison of findings to the theoretical framework and previous literature, leading to the recommendations for leaders and suggestions for future research. Some case studies and quantitative research on offshore outsourcing did not perform a critical evaluation of the software quality. The case studies examined factors that may affect the outsourced products and services (Khan & Khan,

2013; Liu, Zeng, & Zhao, 2014; Patil & Patil, 2014; Sundararajan, Bhasi, & Pramod, 2013).

A quantitative method includes experimental, correlational, or descriptive research that involves certain factors, expressed numerically from answers to close-ended questions about the variables (Marshall & Rossman, 2016). Qualitative research involves the collection of historical or textual data that is often descriptive, in-depth, and voluminous (Yazan, 2015). Mixed methods research occurs when there is numerical data from closed-ended survey questions and a textual component from the answers to open-ended questions, interviews (Denzin, 2012, Zohrabi, 2013). This mixed method approach included 47 close-ended Likert-type survey questions, based on previous research findings published in the peer-reviewed literature and three open-ended questions, led to the benefits provided by both methods.

Research Questions

Three main research questions aligned with the purpose of the study, which was to explore the factors that may affect the quality of outsourced software products and strategies that can improve the quality of the software. The answers to these research questions were obtained from data collected through online surveys, and interviews. The three key research questions that were the focus of this study are:

Research Question 1: What are the most important factors that affect the quality of software products outsourced from Nigeria?

Research Questions 2: What strategies can outsource companies apply to improve the quality software products for companies in Nigeria?

Research Question 3: What strategies can the offshore developers use to improve the quality of the software developed for companies in Nigeria?

Theoretical Framework

According to Vaxevanou and Konstantopoulos (2015), outsourcing encompasses a complex structure with numerous activities and functions leading to administrative and managerial dilemmas. Therefore, outsourcing is subject to theories applied to understand the complexity of the operations and activities involved, and help leaders negotiate these processes effectively. Relational view applies to the theoretical frameworks to be presented to explain and understand outsourcing over preceding decades.

The resource-based view (RSV) theory contributed significantly to organizational competitive advantages because companies can accumulate rare, valuable resources and skills that cannot be easily imitated or substituted, to attain a competitive advantage. But, RSV could not explain how firm-level competitive advantage will succeed in a networked environment because companies maintain regular collaborative relationships with partners in similar industries (Turkmen, 2013).

The resource-based view by described the existence of exchange relations and how the interactions were beneficial to firms in a network, through specialization and scarcity. Specialized organizations cannot own all the necessary skills required to be successful, necessitating the need to share resources and information, shortage of resources constrains the organizational ability to support every aspect of the product.

The relational view was discovered from the resource-based theory view by Barney (1991) and Wernerfelt (1984) and contributed extensively to the study of firm-level competitive advantage. Dyer and Singh (1998) were among the first researchers to

apply the relational view to outsourcing research. The relational view offered a more relevant viewpoint through which to study the outcomes of firm-level outsourcing strategies than a resource-based view or industry structure view. According to Dyer and Singh (1998), relational view resulted in a “supernormal profit jointly generated in an exchange relationship that cannot be generated by either firm in isolation and can only be created through the joint idiosyncratic contributions of the specific alliance partners” (p. 662).

Companies used the relational view to clarify competitive strategies and control market opportunities, thereby creating value in the global network (Wong, 2011). Companies have area of specialty, and cannot have all the skills required to function successfully. Therefore, it is paramount that to "produce the desired product and output, organizations must exchange information or resources on the market” (Turkmen, 2013, p. 2). Dyer and Singh (1998) recommended that a company's vital assets span boundaries but still involve relation-specific resources, knowledge-sharing, complementary assets, capabilities, and efficient governance of processes.

The result led to the creation of high-quality inter-organizational products and services, which are difficult for competing firms to imitate. According to Turkmen (2013), the relational view was applied during make-or-buy decisions, when a company decides to be part of a network by outsourcing. Additionally, it was applied to the supplier selection decisions, because it “emphasizes long-term commitment with fewer but more strategic suppliers” (p. 2).

Mol (2005) conducted research to investigate whether industries engaging in intensive R&D work can be an obstacle to outsourcing. The result showed that such

companies were increasingly relying on long-term, trusting partnership with outside vendors to achieve competitive advantage, and above average returns. Therefore, relational view of outsourcing to maintain buyer-supplier relations may be an adequate substitute for in-house involvement.

The relational view appropriately applies to the study of quality considerations in software development, because it helps to explain how companies gain and sustain competitive advantages within the inter-organizational relationships (Perunović, 2007). The relational view encompasses the study of transition, managing relationships, and reconsideration phases of outsourcing relationships (Lysne, 2014). The opportunity to apply the theory to these three major aspects of outsourcing relationships makes the relational view an appropriate premise to use in this mixed methods study involving the exploration of quality factors and strategies in software outsourcing.

The relational view is applied to improve the practice and performance of supply chain management (SCM) by emphasizing the importance of cooperation, communication, and integration (Wieland, & Carl, 2013). Supply chain members invest in information sharing and communication, to improve the speed, visibility, and head start in reacting to market forces. Additionally, communication between members decreased data irregularity between the manufacturer and suppliers, thereby increasing preparedness (Wieland & Carl, 2013).

The relational view was applied in the manager-stakeholder cooperation to improve organizational reputation regarding competence, responsiveness, and fairness. The ability of the manager and stakeholder to cooperate effectively promoted corporate

integrity, and stakeholder responsiveness to ideas, and initiatives (Vos & Achterkamp, 2015), which may benefit both parties.

Definitions

Agile development. A creative or responsive process of addressing users' needs that satisfied the business requirement faster and cheaper than rigid or unresponsive processes (Dingsøyr, Nerur, Balijepally, & Moe, 2012).

Application complexity. The difficulty experienced by the programmer in performing tasks, such as coding, testing, debugging, or modifying applications or software (Pizzi, 2012).

Capability maturity model. CMM refers to a process designed to improve software development by using successful, orderly, and standard methods to continually improve the quality of the software products (Solemon, Sahibuddin, & Ghani, 2012).

Capability maturity model integration. CMMI replaced CMM as a useful process for the improvement of products and services in the integration of traditionally separate organizational functions (Delgado, 2007; Solemon et al., 2012).

Country of origin. The country in which the company operates to procure goods or services from other specialized companies in different geographical locations (Adina, Gabriela, & Roxana-Denisa, 2015).

Defect rate. The number of defects or errors identified during requirement gathering and design, instead of the program coding phase in which defects are measured by errors per line of code (Jones, 2008; Misirli, Bener, & Kale, 2011).

Offshoring. A term applied to outsourcing offshore, using contractors to manage organizational services, buildings, and data centers, providing organizations products and

services from another location in different countries (Pearlson & Saunders, 2010). Offshoring for companies is the process of outsourcing to organizations, often in Asia and India, whereas outsourcing to Europe, Central, and South America is called near-shoring (Mosher, 2011).

Quality. As applied in this study, quality of software is a combination of the functionality, reliability, maintainability, usability, and performance of software products (Kannabarin & Sankaran, 2011; Setterwall, 2013).

Scope of the Study

The scope of this mixed methods study included the population of IT consultants located in Lagos and Port Harcourt, Nigeria. The recruitment of a purposeful, criterion-based sample of at least 500 IT specialists from the population occurred using the contact information that Accenture Nigeria, Kabo Nigeria agreed to provide (See Appendix A). From this population, a minimum of 217 consultants were expected to complete the survey for the resulting data to be statistically meaningful (Survey Monkey sample size calculator). At least 50 additional participants were recruited to participate in the individual interview for the qualitative study.

Participants were at least 18 years of age, signed an informed consent form, and had at least two years of work experience as an IT consultant involved with outsourcing of software development work. Participants completed one of the following activities: (a) complete an online survey or (b) participate in an interview. The online survey (a) was used for the quantitative study while the interview was used for the qualitative study. The analysis of qualitative data identified themes that helped to answer the research questions, combined with the detailed results of the quantitative data analysis. The discussion of the

findings of the theoretical framework revolved around the comparison of the results of the study to previous literature, leading to recommendations for leaders and suggestions for future research.

Assumptions

Assumptions are beliefs about the research process that may be difficult or impossible to prove. The researcher assumes that the participants recruited through purposeful sampling were honest in their responses to questions about eligibility, outsourcing knowledge, and software development experiences. Inabilities to provide sincere responses may influence the validity of the study and results (Leedy & Ormrod, 2012); but the assurances of confidentiality improved the likelihood of obtaining unbiased data.

There was an assumption that enough participants completed the surveys, and interview sessions to meet data saturation goals. The pool of IT recruits provided by the two companies who signed agreements for recruitment of participants improved the likelihood that enough people responded in ways that met data saturation goals. It was assumed that the quantitative and qualitative methods were appropriate to address the problem of the study, and provided answers to the central research questions.

A related assumption was that the researcher applied the knowledge and skills gained in a doctorate-level educational program to perform the data collection and analysis in a manner free from bias, and conformed to acceptable rigorous research procedures.

Limitations

Brutus, Aguinis, and Wassmer (2013) described research limitations as possible weaknesses of a research study that the researcher was unable to control. The geographical boundaries of this study are within the continent of Africa and involve outsourcing, but the population was limited to the IT consultants that the researcher can access. There may be additional individuals who could inform the study but were beyond the reach of the researcher.

The use of online data collection tools allowed for the involvement of a dispersed sample from the population but prevented opportunities to follow-up on answers to the survey and interviews questions. The voluntary nature of participation led an ideal number of individuals who self-identified to meet the eligibility criteria. Email messages were sent out to more than 500 IT professionals to improve the likelihood of obtaining at least 217 participants being the minimum number needed to make the quantitative research meaningful. Data saturation may require more participants, but the recognition of the point of data saturation depended on the prudent opinion of the researcher, which, because of limited practice in identifying data saturation, was a limitation.

Delimitations

Brutus et al. (2013) emphasized that the recognition of delimitations is important in research studies because delimitations involve conscious choices of the researcher that provide the boundaries of the study. Brutus et al. (2012) described delimitations that relate to the decisions about data collection, participant sampling, and the defined geographical area. This mixed methods study included the collection of qualitative and

quantitative data from multiple participants who have experience with outsourcing of software development.

Only IT consultants who were employees or contractors of Accenture Nigeria and Kabo Nigeria participated in this study, due to agreements with these organizations to recruit participants. The geographical area in which the IT consultants work (Africa) is unique, and the outsourcing involved software development in India, limiting the transferability of findings to other countries participating in outsourcing relationships. The appropriateness and transferability of the results depends on the prudent judgment of readers, enhanced by the consideration of the thick descriptions that will be a part of the published report (Anney, 2014).

Summary

This chapter represented an introduction to understanding the cost of bad software products developed offshore for customers in countries such as Nigeria. Causes of low-quality software are essential for organizational leaders who outsource software development work overseas and those who plan to do so in the future. Outsourcing software development generated some savings for companies because of lower labor costs overseas (Merino, 2015; Vaxevanou & Konstantopoulos, 2015).

The expected savings could not be determined because of risks and revenues lost in reworking or fixing defective software, and hidden or unexpected costs that emerged from the design stage, through completion (Khan & Khan, 2013; Laporte et al., 2012). The costs of poor quality software remained understudied as does the factors involved with software development quality, and the strategies that can improve quality software development in outsourcing relationships.

Various studies conducted on software development success showed that the risks heighten the probability of offshore projects failing to meet business specifications (Khan & Khan, 2013). There was no known study to determine factors that affect the quality of software outsourced to developing countries, and strategies that can improve the quality of outsourced software work. As a start to filling the gap in the literature, Chapter 1 included the background of the problem, the purpose, nature, significance of the study, the scope, assumptions, limitations, and delimitations of the research. The definitions of terms and theoretical framework provided in this chapter helped provide additional context for the mixed methods study.

Chapter 2 included a review of existing literature on outsourcing, developer experience, software developer education, and software quality. The reviewed literature included the history of outsourcing, benefits, problems, and economic impact of outsourcing. The review of the literature culminated in the identification of a gap in the body of knowledge about the factors that affect the quality of outsourced software products and strategies that can improve the quality.

Chapter 2

Review of the Literature

This purpose of this mixed methods study was to explore the factors that affected the quality of offshore outsourced software products, and strategies that can improve the quality. This study included the evaluation of factors that may affect the quality of outsourced software like functionality, reliability, maintainability, usability, performance, requirements certainty, technical infrastructure, knowledge transfer and integration, process maturity, and training of personnel. The literature review included a synthesis of previous related studies to build on existing knowledge.

Title Searches, Research Documents, Journals, and Articles

This review reflected a thorough investigation of existing literature using peer-reviewed articles, scholarly journals, government reports, and validated postings of interest on the Internet. The search for peer-reviewed articles from academic journals occurred primarily using University of Phoenix Library Internet search engines and related databases. The University of Phoenix Library EBSCOhost and ProQuest databases were helpful for the review of the historical background of software development outsourcing, and more recent rigorous research studies about outsourcing and software quality. Table 1 below shows the result of articles published in listed electronic databases on outsourcing and software quality between March 2002 and March 2015.

Table 1
Published Articles in Electronic Database

Database	Source	Result
EBSCOHost	Peer Reviewed Journals	26
Proquest	All Sources	141
	Scholarly Journals	68
	Reports	2
	Trade Journals	2

Historical Overview of Outsourcing

The recognition of outsourcing in the late 1980s as a cost-saving business strategy led to the expansion of the practice during the extensive globalization efforts of the twenty-first century (Page, Deme, & Nodoushani, 2010). The popularity of outsourcing also stemmed from the response to an impending economic recession, high inflation, increasing interest rates, and the computer digit crisis of 2000 (Y2K). As the year 2000 neared, there was a lack of adequate software engineers in the United States to fix the Y2K bug in computer hardware and software (Albert & Thondavadi, 2004); there was a growing belief that outsourcing could help the anticipated Y2K problems.

As outsourcing grew into a known business strategy, a cohesive definition began to develop, as recognized in industry specific outsourcing activities. Outsourcing is the process of providing an organization's products and services from another location in a different country, or the transfer of organization's business or service to another provider overseas (Pedersen et al., 2013). Outsourcing is the continued administration, management, and subcontracting of the company IT processes to a client, to improve IT service quality and effectiveness.

Asia was the most popular destination for outsourcing activities, with China and India providing most of outsourcing activities (Mishra & Mahanty, 2015; Xin & Li, 2013). India remained dominant in IT outsourcing, accounting for more than 55% of the growing market in 2008 because it has a large pool of low cost, high skilled IT workers (Palugod & Palugod, 2011). Outsourcing continued to demonstrate cut in overall cost, labor, and raw materials and enabled organizations to benefit from the economies of scale of the external providers.

Some companies began to outsource software development work because of a shortage of experienced resources, distrust of local external IT companies, or the desire to avoid overdependence on its IT staff (Vasiljeva, 2012), but the study by Bordoloi and Powell (2013) discussed how outsourcing led to controversies in most recent times.

Economic Benefits of Outsourcing

Many companies found outsourcing to be an efficient and cost-effective option for providing goods and services (Lee, 2016). For example, in 2002 J. P. Morgan Chase, invested $5 billion in IT outsourcing with International Business Machines (Edara, 2011). In 2006, Electronic Data Systems (EDS) announced a $3.1 billion deal for outsourcing services to build the United States Marine Corps and Navy intranet technology (Edara, 2011), which can boost the economies of the country of origin and outsourcing countries.

With outsourcing, organizations reduced expenditures by paying for only the needed products, refined competencies, and improve the firm's competitive advantage (Pedersen et al., 2013). Small companies benefited from outsourcing, which would have been an unaffordable technology, and large enterprises improved on existing technologies (Bordoloi & Powell, 2013; Kakumanu & Portanova, 2006). Outsourcing software

development offshore enabled big business to benefit from the resources and a large pool of skilled workers in other countries for a fraction of the local rate (Lysne, 2014).

Technological advancement encouraged offshore outsourcing because communication and file transfer between participants is fast (Bordoloi & Powell, 2013). These benefits partners in both participating countries because it forced the price of consumer goods to drop, created more jobs and services in the client country, and possibly encouraged foreign countries to buy hardware or software from the contracting countries (Hanna & Daim, 2009). The development suggested that the future of outsourcing was bright, but there was no statistical data to support the claim that the global economy will receive quality service (Laporte et al., 2012).

For some organizations, the purpose of outsourcing was not just to save cost but represent a viable business strategy to sustain long-term strategic goals and remain competitive (Lee, 2016). Small companies benefited from the technology that was unaffordable, and large businesses improved on existing technologies (Kakumanu & Portanova, 2006). The global software market grew by 50.5% between 2008 and 2011, equivalent to about $457 billion (Edara, 2011). With outsourcing, organizations reduced expenditures by paying for only the products that were needed, refined its competencies, and improved competitive advantage (Pedersen et al., 2013).

General Outsourcing Concerns

Outsourcing may benefit partners in both participating countries because it may force the price of consumer goods to drop, create more jobs and services in the client country, and possibly encourage foreign countries to buy hardware or software from the contracting countries (Hanna & Daim, 2009). But there are disadvantages of outsourcing

that led to concerns (Bordoloi & Powell, 2013). Outsourcing created problems like unemployment, reduction in research and development, education, and reduced software quality (Lysne, 2014). There were concerns about logistics, strategic alignment, trust, communication, cultural barriers, and legal protections (Betz, Oberweis, & Stephan, 2014; Solli-Sæther, Karlsen, & van Oorschot, 2015).

Unemployment. Jobs outsourced to developing countries created unemployment for local employees if the company did not retrain them for new skills needed in the organization (Brecher & Chen, 2014). Outsourcing destabilized former employees and families, and was responsible for 25% of United States jobs moved to other countries (Whitfield & Joslin, 2008), and created higher levels of unemployment in the country of origin (Brecher & Chen, 2014).

In 2005, the media projected more job losses in the future, and in subsequent years, outsourcing will continue to destabilize employees and families in the U.S. and across the globe (Niederman, Kundu, & Salas, 2006). Yabuuchi (2011) demonstrated that outsourcing might hurt domestic employment, and Whitfield and Joslin (2008) projected billions of dollars of losses to the country of origin as jobs continue to move offshore. Ranganathan and Outlay (2009) showed that outsourcing caused unemployment for 59% to 73% of application developers in the United States.

This approach resulted in massive job losses in the country of origin as companies cut costs along with jobs, affecting about 3.3 million jobs in 2015 (Rutherford & Mobley, 2005). Bordoloi and Powell (2013) followed up with these concerns about the economic impact of outsourcing on a country's labor and social welfare.

Logistics. Distance is not necessarily a problem with outsourcing. Monken (2010) advised that the client must make an initial visit to the offshore location to assess the infrastructure and personnel before work can commence. Outsourcing puts pressure on a country's infrastructure such as power supply, roads, and transport (Patil & Patil, 2014). Sufficiently developed infrastructure is essential for any company outsourcing software development to developing countries.

Overby (2003) pointed out the technology provided by the organization must function as expected within the infrastructure in the developing world. If the foreign country lacks good roads and public transportation, businesses may pay more for transportation (Simran, Tejinder, & Paramjit, 2011). The cost may be unclear or unnoticed in the overall cost budget (Monken, 2010).

Trust. In outsourcing, the ability of the client and service provider to develop trust involves maintaining a positive attitude toward one another and the project, regardless of the risk associated with taking such a position (Hanna & Daim, 2009). Trust improves communication between the parties and simplifies the development process (Simran et al., 2011). Relationships of trust facilitate decision making, reduce risk, and improve client satisfaction (Hanna & Daim, 2009; Lysne, 2014).

A spirit of trust between client's company, and outsource vendor personnel may translate to high performance among team members and is reflected in the output (Simran et al., 2011). Some strategies that may help maintain trust in offshore outsourcing are proper communication, cultural synchronization, respect for the contract, and delivering quality products (Betz et al., 2014; Hanna & Daim, 2009). By implication, a lack of trust between offshore outsourcing partners may lead to project failure (Lysne, 2014).

Communication and cultural barriers. Managing offshore outsourced projects, such as software development, is complex because project management is remote and involves cross-cultural interactions (Haried & Ramamurthy, 2010; Vasiljeva, 2012). Improper communication caused by cultural differences account for a variety of problems encountered when companies try to coordinate, monitor, and control an offshore IT project (Simran et al., 2011). Communication and cultural differences affect the level of trust between the client and service provider (Betz et al., 2014; Kakumanu & Portanova, 2006) thereby making it difficult for both parties to work together efficiently (Lysne, 2014).

Proper communication is critical in managing and coordinating an offshore project and requires that the organization invested heavily in communication infrastructure (Lysne, 2014). In the research conducted by Haried and Ramamurthy (2010), vendors and clients expressed the critical importance of face-to-face communication to enhance their relationship. Hanna and Daim (2009) suggested that both parties should meet face-to-face at the initial stage of the project to build trust and rapport, and reduce hidden costs. Lysne (2014) noted that although outsourcing grants access to a greater pool of resources and talents, surveys showed that good communication in offsite outsourcing could be challenging, yet a necessary process for developing good outcomes from the relationships.

Legal protections. Hanna and Daim (2009) advised companies to understand the legal provisions of the service provider's country on information protection, intellectual property, privacy, and accountability. Service providers could require developers to sign an agreement against stealing intellectual property, but the local laws in most countries

may not enforce that agreement. Due to cultural and legal differences, companies may be unable to make the outsource vendors to comply with the laws and regulations, which could cause a problem for intellectual property ownership protection (Reid, 2012). Outsourcing is a huge financial project that requires business leaders to avoid ambiguity when signing a contract to avoid massive financial loss (Monken, 2010).

Education. Outsourcing has diminished the popularity of computer science study in the United States by creating a negative image of the profession, thereby making it unfavorable among first-year college students (Chabrow, 2004). Denning and McGettrick (2005) revealed that the number of students who enrolled in computer science programs dropped from 60% to 30% during 2000 to 2004. The decline in student enrollments in computer science education created a shortage of graduates to support the United States demand for software developers.

Moncarz, Wolf, and Wright (2008) investigated 160 occupations at risk of experiencing outsourcing. Findings indicated more highly educated, and technically-oriented employees were subject to significant changes in employment. Scholars believe the effects of outsourcing cannot be measured adequately, but the impact of certain occupations like software development was noticeable (Bordoloi & Powell, 2013). Table 2 includes a summary of the effects of outsourcing on application developers.

Adapted from the study of life after information technology outsourcing, Ranganathan and Outlay (2009) reported lessons learned from the resizing of the information technology workforce in both on-site and off-site projects. Ranganathan and Outlay (2009) reported figures in the informational technology workforce that included those employees laid off, out-placed, and in-placed across different outsourcing

initiatives. Information technology positions affected include the application development and maintenance of merchandising and retail systems, development and maintenance of inventory tracking, applications involved with development and maintenance, and applications involved in the development, maintenance of back-office systems, and technical support.

Table 2
Outsourcing Statistics

Outsourcing Initiatives	Total IT workforce before outsourcing / Number displaced by resizing	Percentage of displaced IT workforce who were:			Interviewees
		Laid off	Out-placed	In-placed	
Firm profile: Global retailer of high-end luxury items					
Application development and maintenance of merchandising and retail systems	128/45	73%	-	27%	CIO, IS director, Project manager
Firm profile: Hardware retail company with stores across the U.S.					
Development and maintenance of inventory tracking	336/32	56.25 %	31.25 %	12.5%	CIO, IT manager, Application specialist
Firm Profile: Multinational bank					
Application development and maintenance	750/95	42%	53%	5%	VP-IT, HR-IT, Application analyst
Firm profile: Global provider of risk management and reinsurance services					
Application development, maintenance of back-office systems, and technical support	260/85	59%	12%	29%	Business analyst

Research and development. Despite the necessary investment in outsourcing, companies must be prepared to expand research and development (R&D) capacity to improve employees' capability to handle complex projects (Tamayo & Huergo, 2015).

The heavy involvement of the United States in outsourcing forced some United States companies like Accenture, IBM, and Siemens Business Services to invest in R&D in foreign countries like India, and reduce the domestic R&D spending proportionately, by almost $8 billion in 2002 (Aspray, Mayadas & Vardi, 2006). This resulted in a loss of innovation in the United States and benefits the Indian and Chinese offshore sectors, which have the largest and fastest growing outsourcing industries in the world (Simran et al., 2011).

Hidden costs. Outsourcing, such as software development, to countries like India and China, take advantage of the large pool of low-cost skilled domestic workers (Simran et al., 2011). Khan, Currie, Weerakkody, and Desai (2003) conducted a research on IT outsourcing and found that the annual salary of a Chinese developer was $4750, an Indian developer was paid $5850, while their American counterpart was paid $63,000. The low overhead resulted in huge profits for the outsourcing company. China became an offsite leader in manufacturing while India became a leader in services (Simran et al., 2011).

Hidden costs may affect the outcome of any software development project and are responsible for an estimated 40% of company profits on projects outsourced to India and China (Bordoloi & Powell, 2013). Organizations may incur hidden costs if leaders ignore the cost of hardware or software project duration, and fail to prevent scope creep or unexpected turnover of key employees. Whitfield and Joslin (2008) advised companies to pay attention to these unexpected or unplanned expenses in three of the seven phases of outsourcing: contracting, transition, and execution. Whitfield and Joslin (2008) advised

that intercepting hidden costs at any of these phases could save the project from failure or profit loss.

Most of the prior literature involved case studies and surveys on outsourced product effectiveness, culture, productivity, or cost (Betz et al., 2014; Gurung & Prater, 2006; Patil & Patil, 2014; Simran et al., 2011). Very few studies are about the goals of providing high-quality products at a minimal cost to the company.

Software Outsourcing Concerns

Outsourcing software development offshore involves hiring service providers and software developers in developing countries, such as India or China with lower wages, to write all or part of an application (Hanna & Daim, 2009; Simran et al., 2011). Some companies discovered that unexpected problems might force overall outsource cost to exceed in-house budgets (Hanna & Daim, 2009). This cost may be tangible or intangible, but since companies do not track them, it is hard to consider in the overhead.

Vasiljeva (2012) conducted studies on project management techniques that support successful software development. The data from the 20-year research showed that project managers require practical experience in software development, and identified some stages of the project lifecycle that project managers must monitor for the project to remain within budget. The research conducted by Edara (2011) showed that the probability of outsourced projects failing to meet business specification was between 55% and 75%.

This study suggested that the success of outsourced software work may depend on the programming and communication skills of the developer and project managers. Authors of these studies highlighted factors that may help a project succeed, but leaders

may fail to address them, but desire high quality software (Cerpa & Verner, 2009, p. 131).

Table 3
In-House and Outsourced Failed Projects

Software Project Failure Factors	Percentage of Projects (%)		
	In-House	Outsourced	Overall
Delivery date impacted the development process	93.90	90.50	92.90
Project was under-estimated	83.70	76.20	81.40
Risks were not re-assessed, controlled, or managed throughout the project	73.40	80.90	75.70
Staff were not rewarded for working long hours	81.60	57.10	74.30
Delivery decision was made without adequate information about requirements	83.70	47.60	72.90
Staff had an unpleasant experience working on the project	83.70	47.60	72.90
Customers/users were not involved in making schedule estimates	69.40	76.20	71.40
Risks were not incorporated into the project plan	65.30	80.90	70.00
Change control was not monitored, nor dealt with effectively	63.30	85.70	70 .00
Customer/users had unrealistic expectations	69.40	66.70	68.60
Processes did not include reviews at the end of each phase	75.50	47.60	67.10
Development methodology was inappropriate for the project	71.40	52.40	65.70
An aggressive schedule affected team motivation	69.40	57.10	65.70
The scope changed during the project	67.30	57.10	64.30
The project schedule had a negative effect on team members' lives	71.40	42.90	62.90
Project had inadequate staff to meet the schedule	63.30	57.10	61.40
Staff were added late to meet an aggressive schedule	61.20	61.90	61.40
Customers/users did not make adequate time available for gathering requirements	61.20	57.10	60.00

Edara (2011) conducted a quantitative study of the impact of team structure, the host country, software development life cycle, project duration, software developer education, and compensation, on software project success in offshore companies. Data from the regression analysis and Pearson correlation coefficient analysis showed no

relationship between host country and software project success. The study was focused on offshore software development project success, cost savings, and delivery, but it did not define whether project success was related to the quality of the product.

Cusumano, MacCormack, Kemerer, and Crandall (2003) evaluated whether project manager personality, software developer skill, or distributed development play any significant role in project success, but the investigation did not consider the quality of the product. The survey examined 40 projects implemented in the United States and Japan, and 98 deployed in Western Europe, to evaluate the quality of software development and lines of code error rate. Table 4 shows that software developed in Japan was more reliable than those produced in other parts of the world, including India and the United States.

Table 4
Error Rate by Country or Region

Country or Region (Number of Projects)		India (24)	Japan (27)	USA (31)	Western Europe (22)	Total
Software Type	System Software	7 (29.2%)	5 (18.5%)	4 (12.9%)	4 (18.2%)	20
	Applications Software	4 (16.7%)	4 (14.8%)	7 (22.6%)	5 (22.7%)	20
	Custom or Semi-Custom Software	11 (45.8%)	16 (59.2%)	19 (61.3%)	10 (45.5%)	56
	Embedded Software	2 (08.3%)	2 (07.4%)	1 (03.2%)	3 (13.6%)	8
Level of Reliability	High Reliability	8 (33.3%)	12 (44.4%)	8 (25.8%)	4 (18.2%)	32
	Medium Reliability	14 (58.3%)	14 (51.9%)	20 (64.5%)	18 (81.8%)	66
	Low Reliability	2 (08.3%)	1 (03.7%)	3 (09.7%)	0 (00.0%)	6

Software Defects

Jones (2008) studied 600 companies and 13,000 projects in the United States using the defect potential per function point. This measurement is more reliable than the error rate per lines of code because most of the errors were identified during requirement gathering and design, instead of the program coding phase where errors were detected per line of code (Jones, 2008). Jones (2008) found that defect potential was related to the application size, CMMI level, and software type (Jones, 2008, p. 6). Application size or complexity is the difficulty experienced by the programmer in performing tasks such as coding, testing, debugging, or modifying an application or software.

Table 5
Application Function Defect Rate

Application Function	Defect potential
Requirements defect	1.00
Design defects	1.25
Coding defects	1.75
Documentation defects	0.60
Bad fixes	0.40
Total	5.00

Jones' (2008) findings confirmed earlier research by the Gartner group (King, 2003) that a large application designed with low CMMI level would have a high defect potential. Organizations implemented error detection and prevention strategies to identify the cause of the defects, applied corrective measures, and took adequate steps to prevent such errors from occurring in the future (Misirli et al., 2011; Suma & Nair, 2010). Laporte et al. (2012) placed even greater focus on the prevention of poor quality software, noting the costs to fix errors can be as much as 100 times higher than the costs to prevent them.

Table 6 includes a comparison of defect rates among Indian, Japanese, American, and European companies. The findings were that for every 1000 lines of code, Japanese programs had the lowest error rate of 0.005, followed by the United States and India with 0.030 and 0.033 respectively (Cusumano et al., 2003). Differences in quality or defect rate may be due to several factors, including culture, experience, project management style, reward system, or turnover rate (Betz et al., 2014; Laporte et al., 2012). The investigators did not define the reason for the disparity.

Table 6
Defect Rates by Country/Region

	India	Japan	USA	Western Europe	Total
Number of Projects	24	27	31	22	104
Median Output	209	469	270	436	374
Median Defect Rate	0.033	0.005	0.030	0.050	0.030

Software Quality

Different software development methodologies offer advantages and disadvantages, but the selection of the method that can lead to the highest quality depends on several factors, including quality assurance measures (Hijazi, 2012). Laporte et al. (2012) examined software quality assurance (SQA) as an essential requirement for building high-quality software products. Some users rejected SQA because it may be introduced late into the development process, and will not serve the intended purpose, albeit the outcome may be different if defined at the beginning of the project (Laporte et al., 2012).

Some authors believed developers do not apply prescribed methods or certification, as recommended by some CMM researchers to write high-quality software (Delgado, 2007; Phillips & Shrum, 2011). Kassab, Neill, and Laplante (2014) viewed

software quality differently than Yuk (2009). According to Kassab et al. (2014), software quality has no relationship to the defect density or how well it was written; instead, it pertains to customer satisfaction.

The results from the research showed that the respondents might express satisfaction with the quality of the software, but it was over budget, not delivered on time, and some of the resources were either not productive or adequately experienced. The finding by Kassab et al. (2014) did not consider requirement engineering, as was suggested by Perera (2011), therefore the results may be skewed.

Outsourced IT and software projects can be large and expensive (Bordoloi & Powell, 2013). According to Jones (2011), half of these projects fail because of excessive defects, unrealistic delivery dates, and cost. Jones (2011) examined software quality and cost and compared them to two metrics, software cost of quality (CoQ) and defect containment. Jones (2011) supported the recommendations of Jianguo, Jinghui, and Hongbo (2008), and Phillips and Shrum (2011) that capacity maturity model (CMM) will eliminate excessive defects during software development life cycle. Breu, Kuntzmann-Combelles, and Felderer (2014) opined that good knowledge management automation, data analysis, and collaborative processes could produce high-quality software.

Jabangwe, Smite, and Hessbo (2016) emphasized the importance of ongoing research about software defects and factors affecting the quality of outsourced software development. Prior researchers identified several specific factors that relate to software development (Kannabarin & Sankaran, 2011; Setterwall, 2013). Kannabarin and Sankaran (2011) focused on areas of outsourced software development and emphasized on reliability, maintainability, functionality, usability, performance, requirements

certainty, technical infrastructure, knowledge transfer and integration, process maturity, and trained personnel.

Functionality. Functionality refers to the capabilities of software products to perform in ways that meet the specified needs of the user (Kannabarin & Sankaran, 2011). The ability of the software user to access desired functions depends on the functionality available in the software (Amalfitano, De Simone, Fasolino, & Tramontana, 2016). A functional software consists of several sub-characteristics, such as whether the software is suitable, accurate, interoperable, compliant, and secure (Kannabarin & Sankaran, 2011).

Reliability. Reliability pertains to how well the software maintains its expected level of performances across different circumstances and conditions (Liu, Li, Wang, & Hu, 2016). A user's confidence that the software will meet expectations depends on the reliability of the product (Kannabarin & Sankaran, 2011). A reliable software depends on several attributes that enhance the expectations of the user and will perform its intended functions over a minimum period (Liu et al., 2016). Maturity, fault tolerance, and recoverability are required in a reliable software (Kannabarin & Sankaran, 2011).

Maintainability. Maintainability pertains to the efforts required to make specified changes or updates to the software (Amalfitano et al., 2016). The concept of maintainability revolves around the ease to analyze, modify, stabilize, and test the software (Laporte et al., 2012). Maintainability is the ability to upgrade and customize the software.

Usability. Usability refers is the ability to understand, learn, use, and like a software product, and can be measured by the users' perceptions of understandability,

learnability, and operability. Greater usability indicates that a software product is easy to understand, learn and operate (Kannabarin & Sankaran, 2011).

Performance. The performance of software encompasses a set of attributes that affect how the software performs, and not the resources required to produce it (Liu et al., 2016). Efficiency is often a substitute for the concept of software performance (Kannabarin & Sankaran, 2011). For example, time and resources are two attributed related to performance (Laporte et al., 2012). Less time required to operate the software leads to more efficiency, which translates into higher performance (Kannabarin & Sankaran, 2011).

Requirements uncertainty. The concept of requirements vagueness pertains to elements of requirements of the software that may remain unknown until it is put to use (Kannabarin & Sankaran, 2011). Requirements ambiguity emerges from the inabilities to engage in every possible standardized process that could uncover the needs for improvement of functional specifications (Laporte et al., 2012). Previous studies involving the evaluation of poor quality software led to the identification of the uncertainty requirement results as an ill-defined and unstable problem (Williams & Carver, 2012).

Requirements uncertainties lead to delayed projects and extra costs overrun. According to Gopal and Koka (2010), requirements are more significant in outsourcing of software development, negatively affecting the quality of the resultant software.

Technical infrastructure. Technical infrastructure refers to the support facilities and resources of software developers (Laporte et al., 2012). The technical infrastructure encompasses the interrelated hardware, software, and other devices required to support

information flow and processing (Patil & Patil, 2014). Maintaining high software quality depends on the availability and application of the most appropriate tools, materials, methods, techniques, and resources, based on the newest and more relevant technological developments (Laporte et al., 2012). Kannabarin and Sankaran (2011) claimed that technical infrastructure was one of the most important factors implicated in the development of high-quality software, and noted that technical support must regularly be updated to avoid the obsolescence of technology applications that lead to poor quality software development.

Knowledge transmission and assimilation. Knowledge transmission and assimilation pertain to the practice of accessing and understanding important new ideas, skills, applications, practices, and other types of information from outside sources with the intention of integrating it with the existing expertise of employees to improve products (Lysne, 2014). Knowledge transfer and integration required for the development of quality software is a well-known factor recognized in previous research (Betz et al., 2014). Kannabarin and Sankaran, (2011) discussed technical knowledge applied to technical aspects of software development; business application domain knowledge encompasses knowledge about rules, regulations, activities, stakeholders, and customers' needs. Kannabarin and Sankaran identified both types of knowledge as important factors in the development of quality software.

Communication and control. Communication and control refers to structured and unstructured, and formal and informal exchanges of meaningful information (Lysne, 2014). Kannabarin and Sankaran (2011) claimed that the efficacy of bi-directional communication is more important than the quantity. Communication and control also

encompass the open exchanges of resources that can affect the outsourcing relationship as well as the quality of the developed software product (Lysne, 2014).

Efficient and efficacious communication and relationship controls in software development projects reduce uncertainties thereby enhancing the likelihood of improving quality (Gopal & Koka, 2010). Kannabarin and Sankaran noted that communication correlates positively with outsourcing partnership.

Process maturity. Process maturity reflects how close the developing process is to completion and how the process is subject to continuous improvements (Kannabarin & Sankaran, 2011). Continual improvement should stem from evaluations, assessments, and feedback (Laporte et al., 2012). Software development requires high quality in a short time, to ensure that the software is not obsolete by the time it becomes available (Kannabarin & Sankaran, 2011). Quality software involves the development of software with minimal time, effort, and defects (Laporte et al., 2012).

Trained personnel. The availability of trained, experienced, and educated staff is an essential factor required for software quality (Kannabarin & Sankaran, 2011). Individual expert knowledge and capabilities are among the most significant determinants of software performance as an element of software quality (Betz et al., 2014). Trained individuals should have superior knowledge and skills, highly motivated, collaborative, and dependable (Kannabarin & Sankaran, 2011).

Lysne (2014) called trained personnel an encompassing domain of expertise. Kannabarin and Sankaran (2011) discussed the possible mismatch or shortage of adequately qualified staff in offshore software development which affects quality because experienced personnel enhance defect prevention tactics. In offshore outsourcing, a lack

of appropriately trained staff may lead to frequent changes in staffing and a higher risk of poor communication.

Software developer experience. Latorre (2014) investigated the importance of developer experience to the unit test development document, which is an essential part of a software development process. The Latorre (2014) quantitative study used professionals with different levels of experience to collect data that was analyzed to determine the real effort by the developers to use the development technique. Latorre (2014) concluded that the skilled developers did not need the training to apply the testing method.

Software experience may be necessary to design a good quality software (Kannabarin & Sankaran, 2011). Poon, Tse, Tang, and Kuo (2011) performed a similar research with experienced and inexperienced developers, and concluded that experience helps to improve the quality of the computer software. Result from the study indicated that experienced and inexperienced developers make similar mistakes.

Yuk (2009) conducted research on software quality and group performance using 192 volunteer participants to investigate whether a relationship exists between experience, performance, and training. Yuk (2009) found that experienced developers contributed positively to the group performance. Additionally, such individuals found defects in the software faster than those with less experience. The Yuk (2009) study did not find an adequate response to support the relationship between training and group performance.

The complexities of outsourcing require frequent changes to the application, design, and regular deliverables, which must be managed by a dedicated developer (Betz et al., 2014). To confirm the importance of experience to software quality, Perera (2011)

found that the errors identified during software requirement may cost an average software project between 70 and 85% in additional expenses. Laporte et al. (2012) noted that costs could be as much as 100 times higher.

Similar research conducted by Boot, Merriënboer, and Veerman (2006) on novice and experienced software developers found that experience was essential, but a new developer with the thorough knowledge of the business process may be just as useful. Some leaders prefer a novice with a proper understanding of the firm (Boot et al., 2007). Inexperienced developers can affect the quality of the software; thus, companies should strive to maintain high retention rates and avoid hiring young developers (Lysne, 2014).

Kakumanu and Portanova (2006), "If a company can pay a quarter of what a local programmer makes, but the offshore programmer is only an eighth as productive, then no cost savings is really achieved" (p. 5). A software developer's level of experience is directly related to the number of software errors, defects, reworks, and failures on the project (Laporte et al., 2014). The inability of IT companies to retain its workforce results in loss of knowledge, skills, personnel, and additional recruitment costs (Carayon, Schoepke, Hoonakker, Haims, & Brunette, 2006). Overby (2003) referenced a survey by the National Association of Software and Service Companies (NASSCOM), which showed that a 20% turnover rate could affect the productivity of an application. A previous survey conducted by the Information Technology Association of America (ITAA) in 2001, showed that IT companies lost 15% of its workforce.

Employee turnover is a significant problem for business leaders (Larkin, Brasel, & Pines, 2013). Griffin, Hogan, and Lambert (2013) identified how turnover leads to losses in profits and productivity and added costs of recruiting and training new

employees. Uhl-Bien, Riggio, Lowe, and Carsten (2014) and Vardaman et al. (2014) described the lack of effective strategies to retain employees and reduce turnover within all organizations across diverse industries as problematic.

Carayon et al. (2006) believed employees who are not satisfied with the job or committed to the organization, are the most likely to leave. The findings were unclear if the turnover was due to poor remuneration or the individual developer's quest for the perfect job. The research conducted by Ahuja, Chudoba, Kacmar, McKnight, and George (2007) examined turnover in an organization where employees are not co-located. The researchers investigated four important antecedents (work overload, autonomy, the fairness of rewards, and work exhaustion), which were also subjects of later studies (Khan & Gautam, 2014). Findings did not pertain to how these factors may affect the quality of work performed, but related to an employee's organizational commitment (Garnes & Mathisen, 2013).

The research conducted by Melo et al. (2015) applied the dependability approach to evaluating software development risks. The researchers indicated that the failure rate of software projects was 68%, which may result in huge loss of money and time to the company. The researchers opined that when employees leave a project, the developers required to keep the software project on target are affected (Melo et al., 2015). Melo et al. (2015) suggested using more than one developer on a task to serve as the backup for the other. The high failure rate may be a consequence of the company's inability to manage risks such as employee turnover and dysfunctional behaviors (Christ, Mintchik, Chen, & Bierstaker, 2015).

Lee (2016) reported that in 2013, the outsourced market size was almost $83 billion. Prior studies of outsourcing indicated that outsourcing could benefit an organization if properly implemented (Gopal & Koka, 2010; Gurung & Prater, 2006; Vasiljeva, 2012). Existing literature on software developer experience revealed that several researchers (Boot, Merriënboer, & Veerman, 2007; Latorre, 2014; Perera, 2011; Wong, 2011) supported the importance of experience in group performance, software testing, design, and requirement engineering, but were not unanimous on the relationship of these factors to meeting the business needs.

Software developer education. Outsourcing increased the probability of laying-off computer programmers in the United States and other countries, thereby creating a negative image of computer science degrees, diminishing its popularity, and making it less favorable among first-year college students (Bordoloi & Powell, 2013; Patterson, 2005). Chabrow (2004), and Denning and McGettrick (2005) revealed that the number of students who enrolled in computer science programs dropped from 60% to 30% between 2000 and 2004. This resulted in a shortage of graduates that can sustain the software industry in the United States, the largest producer and consumer of software applications in the world.

Shields (2011) conducted research on working adults in Canada to investigate what constitutes qualification for a job, including computer programmers. Shields (2011) found that simple education cannot determine an employee's relationship with a job. The study indicated that informal or implicit learning may be adequate for an employee to perform a job. This study did not investigate any relationship to the quality of software an employee with informal education can produce. Conversely, Betz et al. (2014)

emphasized knowledge acquisition and knowledge transfer as one of the important factors that ensures the successes of outsourcing software development projects.

The United States department of defense (DOD) commissioned the Software Engineering Institute (SEI) at Carnegie Mellon University to design a set of procedures for software development. Engineers at SEI developed and released the capability maturity model for software (CMM) in 1991 (Delgado, 2007). The intention is to apply best practices to software development with CMM. Implementing CMM helps companies assess its capabilities, control process efficiency, and maintain competitive advantage.

Through CMM, developers increase software quality by standardizing the design, implementation, and testing of software through organized plans and processes. This includes standardized steps for project specification creation, employee code reviews, source code checking, and errors/bug tracking (Delgado, 2007; Jianguo et al., 2008). Software quality assurance processes may improve the quality of software products (Laporte et al., 2012). Guzdial (2008) conducted a study on computational thinking and opined that some basic education is necessary for developers to understand object-oriented thinking, essential knowledge needed for complex software design. Betz et al. (2014) emphasized the importance of this basic knowledge required for complex software design, especially in outsourcing software development projects.

The literature on software developer education and training did not present a consensus because some of the researchers did not think regimented design procedures are necessary to produce high-quality software that meets the customer needs. Outsourcing software development provides a lot of benefits to an organization, but with a failure rate of over 70%, only 10% to 20% of these projects meet customer needs

(Edara, 2011). Therefore, organizations should be very well informed to avoid making the same mistakes as previous 70% whose projects failed, resulting in loss of investments. Researchers, such as Betz et al. (2014), recommended the ongoing study of how to solve various problems in outsourcing that can lead to solutions, and associated recommendations to solve the identified problems.

Summary

Current studies on outsourced software focused on product effectiveness, culture, productivity, or cost (Betz et al., 2014; Gurung & Prater, 2006). There was less emphasis on providing high-quality software products at a minimal cost to the company, which Laporte et al. (2012) claimed are high priority goals for software quality. The offshore software development research by Edara (2011) focused on issues that affect the success of the project, cost savings, and delivery.

Edara (2011) examined the issues that influenced the success of a project and evaluated if project manager personality, software developer skill, or distributed development played any significant role in project success. Recognizing the complexity and problems of outsourcing, Lysne (2014) and Batada and Rahman (2011) advised organizations to screen offshore vendors according to business experience, recommendations from clients in the same geographic region, success stories on implementing a similar solution and proven experience in providing support service.

Cusumano et al. (2003) expected successful leaders to consider several aspects of software development before choosing the service provider, including logistics, trust, communication and cultural barriers, defect rate, experience, legal protections, turnover, and discipline. Regarding software quality, Kannabarin and Sankaran (2011) emphasized

functionality, maintainability, usability, reliability, performance, requirements certainty, technical infrastructure, knowledge transfer and integration, process maturity, and trained personnel.

When an organization sends software development work to developing countries, it can reduce expenditures by paying for only what products are needed, refine its competencies, and improve the competitive advantage (Bordoloi & Powell, 2013). Companies in Nigeria that want to compete will continue to outsource software development jobs and services to India and other low-wage countries (Simran et al., 2011), because they can benefit from technology they could not afford or improve on existing technologies (Kakumanu & Portanova, 2006; Lysne, 2014).

The organization can also benefit from the large pool of skilled workers in other countries for a fraction of the local rate, but the quality of the software is not guaranteed (Betz et al., 2014). Outsourcing software development work to countries such as India, Israel, Russia, Ireland, and China may be cheaper, but the customers are not guaranteed efficient software because of the quality (Edara, 2011). The study by Gurung and Prater (2006) focused on the role of culture in the success of outsourcing software work and evaluated the feasibility of outsourced software projects on timelines, cost, and effectiveness. Studies conducted by Vasiljeva (2012) and Wong (2011) led to expectations of substantial management attention throughout a project to guarantee its success and cut cost.

These studies focused more on reducing the cost of outsourcing instead of ensuring that the organization is delivering the high-quality product it expects. Studies conducted by Carayon et al. (2006), Melo et al. (2015) and Overby (2003) investigated

work overload, autonomy, the fairness of rewards, work exhaustion, project timelines, job satisfaction, commitment, and the importance of job retention. Other scholars examined the underlying issues that contribute to the low quality or failure of outsourced software included Kannabarin and Sankaran (2011), and Setterwall (2013).

In response to pressure from stakeholders to earn more profit, organizational leaders are not investing adequate time and money to ascertain and justify the benefits of outsourcing (Bordoloi & Powell, 2013). Outsourcing discouraged firms from recruiting local developers because it was cheaper to select from the pool of experienced programmers in developing countries. Organizations need information that may be useful during outsourcing software work to save such companies unnecessary hidden expenses, unwarranted software development problems, project cancellation or failure, budget overruns, and poor-quality software.

Chapter 3 included a description of the research method selected for this study based on established guidelines for design appropriateness. The chapter includes the review of the research questions and its relationship to the instrument, data collection, and data analysis. The details about the population and sampling include the identification of geographical limitations and sample size. Justifications for the field test of the qualitative study and pilot study of the quantitative study accompany the discussion of reliability and validity of this study. Ethical standards applied in this study included informed consent, and confidentiality procedures explained in the chapter.

Chapter 3

Methodology

This purpose of this mixed methods study was to investigate the factors that may affect the quality of offshore outsourced software products and strategies that can improve the quality of offshore outsourced software development. This study included both qualitative and quantitative methods to obtain information on the views, opinions, and experiences of IT consultants. The study occurred with participants selected from Lagos and Port Harcourt, Nigeria. The information provided by this study will benefit companies participating or considering outsourcing of software development work.

Chapter 3 included exhaustive information on the chosen research technique, and the reasons other research methods and designs would not meet the objectives of this study. This chapter contained details about the research technique, design appropriateness, the population, sampling, instruments, data collection procedure, validity and reliability, and data analysis methods. The sections about informed consent and confidentiality included the details about how the elements of the study adhered to the ethical standards expected for research involving human subjects.

Research Method

Quantitative analysis helps to identify, confirm, compare, and make generalize to contribute to existing knowledge or develop new hypotheses (Leady & Ormrod, 2012). Quantitative research methods involve the collection of numerical data, often in the form of answers to close-ended questions (Marshall & Rossman, 2016). The quantitative approach encompasses structured steps to determine the relationships and describe the

effects of the phenomenon in experimental and non-experimental processes (Neuman, 2009).

Quantitative researchers investigated the effects of certain circumstances on an outcome of interest in a form that entails statistical analysis on numerical data. This method is most effective in constrained or controlled conditions with study events that are free of any undefined influences (Pearce, Christian, Smith, & Vance, 2014; Reio & Shuck, 2014). Qualitative research involves the collection of data in the form of text or narratives, and qualitative data that pertains to factors or variables that may be unknown to researchers (Englander, 2012).

Qualitative researchers rely on data from interviews, documents, and observations, whereas quantitative researchers make primary use of surveys and frequencies (Yin, 2014). Quantitative research includes a relatively larger sample size, while qualitative research methods result in more in-depth data from smaller samples (Marshall & Rossman, 2016). A mixed method research study includes both quantitative and qualitative data to provide more comprehensive results (Denzin, 2012).

A mixed method design is used to collect data through questionnaires, surveys, interviews (Fowler, 2008; Leedy & Ormrod, 2012; Neuman, 2009). The method involves established procedures to gather information about people and practices in business settings (Denzin, 2012). The mixed method was the choice of this study, and enabled the researcher to investigate and determine the factors affecting the quality of outsourced software. Display of the results of the qualitative and quantitative data, involved tables, figures, graphs, and charts, as necessary and appropriate to display the findings of the study.

Research Design

Mixed methods may apply to different types of research designs, with the most common type called a mixed methods study (Denzin, 2012). Mixed methods study research designs allow the researcher to benefit from close-ended numerical data collected from surveys and in-depth textual data obtained from interviews (Hyett, Kenny, & Dickson-Swift, 2014; Yazan, 2015). The survey research method is the process of asking groups of people close-ended questions, storing, tabulating, and statistically analyzing the responses (Fowler, 2008; Leedy & Ormrod, 2012).

Although the sample size in mixed methods study research is often smaller in size than in other quantitative research methods and designs, the data obtained can undergo descriptive statistics, with more limited inferential applications (Denzin, 2012). The mixed methods study accommodates the collection of qualitative data from single cases or multiple cases. In a mixed methods study, the research encompasses several different sources of data from multiple entities (Yazan, 2015).

The goal was to replicate findings across cases, because this research involved multiple informants, geographically dispersed, provided explanations of possible differences within and between cases. The mixed methods study is a robust, reliable, and appropriate for this study.

Research Questions

The research questions aligned with the purpose of the study which was to explore the factors that affect the quality of outsourced software products and strategies that can improve the quality. The answers to these research questions stemmed from data

collected by online surveys, and interviews. The three most important research questions that were the focus of this study are as follows:

Research Question 1 (RQ1): What are the most important factors that affect the quality of software products outsourced from Nigeria?

Research Questions 2 (RQ2): What strategies can outsource companies apply to improve the quality software products for companies in Nigeria?

Research Question 3 (RQ3): What strategies can the offshore developers use to improve the quality of the software developed for companies in Nigeria?

Table 7 shows the mapping of research questions to survey and interview questions.

Table 7
Research Questions and Survey/Interview Questions Mapping

Research Question	Survey Question
1	2-12, 26, 32, 33, 36, 37, 48
2	13-21, 27, 29, 30, 39, 41, 43, 44
3	22-25, 28, 31, 34, 35, 38, 42, 45-47
Research Question	**Interview Question**
1	1
2	2
3	3

Population

This study required participants with knowledge of the IT industry and working experience of outsourcing software development work by companies in Nigeria. The population selected for the study included more than 500 IT professional provided by Accenture Nigeria, and Kabo Nigeria (See Appendix A). The population included functional consultants, solution architects, system administrators, technical consultants, project managers, and software analysts who provided services and solutions to

companies in Nigeria. These participants were at least 18 years of age, and had at least two years of software outsourcing experience.

Sample Size

The sampling strategy for this study was purposeful sampling, designed to identify participants who met certain criteria required to inform the research. Purposeful sampling involves the identification of information-rich informants who are willing to share knowledge about the research topic (McCrae & Purssell, 2016). Anney (2014) stressed the importance of trustworthiness of the research, which requires providing reasonable, well-justified explanations for the choices in the investigation, including sampling strategies.

The two companies, Accenture Nigeria, and Kabo Nigeria provided signed permission to recruit participants from the employment pool. The organizational leaders agreed to provide a list of employee email informational, along with the job titles and length of employment. Emails were sent to all the employees that met the criteria of working at least two years as IT consultants.

The letter of invitation with the informed consent form attached to the emails included the criteria for participation in the study. Prospective participants who expressed interest in the study, self-reported eligibility based on criteria, and who were willing to sign the informed consent form, became a part of the study sample.

Participant selection for a quantitative study. A population of more than 500 IT professionals were recruited to participate in the quantitative online survey. Using 95% confidence level, and 5% margin of error, a minimum of 217 consultants completed the survey for the resulting data to be statistically meaningful (Survey Monkey sample

size calculator). Confidence level measures the reliability of the research. Therefore, if this survey is repeated 100 times under the same conditions, 95 times out of 100, the evaluation will fall within the margin of error.

Pilot Study. A pilot study for the online survey helped to determine that the questions for the survey were appropriate and comprehensive (Morin, 2013). The pilot study verified the validity of the survey questions, tested the possibility of the design, identified the variables of interest, checked the appropriateness of the sample/population, methodologically tested the implementation of the survey instrument, evaluated the efficacy of the research, and assisted the researcher to make changes where necessary.

Connelly (2008) suggested that 10% - 20% of the actual sample size is adequate for the pilot study, while Hill (1998) suggested that 10 – 30 participants should be sufficient. This pilot study used twenty-eight (28) participants, which satisfies the minimum requirement proposed by all the researchers. The pilot study participants completed the online survey instrument (See Appendix B) representing a miniature version of the main study.

Numerical data collected from the pilot study was not part of the data used for analyzing the findings from the research. Feedback provided by pilot study participants about the survey process resulted in revisions of the survey instrument used for the main study (Morin, 2013).

Part of the 47 close-ended questions stemmed from the work of Kannabarin and Sankaran (2011), Laporte et al. (2012), and Setterwall (2013) on quality software development. The areas addressed included functionality, maintainability, usability, reliability, performance, requirements certainty, technical infrastructure, knowledge

transfer and integration, process maturity, and trained personnel. The 47 close-ended questions were in a 5-point Likert scale.

The Likert-style scale was treated as interval variable because the ordered named responses translate to basic continuum or quantitative score to respondents (Willits, Theodori, & Luloff, 2016) with answers choices of 1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree), and 5 (Strongly Agree). Frequencies, and percentages are appropriate descriptive statistics for this data type because they present summary result of respondents' perception of each question in the survey.

The best choice answer format required the participant to select the answer that best reflects the participant's perceptions and experiences. This study used the Likert-type scale to grade the responses because it was statistically easier to describe and summarize (Jackson, 2015). The Likert scale is appropriate when the participant cannot provide a definite answer; therefore, the researcher can assume variations in attitude (Lund & Lund, 2013).

Analysis of Pilot study data: Pilot study helps to establish the reliability of a research. Therefore, the data collected from the pilot study went through similar calculation and analysis as the main study. The numerical data from this study were analyzed with SurveyMonkey analytics tool. The software calculated the weighted average, and percentage of individual response to every pilot study question.

The weighted average was based on the Likert scale value of each response (Strongly Disagree = 1, and Strongly Agree = 5), which provided useful information to summarize the pilot study participants' responses (Lund & Lund, 2013). The result of the

SurveyMonkey analytical tool enabled the researcher to identify a relationship and summarize data for trends or patterns that emerged.

The pilot study survey instrument (See Appendix C) was sent to twenty-eight participants and fifteen (15) of them responded. Eleven (11) respondents were male, representing 73.33%, and four (4) were female, representing 26.67%. All the respondents had outsourcing experience. Those with less than two years of experience represented 40% of the responses; respondents with 2-5 years of experience represented 33.33%, and those with more than five (5) years of experience represented 26.67% of the sample.

Table 10 (See Appendix C) showed responses with a weighted average lower than 3 points, which means most of the participants disagree with the questions. For example, more than 50% of the respondents disagreed with questions 9, 17, 24, 26, and 39. A high-quality software should receive a better response from these questions. Table 11 (See Appendix C) showed responses with a weighted average of 3.0, which means most of the responses neither agreed nor disagreed with the question. Additional investigation was required to understand the result.

Table 12 (See Appendix C) showed responses with a weighted average greater than 3.0, which meant that most of the respondents agreed with the survey questions. Table 13 (See Appendix C) showed the response with the highest number of respondents that strongly disagreed with the question. Additional investigation was required to confirm the result. Table 14 (See Appendix C) showed the response with the highest number of respondents that strongly agreed with the question.

Some pilot study respondents provided additional comments to improve the quality of the research questions. Most respondents suggested a fewer number of research

questions, but observed that the survey was completed in less than 10 minutes, shorter than the 30 minutes anticipated. Additionally, the respondents suggested that some of the research questions should be modified or simplified so that respondents can understand the questions easier.

The result from this pilot study indicated that additional work was needed to enable the researcher to identify the relationship between the factors being investigated and the quality of outsourced software. The feedback from respondents did not affect the number of research questions, but some were modified to make them simple to understand. This pilot study was essential for the researcher's development and ensured that the main study questions were appropriate and feasible. It enabled the researcher to identify items that were useful in the larger study, set success criteria when assessing the feasibility of the research, understand, and plan for the risks expected in the more extensive study.

Participant selection for a qualitative study. A minimum of 20 IT consultants participated in the individual interview for the qualitative study, which exceeded the minimum number of participants for a qualitative study in a typical doctorate-level research (Mason, 2010). The researcher conducted three consecutive interviews with no new information revealed before data saturation was achieved. Marshall, Cardon, Poddar, and Fontenot (2013), opined that sampling should continue until the point of data saturation.

Marhsall et al. (2013) described data saturation as the point at which no new information emerges from ongoing data collection efforts. Although there was a quantitative component of the mixed methods research, the numerical data was for

descriptive purposes. The focus was on the concept of data saturation, which the researcher recognized when the data from any participant began to become repetitive.

Marshall et al. noted that although researchers may have a sample size in mind at the start of the research project, preparations should include plans for a smaller or larger sample size based on the concept of data saturation. Given the wide geographic distribution of the population, Internet-based surveys, and individual interviews were among the most feasible of the options because delivery was fast and inexpensive, and respondents could access the Internet on mobile devices like telephones, notepads, and computers.

Internet-based data collection efforts can reach many respondents more quickly (Moore et al., 2015). Although the use of Internet-based data collection tools narrows the sampling strategy and may lead to biased sampling, the statistics of internet users (2009) showed that there were about 43,989,000 users in Nigeria, which eliminates the chance that members of the population may not be computer savvy.

Field Test. The University of Phoenix IRB suggested that 3-5 experts may be adequate to give feedback on the open-ended questions to determine if the questions were suitable for the study and the participants. The proposed personal interview questions for the qualitative survey were sent to five experts in outsourcing, information technology, and software development, who provided feedback that helped to refine and improve the interview questions, to avoid bias, ambiguity, and reduce repetition. The field test led to changes in the proposed questions to improve terminology, question order, and the number of interview questions planned for the main study.

The three open-ended questions pertained to factors that may affect the quality of outsourced software products and strategies that can improve the quality. These questions required that participants offer a professional viewpoint on the issue, and possibly provide information that may benefit the study. Responses from the open-ended question was not subject to statistical analysis but was qualitatively analyzed to identify themes that helped to answer the research questions.

The purpose of the first open-ended question (RQ1) was to investigate various essential factors that were likely to affect the quality of software outsourced from Nigeria. The respondents were expected to reveal the issues encountered while providing professional service to the client, and possibly reveal some transient factors that elude project managers.

The purpose of the second research question (RQ2) was to examine those strategies that outsourcers can apply to improve the quality of outsourced software development from Nigeria. This was a follow-up to the first research question. Based on experience, the respondents provided strategies that were applied successfully on some of the projects that may have similar effects on other projects.

The third open-ended question (RQ3) investigated strategies the offshore software developers can use to improve the quality of the software developed for Nigerian companies. The question explored the obstacles and challenges developers must overcome to meet quality and user expectation. It provided insight into the role played by vendors in identifying, preventing, and resolving those challenges.

Informed Consent

This component of the study adhered to the ethical guidelines established for human research subjects, including the use of informed consent and confidentiality procedures, as required by the institutional review board (IRB). Invitation letters containing informed consent information were sent by email to all prospective participants. The informed consent provided a description of the purpose of the study, the contact information of the researcher, and details about the participants' responsibilities.

It included the notice that participation in the research was strictly voluntary, and there were no incentives to participate other than contributing to the body of knowledge. There were no tangible benefits, incentives, or enticements to participate and no penalties or consequences for not participating. The data collection process did require in-person contact between the researcher and the human subjects. Therefore, it was impossible to have a signed informed consent.

Any participant could withdraw from the study, before, during, or after data collection without consequences. Notification of intent to withdraw could occur by email or telephone. Participants could send an e-mail to the researcher to withdraw from a completed survey at any time before the survey result was submitted. The researcher could use the identification code assigned to the participant to identify all information related to each participant and delete them where necessary.

Publication of the results of the study occurred without the disclosure of the identities of participants, which remains confidential. No names of participants or third parties identified by the participants appeared in the published reports. The participants were identified only by pseudonyms. For example, S1 referred to the first survey

participant and P1 referred to the first interview participant. The pseudonyms were assigned in the order in which individuals signed for the study. Data remains in locked storage for three years after the publication of the work, followed by thorough destruction and permanent deletion of data, associated documents, and signed informed consent forms.

Confidentiality

The research required the involvement of human subjects. Therefore, it was ethical to protect the identities of participants and safeguard all responses to maintain confidentiality throughout the research (Check, Wolf, Dame, & Beskow, 2014; Ferreira, Buttell, & Ferreira 2015; Tam et al., 2015). The researcher maintained and controlled the information provided by the study participants in a secured area. During review and analysis, a coding process provided additional assurance of participant confidentiality.

Any data considered confidential, such as respondent names were masked, and they were assigned pseudonyms to respect their confidentiality during the interview. Data collected electronically from the survey were anonymous. Participants' names were not used in the study, except for providing electronic signatures for the informed consent process. The encryption process provided by Survey Monkey protects the data from access by third parties.

The only time the researcher will request the participant's information from the survey site will be to identify data from a participant who elects to withdraw, to exclude that data from the analysis in the study. All data from the computer were downloaded to a removable high-speed storage media device for archiving. Research data on the storage

device and documentation collected during the study remain in a secured container in the researcher's office for three years.

The secured container in the researcher's office is a controlled access facility, accessible only by the investigator. All paper copy and electronic media used for the study are in a safe or on a password protected computer, with a password known only to the researcher. The data undergoes destruction after three years by burning papers and permanently deleting the media storage device and all electronic files.

Instrumentation

The questions used in the research pertain to the factors that affect outsourced software quality and strategies to improve the quality of software. The web-administered survey was the quantitative instrument of choice because it was fast, inexpensive, anonymous, and very flexible (Neuman, 2009). The qualitative data was derived from three additional open-ended questions from individual interviews. The distribution of participants across different locations made access through face-to-face instruments complicated within the study period. The study occurred in two phases: completion of an online survey, and the individual interview. A participant completed only one of the data collection processes.

Validity

The validity of a research effort confirms that the data collected reflected what it was meant to measure (Creswell, 2008). Validity pertains to integrity, bias, systematic error, or truthfulness of research (Neuman, 2009). According to Creswell (2008), the instruments used can affect the validity of research and the results must be confirmable (Leedy & Ormrod, 2012).

The validity of the overall research is both internal and external. External validity is concerned with the ability to apply the outcome of the study to other situations and people, and addresses the conditions, circumstances, and time of the study (Roberts, Priest, & Traynor, 2006). External validity determines the possibility of generalizing research findings beyond the study sample and design (Leedy & Ormrod, 2012). This concept applied in qualitative research is transferability, which is subject to the prudent judgment of the readers, enabled by the well-documented descriptions provided about the research (Anney, 2014).

The nature of a mixed methods research study is the combination of qualitative data using a smaller sample, and quantitative study with a larger data sample (Denzin, 2012). This study included both field testing with 3-5 qualitative research experts and a pilot study with about 30 participants, to ensure that the questions were clear, concise, and satisfied the purpose of the survey. Modification of the questions followed the feedback received from the field testing and pilot study processes. Comparisons of the results of the descriptive statistics to the qualitative data (triangulation process) helped to strengthen the trustworthiness of the study findings (Anney, 2014).

Quantitative research validity. Internal validity of quantitative research can be approached in three ways namely content, criterion, and construct validity (Neuman, 2009; Roberts et al., 2006). Content validity confirms to others that the study instrument or tools are measuring what it intended to measure or whether the content included the concept to be measured (Twycross & Shields, 2004). Content validity is adequate in a quantitative study when the researcher conducts a pilot study on a sample population identical to the intended participants in the actual study (Roberts et al., 2006). Secondly,

the researcher ensures that the indicators do not fail to capture the complete content of the concept (Roberts et al., 2006).

Qualitative research validity. The validity of a qualitative research refers to the credibility of the descriptive data, interpretation, explanation, conclusion (Maxwell, 1992). Therefore, emphasis is on the trustworthiness of the data rather than the numerical values of the subsequent validity tests (Anney, 2014). According to Maxwell (1992), there are five categories of understandings qualitative research validity, namely: descriptive, interpretive, theoretical, generalizability, and evaluative validity (Maxwell, 1992).

Descriptive validity checks the accuracy of the researcher's explanation and reporting of the descriptive information, such as the events, objects, people, behaviors, settings, places, and times (Johnson, 1997; Maxwell, 1992). Interpretive validity validates the researcher's accurate interpretation of a qualitative study participant's mindset and whether the researchers correctly perceives the views, thoughts, intentions, feelings, or experiences of an interview in the report (Johnson, 1997). Descriptive validity was considered for this study.

Theoretical validity is the credibility or appropriateness of the theoretical details developed from a study, and how it fits the data (Johnson, 1997; Maxwell, 1992). Maxwell (1992) defined evaluative validity as a process that involves the application of an evaluation framework to the objects of the study, rather than a descriptive, interpretative, or explanatory framework, making it less fundamental in qualitative research than other validity types. This study did not consider theoretical validity.

The last qualitative validity is generalizability, defined as the ability of the researcher's discoveries to apply to persons other than the group being studied, times, or settings (Maxwell, 1992). It has two components namely, (a) generalizing within a community, group, or establishment to settings and events not explicitly observed or persons not interviewed, and (b) generalizing to other communities, groups, or institution. This type of validity was not considered for this study.

Approaches to maximize study validity. This research contains a detailed description of the methodologies and recognized any research shortcomings and probable effects. Researchers (Creswell, 2008; Johnson & Christensen, 2008; McCabe & Holmes, 2009) recommended six strategies to establish rigor and improve the validity of a study, namely triangulation, negative case sampling, reflexivity, peer review, member checking, and audit trail.

Triangulation. Triangulation supports a study by combining methods, and using several kinds of data, including quantitative and qualitative approaches. There are four types of triangulation namely: triangulation of measures, observers, theory, and method (Neuman, 2009).

Measure triangulation takes several steps of the same concept, with the intention of seeing various aspects of the concept (Anney, 2014). Observer triangulation refers to the use of multiple observers in the research to provide different perspectives, social characteristics, or backgrounds to reduce the limitations a single observer may present (Neuman, 2009). Theory triangulation refers to the use of several theories during the research planning or data interpretation (Denzin, 2012).

Method triangulation refers to mixing quantitative and qualitative research methods. Methods triangulation involving multiple methods and multiple informants applies to this research. The researcher used the quantitative and qualitative data in the analysis, with single theory interpretations. By using large participants in the survey and detailed individual interview, the credibility of the research was established (Shenton, 2004).

Negative case sampling. This process requires locating and investigating cases that disagree with the provisional expectations or explanations of a researcher (Johnson & Christensen, 2008). Qualitative studies researchers use this strategy to reduce the effect of the researcher's bias, by deliberately seeking scenarios that produce the opposite effect. The study did not use negative case sampling.

Reflexivity. This concept is grounded in the epistemological belief that the researcher cannot be excluded from what is being researched. Mostly, the study may bring in the investigator's values, biases, and experiences (Creswell, 2008; Newton, 2009; McCabe & Holmes, 2009). Newton (2009) opined that reflexivity should not be viewed as a threat, rather "opportunities or possibilities to provide insight into the practice of doing research" (p. 106). Any personal reflections recorded or perceived during this study was included in the final report.

Peer Review. This study included triangulation and peer review strategies to improve validity. Peer review procedures require the researcher to discuss the study findings, conclusion, analysis, and interpretations with other researchers or people interested or involved in the study (Anney, 2014). These peers may be committee members or people familiar with the study (Roberts et al., 2006). Peer reviewers may

require additional information or feedback beneficial to the research (Hyett et al., 2014). The committee members of this study reviewed the outcomes of the research and scrutinized the methods, design elements, and the results.

Member Checking. Researchers adopt this strategy to validate the accuracy of the transcribed text, by discussing the transcribed interview with the participant and requesting for verification and confirmation, thereby addressing the descriptive and interpretive validity threats (Cooney, 2011, Johnson, 1997). This research gave participants access to the interview transcripts, requested them to verify that the recordings were captured correctly, and the feedback was included in the final report, thereby satisfying the requirement for rigor in qualitative research.

Audit Trail. A proper research should be adequately documented to ensure that it can be replicated by another researcher quickly (Cooney, 2011). The audit trail is established in the logs, journals, memos, notes, computer files of the research tools, and other relevant data. This study provided all relevant audit trail documents to enable the audience or researchers to trace the path of the study, step-by-step using the procedures and decisions described (Shenton, 2004).

Transferability

This is the application of the findings of this study to other situations. It required the researcher to demonstrate that the result of the study can be applied to a larger sample size or population (Creswell, 2008; Shenton, 2004). This study adequately addressed transferability because:

- Participants were at least 18 years of age, had at least two years working experience as an IT consultant involved in the outsourcing of software development
- Participants were employees of Kabo Nigeria, Accenture Nigeria, all based in Nigeria
- A minimum of 500 respondents were contacted to participate in the study
- Data was collected through online survey and individual interviews
- The study conducted two data collections over a period of twelve weeks

Confirmability

This is the final criteria required to test the trustworthiness of a study. The primary goal is to establish the qualitative researcher's objectivity "that the work's findings are the result of the experiences and ideas of the informants, rather than the characteristics and preferences of the researcher" (Shenton, 2004, p. 72). This study triangulated the interview data with the participant to eliminate researcher bias and ensured that researcher beliefs and assumptions were reported.

Data Collection

The use of qualitative and quantitative data led to the identification of the method as a mixed methods study. The data included quantitative data (from close-ended questions on the online surveys) and qualitative data (from open-ended interview questions). The collection of data occurred with multiple informants working across different settings.

Prospective participants were invited through the email addresses provided by the companies who signed agreements to provide access during participant recruitment, and

they could contact the researcher with questions about the study. Participants had a choice of completing the anonymous online survey, or individual interview. Data collection occurred after the prospective respondents agreed to the conditions of the informed consent.

Data collection for online survey. Each selected participant was registered with a pseudonym S#, with 'S' representing the survey process and # representing the sequential number assignment. An invitation email for online survey participants (See Appendix D) instructed those interested in participating in the survey to click a link included in the email to be transferred to the questionnaire page, which started with the consent form (See Appendix E). Respondents acknowledged the terms of participation to continue with the survey or chose to leave.

Each survey page offered the participant an opportunity to withdraw from the study or not answer survey questions. Each survey question included the option to avoid answering the question or withdraw from the study by exiting the survey. Completion of the entire survey took no more than 30 minutes, representing approximately 30 seconds to read each question and reflect on the possible answers. All unsubmitted survey documents were considered incomplete or missing, and were excluded from the data analysis.

Data collection for individual interview. The minimum number of participants for a qualitative case study was eight (Creswell, 2012). This study interviewed a minimum of 20 participants to achieve a theoretical saturation of data (Hart, 2009). The invitation email for interview participants (See Appendix F) instructed them to reply the researcher with the email address provided in the invitation email. Those who replied the

researcher were assigned a pseudonym P#, with 'P' representing the interview process and # representing the sequential number assignment.

The researcher negotiated the interview date and time with each participant by e-mail. A semi-structured interview is the most modern data collection process for qualitative research because it allows the interviewer to ask a set of field-tested open-ended questions and unambiguous follow-up questions depending on the participant's response (Maxwell, 2012; Swanborn, 2010). Unlike the structured format that applies restricted guidelines, the interviewer guided the entire interview process to ensure that every interview was unique to each participant.

When the interview date and time was agreed, interview participants received instructions through e-mail, for the private telephone call session specifically for the survey. The instruction included the interview date and time. Ali et al., (2014), and Ozer and Douglas (2015) recommended that participants choose a quiet, comfortable, and private place for the interview, to avoid distractions, and ensure that the recorded interview is precise and reliable.

The interview process. Upon getting into the telephone call, the researcher welcomed the participant, introduced the purpose of the telephone call, and allowed participant to introduce himself or herself. The researcher read the consent form (See Appendix E), and asked the participant for any questions that needed clarification. The researcher ensured that the interview environment was confidential, anonymous, and free of any outside influence or intimidation before starting the interview.

The researcher informed the participant that a digital recorder was used throughout the interview process to ensure that the participant's responses were

captured accurately. The participants confirmed that he or she was satisfied with the entire interview process, and permitted the researcher to start recording the interview. The researcher had an interview sheet with all the approved open-ended questions, two black pens, a pencil, glass of water, notebook, and digital recorder.

The interview sessions lasted between 30-45 minutes, representing 10 minutes per question, and additional time for the researcher to ask follow-up questions or capture extended responses from the participant. After each interview, the researcher thanked the participant for participating in the interview process, stopped the recording, and downloaded the file from the digital recorder to a secured hard drive on the researcher's computer for later transcription.

The researcher interviewed 23 participants to achieve a theoretical saturation of data (Hart, 2009). Creswell (2012) suggested that there was no reason to continue the interview when no new information was feasible because data saturation had occurred. The researcher reached data saturation when participant responses became repetitive and insignificant.

The recording of the session allowed a verbatim text of the session to occur, and the researcher commenced the transcription of the interview into Microsoft Word (MSWord) text following each interview. Each recorded interview was transcribed three times to ensure that each conversation was converted to text accurately. Each file was named with the participant's pseudonym and transferred into sources folder in NVivo 11 software application provided by the University of Phoenix. The nodes in NVivo 11 were used to compare the responses of participants to the research and theoretical framework.

Reliability

Reliability of research is interrelated with the validity. Neuman (2009) suggested that reliability of measurement can be increased by applying clear conceptualized constructs, using a precise standard of measurements, multiple indicators, and using pilot study or tests. Validity determines the accuracy of the measurement, while reliability measures the ability to replicate the research and produce consistent results (Neuman, 2009). Reliability ensures that results do not change in repeat studies (Neuman, 2009). Roberts et al. (2006) discussed three types of reliability namely: stability reliability, representative reliability, and equivalence reliability (Neuman, 2009).

Stability reliability is the ability of the measurement to produce a consistent result at various periods if the source of measurement does not change. Representative reliability is the ability of the measurement to produce consistent result across different social groups. Equivalent reliability is the measure that provides consistent or similar results using various specific indicators, but the same construct (Neuman, 2009). Equivalence reliability was achieved in this study through the pilot study. Multiple forms of data collected using precise and consistent measurement format on the closed-ended survey questions, open-ended interview questions, and conceptualized constructs based on a thorough review of the previously published literature.

Neuman (2009) explained that better reliability stems from data collection performed at a refined level. According to Neuman, when researchers measure more accurate information, the possibility of measuring anything different from what was intended is reduced or eliminated. The study included field testing of the qualitative instrument to increase the reliability because the draft instruments were subject to review

by committee members, academics, IT experts and professional colleagues to test the responses and refine the open-ended questions in the data collection instrument.

The purpose of the pilot study was to test the quantitative survey questions with a pilot group to further refine the questions to ensure a clear, relevant, and easy to apply process with content and timeframe appropriate for the study. Data collected from the pilot study was not part of the data analysis for the primary study of this research but helped to refine the data collection efforts. Morin (2013) opined that pilot studies enable the researcher to replicate the study internally, possibly make some changes, and improve the quality of the measure over time.

According to Shenton (2004), "to address the dependability issue more directly, the processes within the study should be reported in detail, thereby enabling a future researcher to repeat the work, if not necessarily to gain the same results" (p. 71). Although repeat studies are beyond the scope of this research, it provided concise descriptions of the research process, population, sampling strategy, instruments, and analysis process to enable others to apply similar methods to future study (Anney, 2014).

Data Analysis

Rowley (2012) recommended four steps in mixed methods data analysis. The first step involved organizing the data sets that stemmed from the different sources and approaches. The second step was to become acquainted with the results of the inspected data. The third step involved describing, interpreting, and explaining the data. The final step was the presentation of findings including the results of the qualitative and quantitative data analysis processes, described with consideration of the relationship to each other, theoretical frameworks and literature that provided the foundation for the

study (Rowley, 2012). This final step of the mixed methods case study connects the literature, framework, methodology, and results of the study (Yin, 2014).

The juxtaposition of the results with previous research findings strengthens the trustworthiness of the study, the primary themes, and the answers to the central research question (Denzin, 2012). The data analysis process included both a qualitative and quantitative component as recommended by Denzin (2012) for mixed method case studies. The steps included data preparation, data importation into Statistical Package for the Social Sciences (SPSS) and NVivo 11 qualitative data analysis software, identification of response rates and biases, actual analysis of the collected data, and reporting of the findings.

The results were discussed against the real data and juxtaposed to the previous literature and theoretical framework for the study. SPSS quantitative analysis software and NVivo 11 qualitative analysis software provided the analyzed data for the research and interview questions.

Quantitative data analysis. When the online data collection process was completed through SurveyMonkey website, the tool coded the responses from the participants. The quantitative data from the 47 Likert-type closed-ended questions of the online survey was downloaded from the SurveyMonkey website to a personal computer in Excel and SPSS file formats. The raw data was imported into the SPSS software for analysis, and enable the researcher to identify a relationship, and summarize the data for trends or patterns as they emerged. The inspection of the responses in a numerical format was performed to eliminate possible human errors. Inspection of the raw data occurred to identify and exclude incomplete surveys or those with obvious errors. The demographic

information provided by participants was used to describe the sample of participants that completed the online survey.

Additional descriptive statistics followed the description of the sample, including frequencies and percentages of the respondents' answers to the questions. According to Leedy and Ormrod (2012), SPSS is user-friendly for several statistical procedures. A summary of analytical results can show the central tendencies graphically like mode, median, and mean (Marshall & Rossman, 2016), or spread of the data including range, absolute deviation, quartiles, standard deviation, and variance (Creswell, 2008).

The calculation of the mean, median, standard deviations and mode provides useful information that summarizes the participants' responses (Lund & Lund, 2013). The result of the statistics produced by SPSS may enable the researcher to identify a relationship, summarize data for trends or patterns that may emerge. Statistical analysis enabled the researcher to determine the overall perception of participants on outsourcing software development and the spread of factors that affect the software quality.

Qualitative data analysis. The answers to the three open-ended questions of the individual interview sessions was in textual form and subject to qualitative data analysis. The purpose of the qualitative data analysis is to identify themes that emerge from the data (Englander, 2012). Individuals selected for the interviews were a minimum of 20, and additional participants were added to ensure that enough information was collected to develop and saturate the model (Creswell, 2008).

The software NVivo 11 facilitated the organization of the qualitative data analysis process, expedited data analysis involving voluminous amounts of qualitative data, offered options for the display of related findings (QRS International, 2014). The use of

NVivo 11 helped to maintain organizational consistency of the data analysis process and led to the identification of trends in the data, convergence, the divergence of common words and phrases, and connections among ideas expressed by participants from the various sources of data. It also helped with the identification of the major concepts expressed in the data that the researcher used to confirm the emergent themes for the study (Bazeley & Jackson, 2013; Castleberry, 2014).

The identification of themes started with reading and re-reading the textual data, and studying the answers to the open-ended interview transcripts (Hyett et al., 2014). Organizing the data into categories began with classifying and coding the data based on descriptive words or phrases that appear repetitive or significant to the research topic (Wilson, 2012). Coding of data led to the larger formation of broader patterns that informed the themes. The identification of themes occurred with the assistance of NVivo 11 qualitative data analysis software (Bazeley & Jackson, 2013; Castleberry, 2014).

Summary

Chapter 3 included descriptions of the research method, design, and appropriateness of those choices. The chapter included details about the population, sampling strategy, data sources, data collection method, validity, reliability, and data analysis. Information provided to the respondents included a description of the research purpose and assurances of participant confidentiality, available in the informed consent form. Participation in the study was voluntary.

Participants signed informed consent forms before data collection. The survey and individual interviews included specific and open-ended questions on outsourcing software development and quality, and it occurred because of the convenience and ease

of delivery. Participants could withdraw from the study at any time by exiting the questionnaire or interview, or communicating the intent to withdraw. Responses were downloadable from the survey monkey website, stored in a private, password protected, removable media device accessible only to the researcher, that will be deleted after three years. Data analysis involved triangulation using data from qualitative and quantitative analysis.

Chapter 4 included the presentation of findings from the portion of the sample that completed the online survey and open-ended interviews. The results of the descriptive statistics performed on the quantitative data augmented the results of the qualitative data analysis. Graphs, tables, and figures represented the data findings, as necessary and appropriate, to provide a visual representation of the results of the study.

Chapter 4

Presentation and Analysis of Data

The purpose of this mixed methods study was to explore the factors that affected the quality of offshore outsourced software products in Nigeria, and strategies that can improve the quality. The questionnaire was distributed to 500 IT executives, functional, and technical consultants, project manager, and other IT professionals to identify factors required to produce high-quality outsourced software. Additionally, interviews invitations were sent to 50 IT Managers, and professional to identify common themes essential to the quality of outsourced software (Kannabarin & Sankaran, 2011; Laporte et al., 2012; Setterwall, 2013). Chapter 4 is a presentation of the finding of questionnaires completed by 226 IT executives, functional, and technical consultants, project manager, and other IT professionals with experience in software outsourcing, and the interview conducted with 23 IT managers and professionals.

Pilot Study

A pilot study with IT professional in Nigeria was used to test the appropriateness, feasibility and suitability of the questions, to enable the researcher to identify useful facts needed to conduct the more extensive study and plan for risks that may be expected in the study. The Pilot study helped to establish the reliability of the research because the data collected from this study went through similar calculation and analysis as the main study. The numerical data from the pilot study was analyzed with SurveyMonkey, provided by the University of Phoenix.

The software calculated the weighted average, and percentage of individual responses to every pilot study question. The weighted average was based on the Likert-

scale value of each response (Strongly Disagree = 1, and Strongly Agree = 5), which provided useful information to summarize the pilot study participants' responses (Lund & Lund, 2013). The result of the SurveyMonkey analysis enabled the researcher to identify a relationship and summarize the data for trends or patterns that emerged.

The pilot study survey instrument was sent to twenty-eight participants, and fifteen (15) of them responded. There were eleven (11) male respondents, representing 73.33%, and four (4) female respondents, representing 26.67%. All the respondents have outsourcing experience. Those with less than two years of experience provided 40% of the responses; respondents with 2-5 years of experience represented 33.33%, and those with more than five (5) years of experience represented 26.67% of the respondents.

The pilot study result was grouped by similarities in responses. Table 10 (See Appendix C) shows responses with a weighted average below 3 points, which means most of the participants disagree with the questions. For example, more than 50% of the respondents disagreed with questions 9, 17, 24, 26, and 39. If the outsourced software was of high-quality, the participants should have provided better responses to these questions. Table 11 (See Appendix C) shows responses with a weighted average of 3.0, which means the majority of the responses neither agreed not disagreed, which may mean that additional investigation was required to understand this result.

Table 12 (See Appendix C) shows responses with a weighted average greater than 3.0, which means a majority of the respondents agreed with the survey questions. Additional investigation was required to confirm the reliability of the result. Table 13 (See Appendix C) shows the response with the highest number of respondents that strongly disagreed with the question. Additional investigation may provide a better

understanding of the responses to the question. Table 14 (See Appendix C) shows the response with the highest number of respondents that strongly agreed with the questions. A broader investigation of this question was required to explain why the majority of the responses were positive.

Some pilot study respondents provided additional comments to improve the quality of the research questions. Most respondents suggested that the number of survey questions should be reduced, though most of the survey was completed in less than 10 minutes, shorter than the 30 minutes anticipated. Additionally, some respondents suggested that certain research questions be modified or simplified to make them easier to understand.

The pilot study result showed that additional work was needed to enable the researcher to identify a tangible relationship between the factors being investigated and the quality of outsourced software. The feedback from respondents did not affect the number of research questions, but some questions were modified to make them simple to understand. This pilot study was essential for the researcher's development and ensured that the main study was appropriate and feasible. It provided the researcher useful information that were beneficial to conduct the larger study, set success criteria when assessing the feasibility of the research, understand, and plan for the risks were expected in the more extensive study.

Data Collection Process

Before contacting the research participants, the University of Phoenix Institutional Review Board approved the data collection process. The data collection for the qualitative segment of the research involved open-ended interview of executives,

functional, and technical consultants, project manager, and other IT professionals. The executives, functional, and technical consultants, project manager, and other IT professionals were recruited through the contact information provided by their employers.

The researcher invited 50 participants through email and phone calls to the interview. Those who accepted to participate were contacted by email and scheduled for an interview on separate days. 23 IT professionals participated in a 15-minute telephone interview to provide individual experience and perception of outsourcing software development from Nigerian. The interview data enabled the researcher to identify four transcribed themes namely business process, project management, business requirement, and vendor.

The data collection process for the quantitative segment of the study involved a 5-point Likert-type scale survey, with the answer choices of 1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree), and 5 (Strongly Agree). The questionnaire consisted of 47 items developed through a rigorous review of the literature on outsourcing (See Appendix B). The 226 executives, functional, and technical consultants, project manager, and other IT professionals were recruited through employer-provided contact information, which included e-mail addresses and telephone numbers.

The participants were sent invitation e-mails (See Appendix D) to participate in the survey. Those interested in the participating in the survey clicked the SurveyMonkey link included in the email, to be redirected to the questionnaire. The first page of the questionnaire contained informed consent (See Appendix E) followed by the survey

questions. The survey result presented the perception of the participants on the quality of software outsourced by companies in Nigeria.

Demographics

The survey collected demographic information of the participants to determine how many participated, how many completed the full surveys. Out of the 226 IT professionals who responded to the survey, 158 (69.9%) were male, and 68 (30.1%) were female (see Table 9). Additionally, out of the 23 executives, functional, and technical consultants, project manager, and other IT professionals who participated in the interview, 19 (82.6%) were male, and 4(17.4) were female.

Description of the Sample

The sample for the mixed methods research consisted of executives, functional, and technical consultants, project manager, and other IT professionals who worked in Lagos, and Port Harcourt, Nigeria. A total of 500 executives, functional, and technical consultants, project manager, and other IT professionals received the survey instrument, but only 226 responded. A total of 50 executives, functional, and technical consultants, project manager, and other IT professionals were contacted to participate in the interview, but only 23 were represented.

Methodology

The methodology utilized for this mixed methods case study had characteristics of both qualitative and quantitative data collection and analysis. The researcher investigated and explained the observations and perceptions of IT professionals on the quality of software products outsourced from Nigeria. The mixed method provided insight into factors that affected the quality of software outsourced from Nigeria. The case study and

interviews explored the research participants' perception of outsourcing and reinforced the validation of the mixed method approach.

Validity of the Research Instrument

The researcher recorded the interviews, transcribed, and sent them to all the interview participants to cross-check and validate their responses, to eliminate ambiguities, and confirm that the researcher recorded the interviews correctly. This aligned with the requirements of interpretive validity (Johnson, 1997). Feedback from the pilot study helped to verify the validity of the survey questions, tested the possibility of the design, and identified variables of interest. It checked the appropriateness of the sample/population, removed ambiguity, methodologically tested the implementation of the survey instrument, improved clarity, and evaluated the efficacy of the research (Morin, 2013).

Reliability of the Research Instrument

The researcher developed a 47-item Likert-style scale for the quantitative data collection instrument, which met the expected purpose of this study. The study was focused on software quality, the outsource vendor, and developers. The participants received email invitation which included a link to the questionnaire on SurveyMonkey website. The questionnaire included the informed consent on the first page. SPSS 24 was used to calculate the Cronbach's alpha of the responses. The Conbach's alpha for each survey question is displayed in Appendix G. Table 8 shows Cronbach's alpha of .982 for all the 47 questions, which confirms that the reliability of the research instrument is reasonable.

Table 8
Reliability Statistics for the Main Study

Main Study		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
.982	.982	47

The researcher used SPSS 24 analysis tool to calculate the mean and standard deviation of responses to each question. As shown in Table 15 (See Appendix H), the standard deviation of each survey question is close to 1 which confirms that responses to the questions were uniform.

Summary of the Quantitative Findings

The survey collected demographic information of the participants to determine how many participated and completed the surveys. Out of the 226 IT professionals who responded to the survey, 158 (69.9%) were male, and 68 (30.1%) were female (see Table 9).

Table 9
Participants Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	158	69.9	69.9	69.9
	Female	68	30.1	30.1	100.0
	Total	226	100.0	100.0	

Questions 2-12, 26, 32, 33, 36, 37, 48 focused on IT professionals' perception of the quality of software outsourced from Nigeria (see Figures 1 – 9). On the question of outsourced software fulfilling the user requirements, there were 226 responses, 63% agreed, but over 10% disagreed. Out of the 225 who responded to questions on the delivery and integration requirement of the outsource software, 61% agreed that the software was delivered on time, and satisfied the integration requirements.

Out of the 226 who responded to the question about outsourced software results, 62% agreed that the results of outsourced software were accurate. Out of the 224 who responded to the question about the stability of the outsourced software, 59% agreed that the software was stable and unlikely to fail easily, but 18% disagreed. On the question of outsourced software withstanding system failures, 65% of the 224 who responded agreed that the system was able to withstand system failures and return to optimal performance. On the question of reliable results, 64% of the respondents agreed that outsourced software exhibited reliable results under different conditions, similar to the 61% who agreed that the results were accurate.

On the question of scalability and change management, 62% of the 225 who responded agreed that outsourced software was scalable and included change management features, which prepared the users for the new application. On the question of making changes to the software, 62% of the 225 who responded agreed that making changes to outsourced software was easy, but 19% disagreed with that perception. On the question of signing off on requirements, 71% of the 225 who responded agreed that stakeholders signed off on the requirements on time.

On the question of the effect of country-specific requirements on the quality, 74% of the 226 respondents agreed that country-specific requirements could affect the quality of software development projects. 224 participants were asked if business domain knowledge can affect software quality, and 73% agreed with the perception that business domain knowledge transferred from the clients impacted the quality of software developed offshore. On the question of proper project management of the outsourced software, 62% of the 225 who responded agreed that proper leadership coordination

helped to integrate the knowledge between offshore and onsite resources, and 63% of the 226 who responded agreed that software development and project management were defined to achieve product quality. On the question of the relationship between proper communication and quality software, 83% of the 225 who responded agreed there was a relationship between proper communication and the quality of outsourced software product, 4% disagreed, but none of the respondents strongly disagreed with the question.

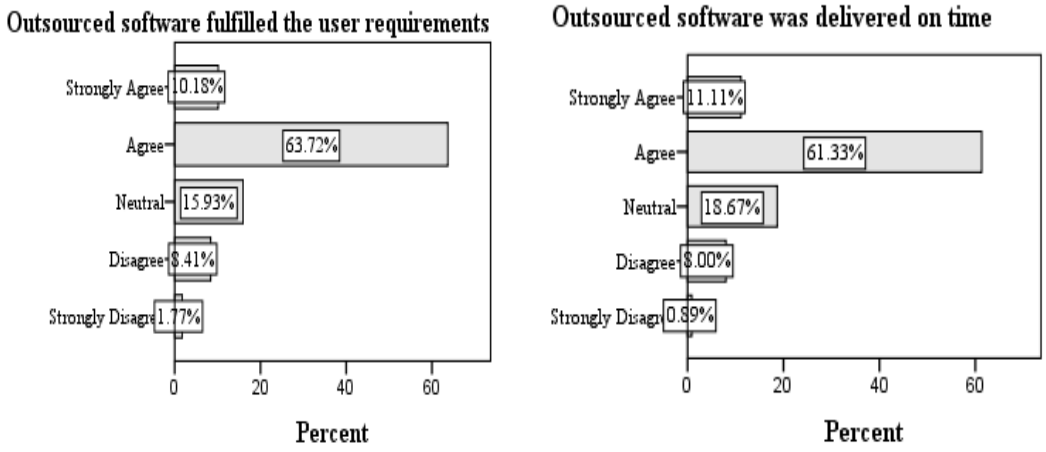

Figure 1. Fulfillment of user requirement and on-time outsourced software delivery.

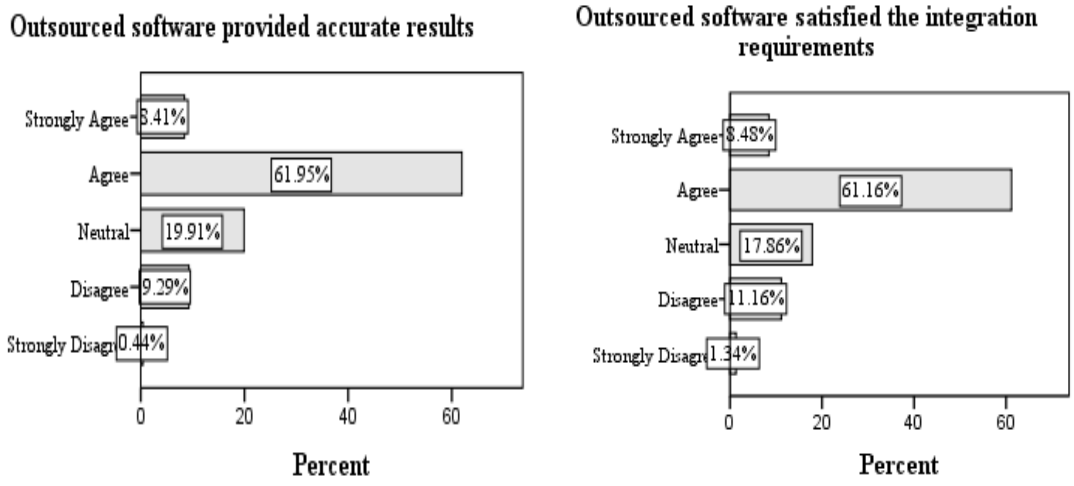

Figure 2. Accuracy of the results and satisfaction of the integration requirements.

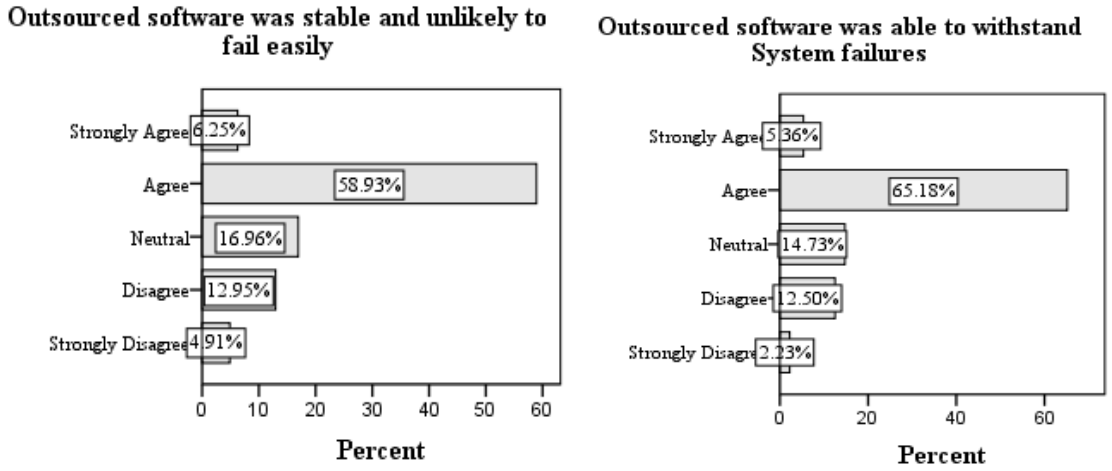

Figure 3. Software stability and probability to withstand failure.

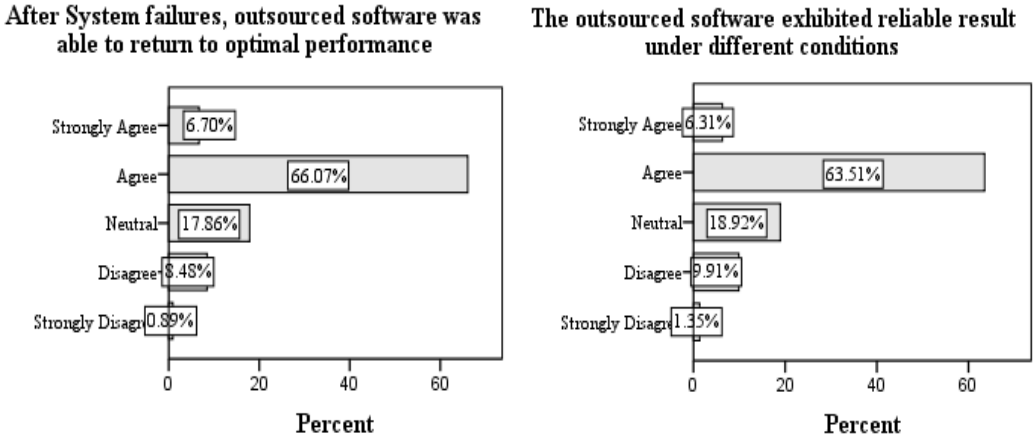

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Figure 4. Outsourced software ability to return to optimal performance.

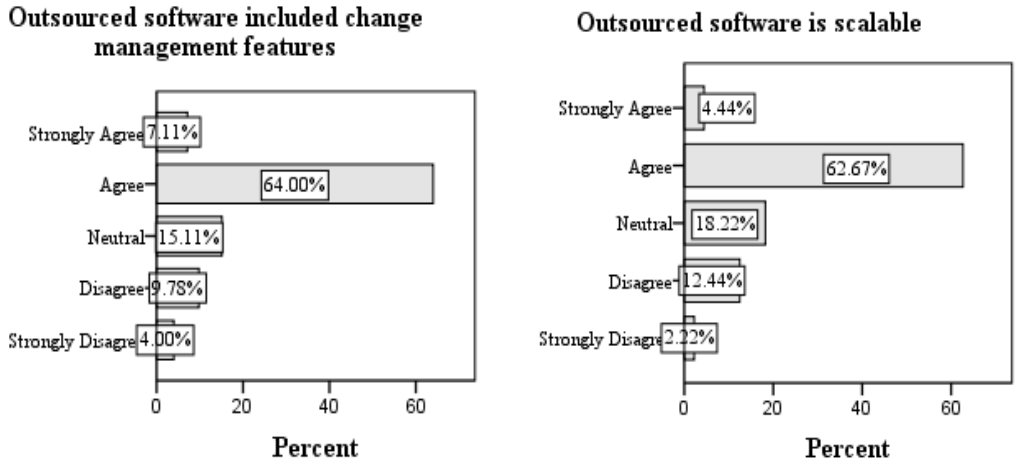

Figure 5. Change management features and scalability.

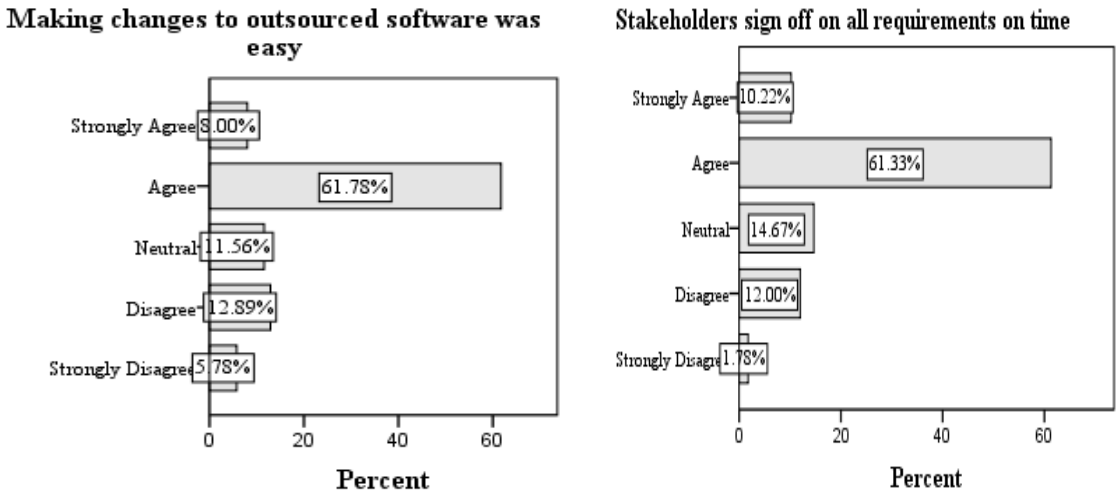

Figure 6. Changes to outsource software.

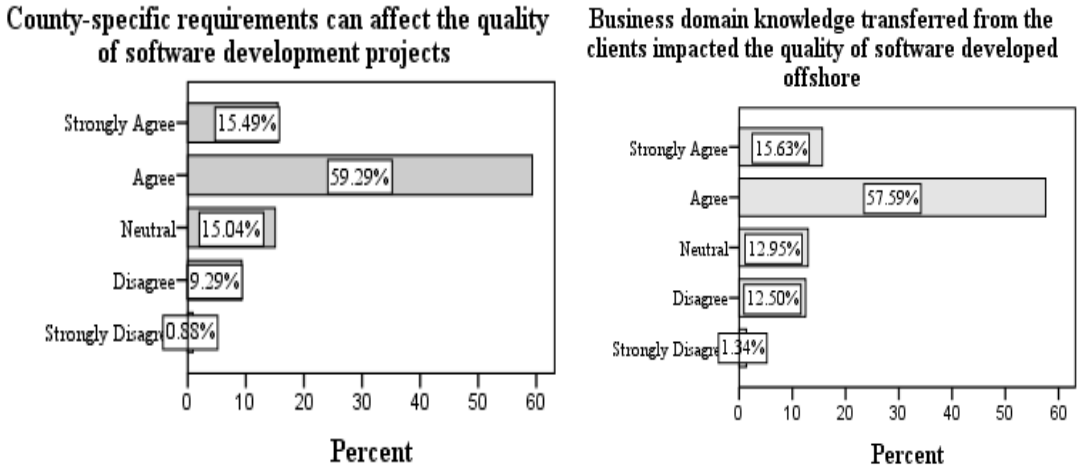

Figure 7. Effect of country-specific requirements.

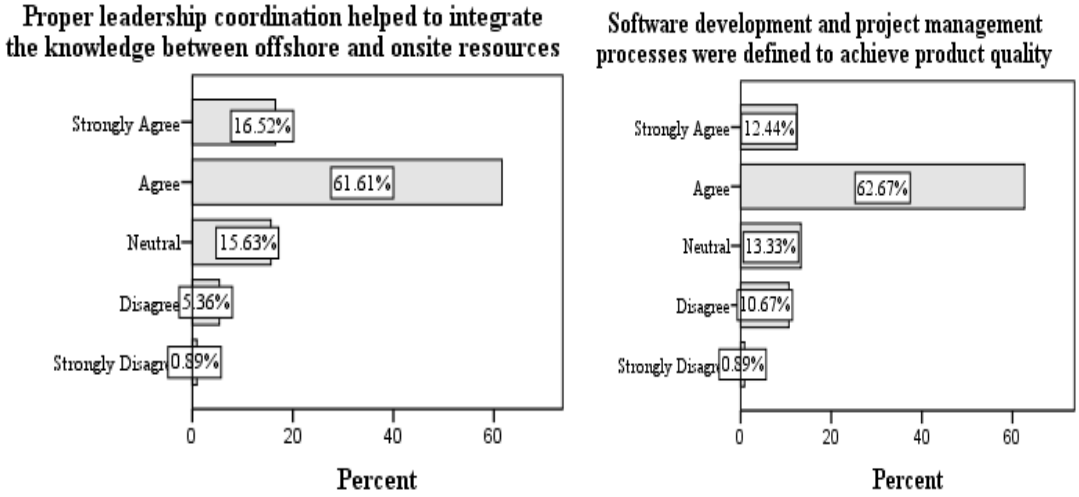

Figure 8. Proper leadership on knowledge integration.

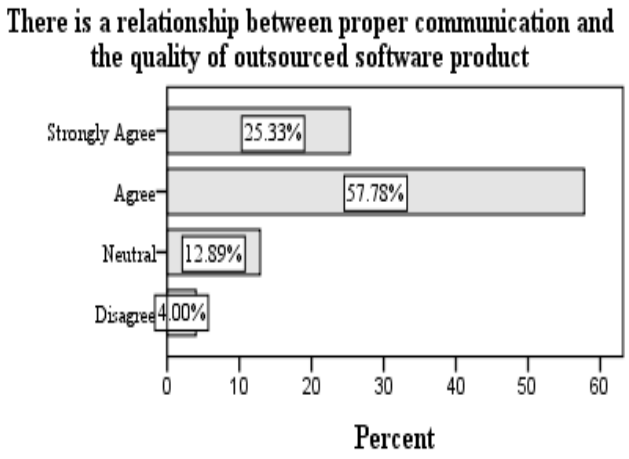

Figure 9. Relationship between proper communication and software quality.

Questions 13-21, 27, 29, 30, 39-41, 43, and 44 were focused on IT professionals' perception of strategies the outsource vendor applied to improve the quality of the software for companies in Nigeria (see Figures 10 – 18). Regarding the 225 who responded to the question on vendors providing documentation, 70% agreed that vendors provided comprehensive documentation of the outsourced software. A total of 225 participants responded to the question on users experience of the software interface, and 72% agreed that users appreciated the software interface.

Regarding the 225 who responded to the question on installing, learning and understanding outsource software, 68% perceived that the software was easy to install, 71% agreed that it was easy for different users to learn, while 66% agreed that outsourced software was easy to understand. Regarding the 222 who responded to the question on the impact of outsourced software on company operation, 69% agreed that outsourced software products made the company operation easier. Regarding the 222 who responded to the security features included in the software, 77% perceived that the software included adequate security features.

A total of 223 participants responded to the question on troubleshooting and detecting failures in outsourced software, and 65% perceived that failures in outsourced software were easy to troubleshoot and detect. Regarding the question on the response time of outsource developers, 65% agreed the response time of outsourced developers satisfied user expectation during software failure. Regarding the 225 IT professionals who responded to the question on the tools used to convert client needs to requirement specifications, 69% perceived that proper tools were used to convert client needs to requirements specifications.

A total of 225 IT professionals responded to the question on the licenses and development tools provided to offshore outsource resources, and 82% perceived that offshore outsource resources were provided necessary licenses and access to development tools needed to complete the task. Regarding the 226 IT professionals who responded to the question on the levels of maturity set by the vendor, 68% perceived that outsource providers set higher levels of process maturity than the customers expected. Regarding the 225 IT professionals who responded to the question on the use of metrics in software development, 65% perceived that detailed metrics were used for all offshore software development projects.

On the question of availability of adequate, trained or additional resources to implement a project, 67% perceived that the outsourcers provided adequate resources throughout the duration of the project. 68% agreed that trained personnel were always available to implement the project, while 72% perceived that additional resources were recruited to take up the outsourced project when necessary.

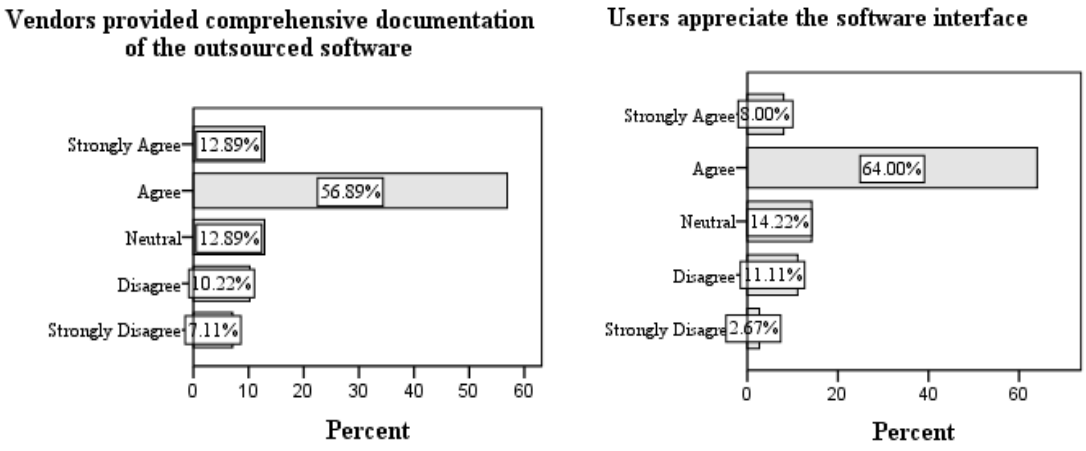

Figure 10. Vendors documentation and users experience of outsourced software.

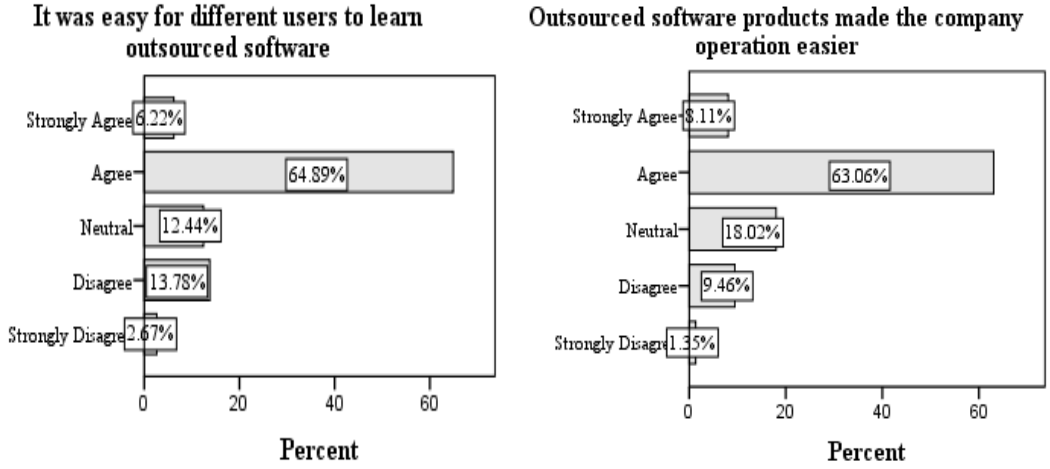

Figure 11. Outsourced software and how it impacts the company's operation.

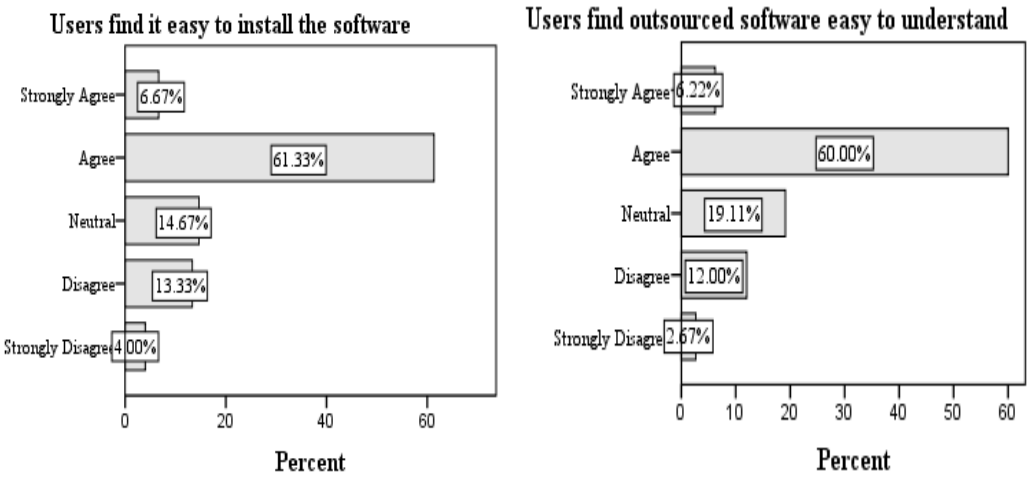

Figure 12. Understanding and installing outsourced software.

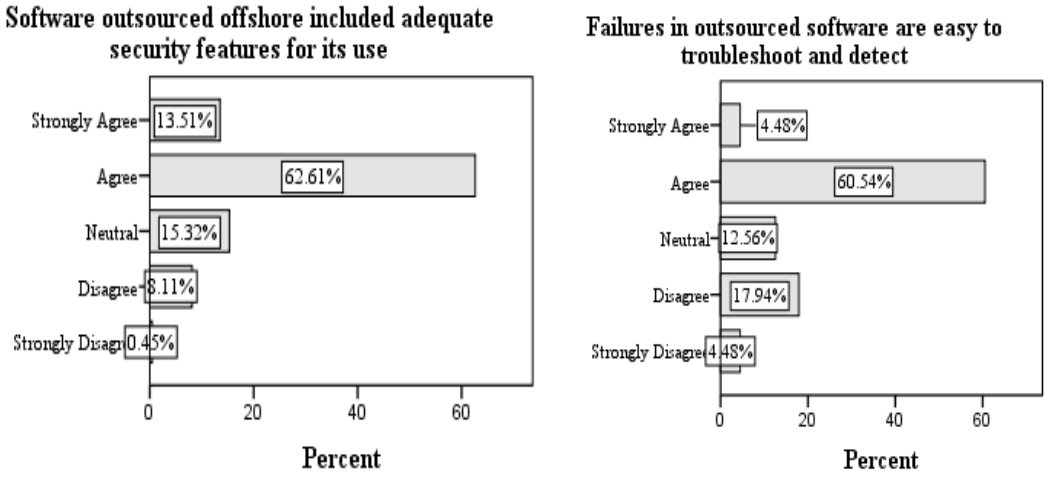

Figure 13. Troubleshooting and security features of outsourced software.

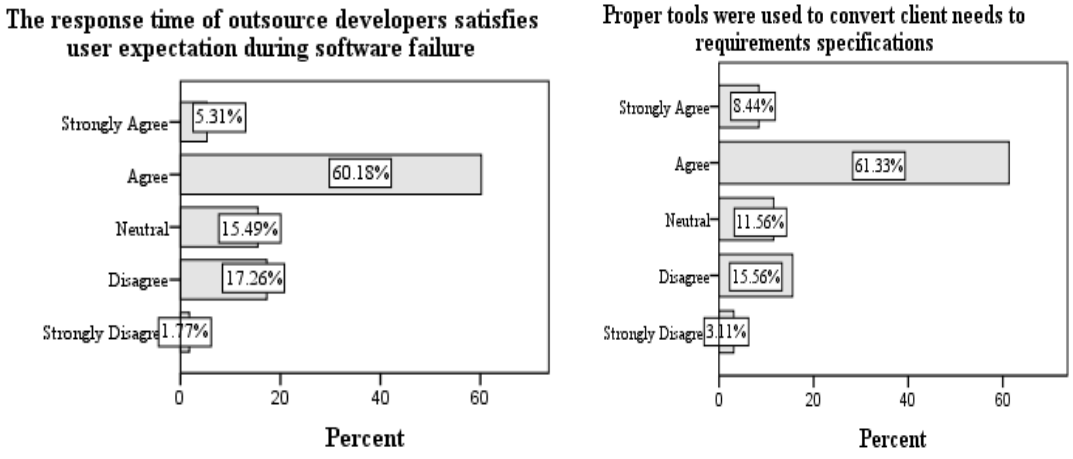

Figure 14. Response time of outsource developers during software failure.

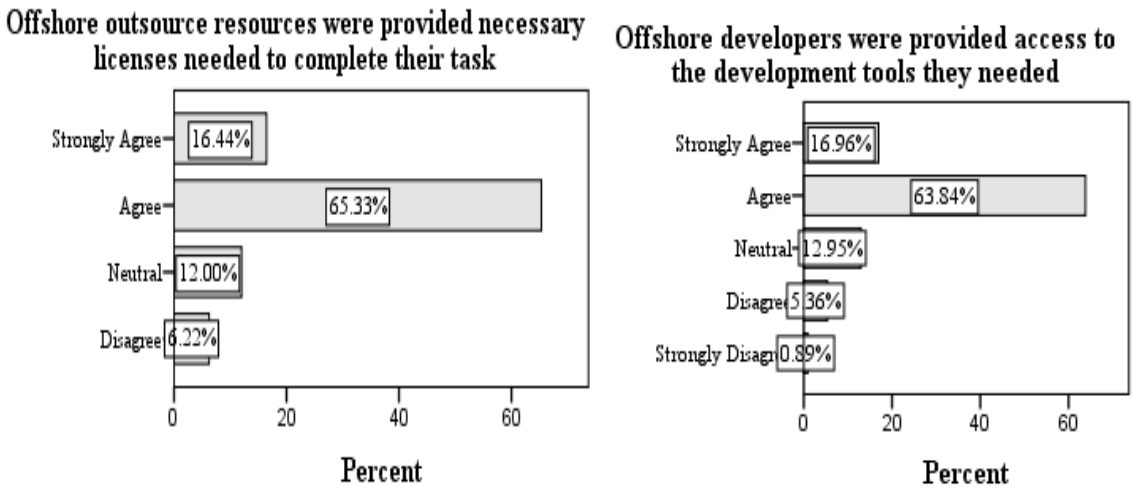

Figure 15. Perception of the access to development tools and licenses.

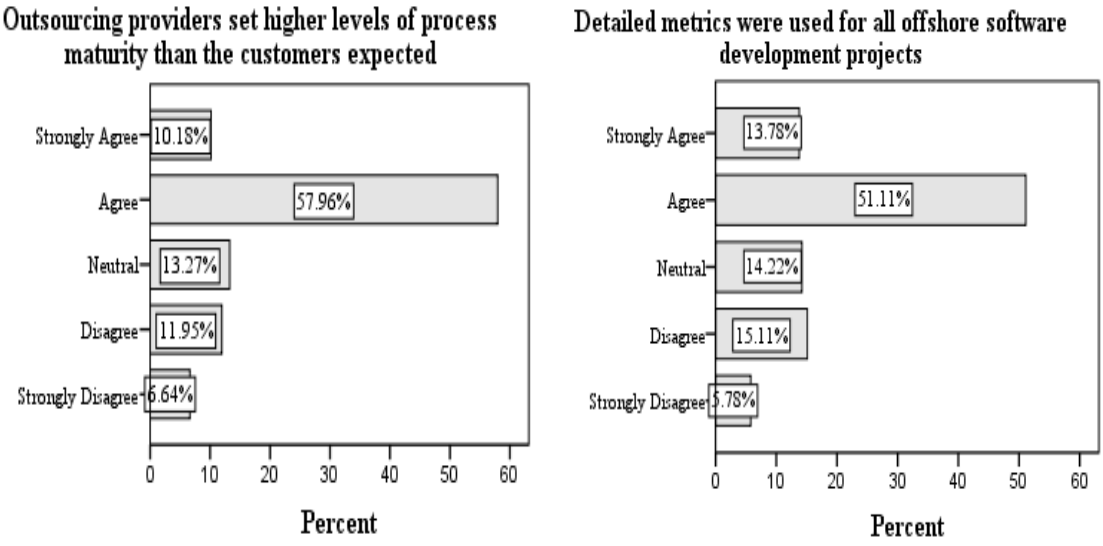

Figure 16. IT professionals' perception of the metrics used in software development.

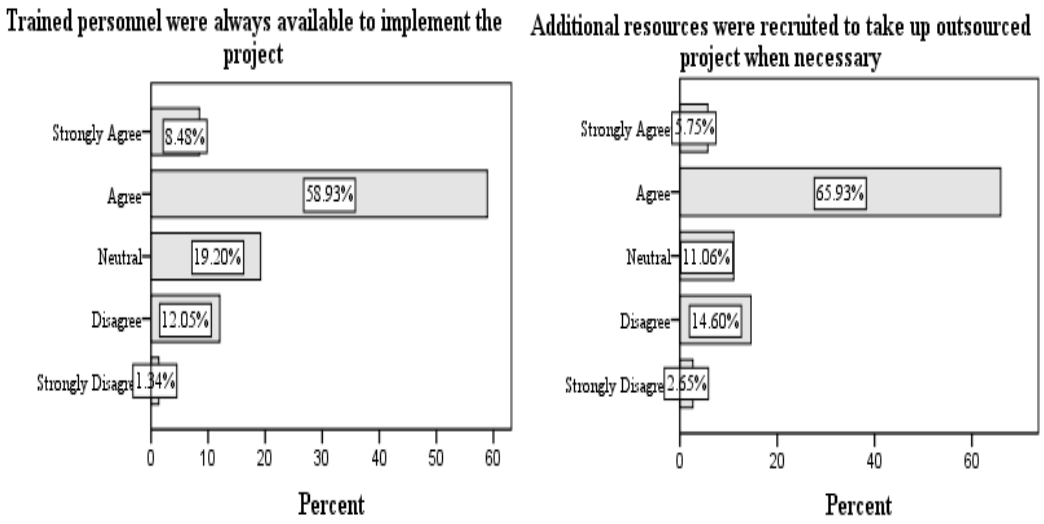

Figure 17. Provision of additional resources to take up a project.

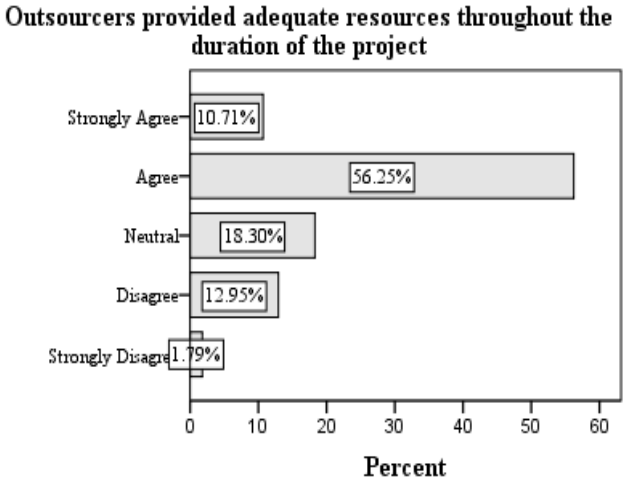

Figure 18. Provision of adequate resources throughout the project.

Questions 22-25, 31, 34, 35, 38, 42, 44-47 were focused IT professionals' perception of strategies the outsource developers applied to improve the quality of the software for companies in Nigeria (see Figures 19 – 25). Regarding the 225 who responded to the question on developers who understood the user requirement at the beginning of the project, only 66% perceived that the developers understood the requirement. But 18% either disagreed or strongly disagreed with the perception.

All the 226 participants responded to the question on developers using processes established during requirement gathering for their development work. About 75% perceived that the developers applied the established process during software development. A total of 225 participants responded to the question on developers who traced and tracked requirements with standard development tools, and 70% perceived that the developers applied standard development practices to trace and track the requirements. Regarding the 226 who responded to the use of prototype to simulate the requirements, 70% agreed that prototypes were created to simulate the requirements. The perception of IT professional who responded to developers providing necessary access to production data and resources was 73%.

The perception of IT professional who agreed to the availability of developers with technical knowledge of the software was 81%, and knowledge of existing application or system was 78%, thereby improving the quality of the software. The perception of IT professionals who responded to the improved knowledge transfer through creative ideas developed through interaction between offshore and onsite resources was 75%, developers providing quantitative feedback was 80%, and developers making knowledge transfer available during the software development process was 66%. The perception of IT professionals who responded to the relationship of developers' years of experience to software quality was 85%, years or employment to software quality was 69%, and the relationship of the developers' academic background to the quality of outsourced software product was 71%.

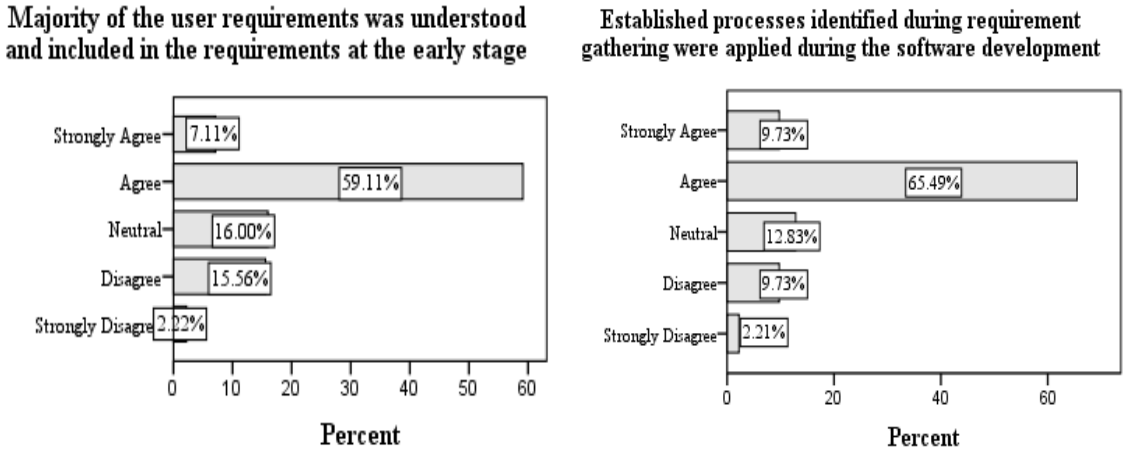

Figure 19. Developers understanding of the user requirements.

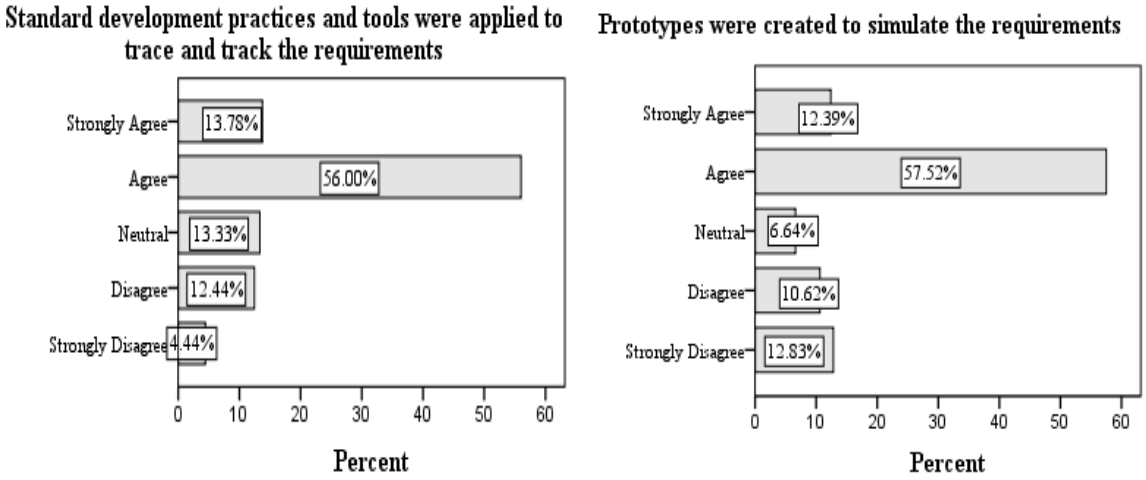

Figure 20. Practices and tools used to track approved user requirements.

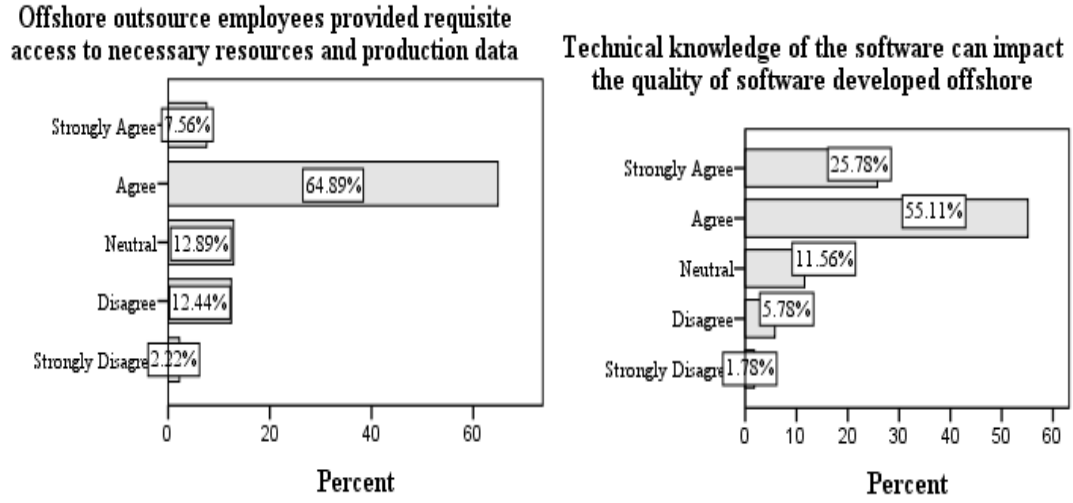

Figure 21. IT professionals' perception of impact of developers' technical knowledge.

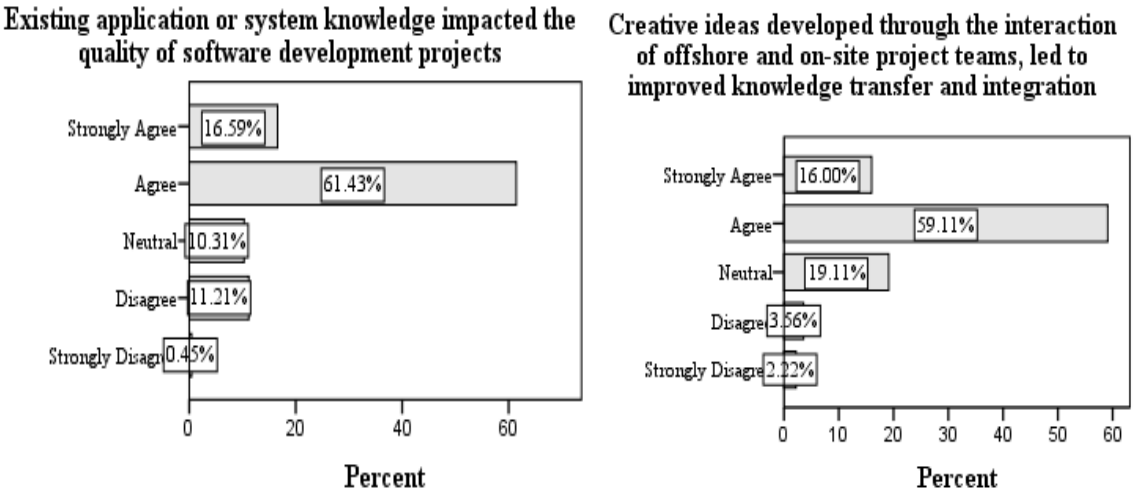

Figure 22. Benefit of creative ideas between the onsite and offshore teams.

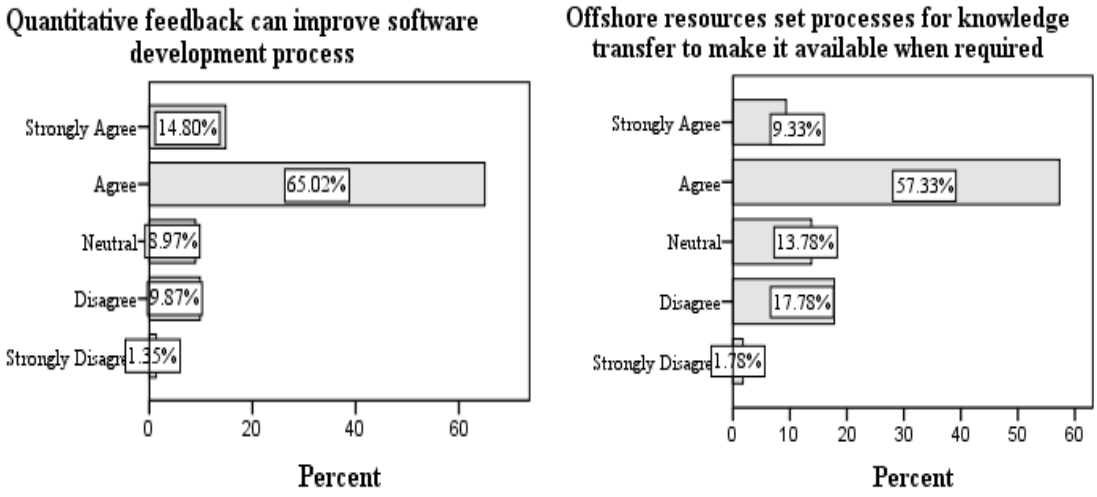

Figure 23. Benefits of quantitative feedback during the development process.

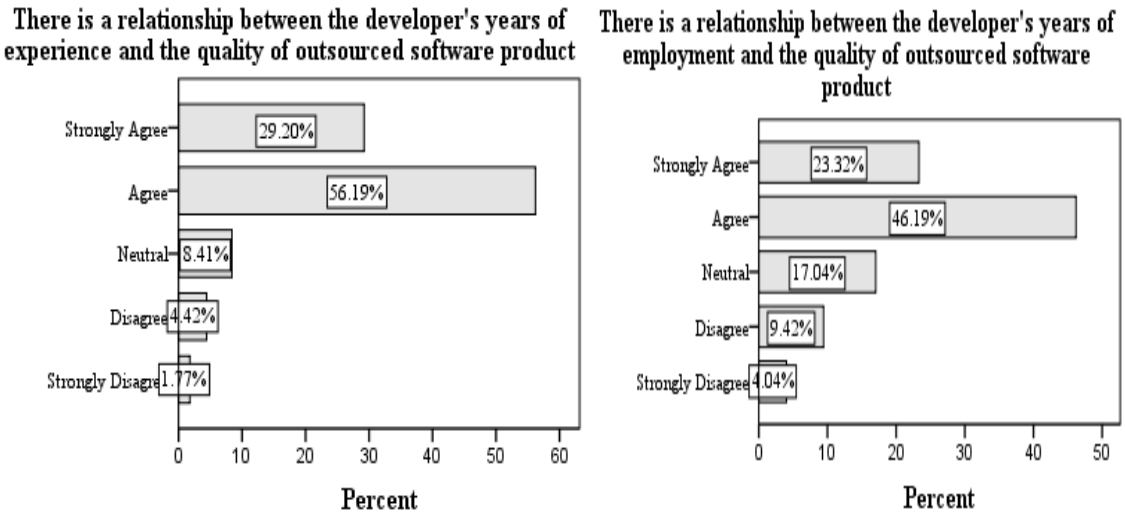

Figure 24. Perception of effect of the developers' working experience.

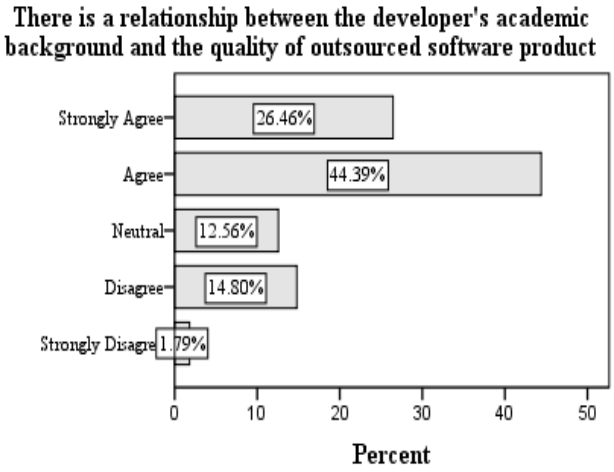

Figure 25. Perception of effect of the developers' academic background.

Qualitative Findings

Twenty-three IT professionals selected from consulting companies located in Lagos and Port Harcourt, Nigeria participated in the telephone interview, aimed at in-depth investigation of the factors that affected the quality of software products delivered to Nigerian companies. These IT professionals did not participate in the quantitative survey. Participants in this study comprised (a) graduate from a university, tertiary institution, or its equivalent, with (b) at least two years of software outsourcing

experience, either as a manager, or administrator, (c) consent to participate in the telephone interview, (d) interest in the survey.

The researcher selected the IT executives, functional, and technical consultants, project manager, and other IT professionals using purposeful sampling. The researcher used emails and Microsoft Outlook to schedule the interviews with the twenty-three on different times and days within four weeks. Each participant was sent an interview letter of invitation (See Appendix G) which include the purpose of the study, duration of the interview, assurance of the confidentiality of the interview, and that participation was voluntary.

The researcher obtained the permission of the twenty-three executives, functional, and technical consultants, project manager, and other IT professionals to record the interview. The researcher used the "Listen N Write" application to transcribe the audio files into text files, and sent the files to the interviewees to crosscheck, and confirm the contents, to ensure that the researcher's transcription was accurate, and accepted by the interviewee. The transcribed files were used as the qualitative data, and served as input to the NVivo 11 software, to facilitate the coding, and identification of themes.

Interview questions. Three interview questions were used for this mixed methods study: RQ1: What are the most important factors that affect the quality of software products outsourced from Nigeria? RQ2: What strategies can outsource companies apply to improve the quality software products for companies in Nigeria? RQ3: What strategies can the offshore developers use to improve the quality of the software developed for companies in Nigeria? The researcher used the survey result to

analyze the factors that affect the quality of software outsourced from Nigeria (see Table 8 and 9, Figures 2, 3 and 4).

Identified themes. Identifiers for the executives, functional, and technical consultants, project manager, and other IT professionals who participated in the interviews were P1–P23. The participants responded to the semi-structured interview questions (See Appendix G) that provided data for the qualitative study. The data was examined, and it revealed 17 themes related to the quality of outsourcing. The researcher collapsed these themes into four main themes appropriate to the research questions, numbered in sequence, 1- business process, 2- requirement gathering, 3- project management methodology, 4- development process.

Theme 1: Company business process. This theme captured participants perception of the company business processes. The participants responded to different components that relate to the business process. P6, P11, and P17 stated that the differences in culture and unverified assumptions about the company's business processes affected the quality of outsourced software. The cultural difference made it difficult to adapt the software to blend with its new environment, and the respondents suggested that developers should visit the client to understand the cultural expectations or engage some Nigerian IT professionals for assistance during design.

Participants P1, P2, P3, P4, P8, P9, P10, P14, P15, P17, P19, P20 and P22 stated that employees' skillset gap affected the company business process. The assumption that the foreign worker was better than the local resources created what was referred to as 'expatriate syndrome'. PA10 stated,

> Expatriate syndrome means that a lot of Nigerian companies don't have trust in the local resources. You don't have trust in what you want and you don't have knowledge of what you want.

Participants P17, P18, P20 stated that Nigerian resources have the certificate-driven knowledge, but lacked the skilled knowledge necessary to manage different tool in different environments. When systems are overly customized by the developers, it may require additional fixes when delivered to Nigeria, and without proper management, it turns into an unrealistic project. Unfortunately, it was difficult to evaluate the competency of a foreign worker who was not within the company locality. Outsourcing should be examined holistically with special consideration of the skillset available in-house, who were expected to be embedded with the development team and responsible for interpreting the requirement. P18 stated,

> They bring all foreign experts and don't try and source for foreign local experts, people originally come from the Nigerian environment, but have now established themselves in this foreign environment to come back home and help with the implementation.

Participants P2, P6, P19 and P23 stated that good understanding of company business processes helped with outsourcing decision to ensure that the company was not at the mercy of the vendor and developers. The company can invite the lead developer for a short training to get the right exposure and understanding of the client's business process, understand the client's expectation, and improve the product quality. Where the company does not have the resources that can capture its business process accurately, it could outsource that responsibility to another third party. P19 stated,

> You might again outsource, on a lower scale, for a third party to come in and fully specify what you want to be done for you. That person will understand your need, capture it very well, in a very professional manner for the delivery party to understand and know what you are looking for, just like having an interpreter.

Participants P3, P4, P5, P8, P10, P9, P12, P14 P17, P18 and P21 stated that vendor selection was an important part of a business process, because of the effect on the quality of service derived from an outsourced project. The participants stated Nigerian companies did not investigate or interview the vendors, or cross-check provided references. If technological constraints made it difficult to obtain information on these companies, no effort was made to use independent companies to research the vendor and validate their track record. The developers were not pre-qualified, and there was no way to rate their competence level. Developers were not interviewed either by telephone or video conference to ensure that a less-competent resource was used to do the actual development work. P14 stated,

> Any consultant that says I worked for XYZ company, make sure you call up the company. At the interview, ask the consultant, where is this company, who was in the team, how big was the team, what was your task. If they have not done a real-time project, they will fail all these questions.

Participant P10 stated,

> It is always good to check the background of a consultant. Not that you were on a project. What did you achieve, what impact did you have, what was the complexity of the project? I feel we should always go for quality and cost. But we should always balance, but quality should come first.

Participant P12 stated that Nigerian companies should ask questions, "Is it only one guy who is doing all the jobs, we are not sure? What is the quality of these developers? Do we have any opportunity to interview them and pre-qualify those who will be working on the team? Though we don't have fact to back up this right now, I am wondering if most these vendors take advantage of project to train upcoming developers so they are now using their own software to train"

P14 stated that,

> I definitely want to be having a video conference with the consultant directly and interview each of those before I bring them to my team. I want to make sure the person I am talking to on the other end, is the person who is going to be working on it. You don't want a situation where somebody else is applying for a job, and another person is taking the interview. So, when they get the job, they actually put a junior consultant, then you will say this is not the person I talked to.

Participants stated that most Nigerian companies did not include vendor or developer evaluation in their business process to ensure that the outsource resource was on track with the project. Nigerian companies did not have the ability to provide feedback on a developer who had a lot of defects, who did not meet the deadline or did not seem to work well with the culture or staff. P16 does not trust in referrals from Indian companies and stated,

> Sometimes you will get a company to vouch for somebody or another company in India. Truthfully, they are both the same, they are on par.

Theme 2: Requirement gathering. This theme captured participants perception of requirement gathering in Nigeria. The driving factors of this theme are communication

and documentation. The participants perceived that requirement gathering is the foundation of a successful outsource software development project. The participants highlighted that communication was the most important factor that affected the quality of an outsourced software from Nigeria. P1 stated,

> The biggest problem is language. If the focal point between the two parties, client and people doing the development, if the person in between them is not very versed at interpreting the requirement in the language the Indians or whoever they are outsourcing to understands, there might be a disconnect. I will first say language, as a big disconnect. Even though they speak English, we all know English has accent and it has different variations.

Participant P5 highlighted the importance of having the project team at the same location to aid communication. P5 stated,

> Because the team is not specifically co-located there could be communication challenges, and that could result in more time being spent in getting the work done actually, due to lack of clarity in communication.

Technological advancement presented project teams with more options when selecting a communication facility. P8 stated,

> From my experience, Indians can be very simple in nature, for example when you describe something to them and ask if they understand, they will tell you they do. At the end of the day, they did not understand what you said. Probably you were too fast for them, or you were not saying it in the words that they understand. Culture and communication, I will group together.

Participant P6, P7 and P8 emphasized that communication issues made it difficult for the Nigerian company to interpret the requirement to the level that the outsource resources could understand. P6 stated,

> One of them is the interpretation of our requirement. Requirements are part of what is needed to build a quality software. Often, due to the communication gap, or lack of interpretation in understanding what the requirement says it turns out that the quality of the software is not as we expected it to be.

P8 stated,

> Customers who request for something and don't define the requirement very well. That is a recipe for disaster. They should have the right level of experts to be able to review what the customer sent to them and they must have the right structures, processes, and procedures to make sure standards are followed

P7 stated,

> We outsourced some of our jobs down there. One of the things that I found out from there is that if you are not clear enough, those guys will not understand you. So, there is a language barrier to start with.

Participant P9 highlighted the problems companies experience interpreting the requirement to the outsource resources. P9 stated,

> They need to find a way to understand the requirement, not just from employee point of view, but researching what the requirements of the country is, and add value to it, especially if the development is coming from a more developed country.

Requirement gathering should be solid and signed off, such that everyone is happy with it. Implementation should go through proper standards that have been around for so long. In Nigeria, people tend to introduce culture into things instead of following the standards.

Sometimes the client needed the help of another company to interpret the requirement in a language that the developers understands. P19 stated,

Sometimes, you need a third party to help you specify exactly what you want achieved. If that is the case, it therefore means you have to get another third party again to help you specify exactly what you want, professionally, to the outsource party.

P12 stated,

Understanding of the use case, and of course our environment here too, the way we like our software to be a bit more intuitive. So, the developer also having some mindset in terms of their own understanding. This is for me an issue, and I believe that this can be improved, especially with the language I talked about and our environment. In terms of the quality, it is also good to understand that some of the things that we identified as an issue is again the communication. It has been a lot of challenge between the developers and the customers.

Participant P17 acknowledged that understanding the requirement in a virtual setup was a major issue during outsourcing. P17 stated,

You also have scenarios where language barrier, language also plays a role. The fact what we will be doing is virtual, the fact that we are not having a face-to-face understanding, you find out that we end up spending hours over the phone trying

to understand the requirement. Most of our outsourcing partners are in India, and some Eastern European countries. You find out that understanding the actual crust of the requirement, it plays a bigger role in developing an application, that sometimes becomes problematic, and we have scenarios where we say that this is not what we want.

Participants P18, P19, P21, P22, and P23 highlighted that the Nigerian company should have been able to state what it wanted to enable the developers know what to design and implement. P18 stated,

> On the side of the service provider, there may not be full understanding of the requirement of the client that the project is being outsourced from, and then on the side of the client, there is no clarity on whether the person who is taking the outsource project has understood the requirement and understood what is needed.

P19 stated,

> The biggest challenge that affect the quality has to do with proper specification of what is required from onset. If you do not do proper specification of what you want, whoever is delivering that service is not likely to meet your expectation. That they don't have in-house to deliver that solution does not mean they should not also have the capacity to specify exactly what they want, because if you cannot specify what you want it becomes an issue for whoever is going to deliver to know exactly what you are looking for.

P21 stated,

> Before you award or place that contract, your ability to specify very clearly what your requirements are, gives you a better at getting a product that is better tailored

to your requirement. But if you leave it wide and open-ended, you might also find yourself in some form of trouble, quality-wise.

All requirements gathered for a project must be communicated and documented in such a way that all responsible parties could understand. It should state what the client wanted achieved. Participants P1, P2, P3, P7, P8, P15, P16, P17, and P18 highlighted unprofessional requirement gathering process and attendant problems encountered during the software development. Good documentation of the requirement could answer the questions that could not be answered through direct communication. P15 stated,

> Good documentation is very important. I remember when I was on a project and I was speaking to developers in India. I remember I could not understand him because of how strong his accent was. One of the things that really helped is that, even though I did not understand what he was saying, he had very good documentation. I could go through his documentation and understand all the stuff that he had done altogether.

Participant P7 emphasized the important of setting a threshold for all documentation from each party to ensure that the entries met an agreed standard. P7 stated,

> There also needs to be documentation process standard. You need to have the threshold to measure all these on. So, if whatever you are sending meets the threshold, the outsourcing company will collect it from you. If it does not meet the outsourcing company standard, they won't accept it and will probably send it back to you with comments on things to fix. Also, you need to have your own threshold, to ensure that it is meeting your delivery threshold. It is meeting the

quality that you desire.

The Nigerian company did not set a threshold, and that explained why the outsource companies assigned them inexperienced resources. P16 stated,

> Sometimes they get somebody who hasn't got sufficient experience someone from back street or whatever trying to do the work, there isn't sufficient documentation, so whenever there is an issue, they have no point of reference, so, of course they can do everything, but then will they give you the best quality product that you are after.

P17 stated,

> Insufficient documentation, especially on the technical side of things. So, what normally happens is most of these outsource consultants maybe functional or technical, you find out that because time is a problem, they are always trying to minimize time, so they compromise on relevant documentation which is vital for the continuity of that software application.
>
> Our technical team that were offshore were not able to provide quality and standard, up to the required standard delivery of the technical specification, and that gave us a lot of issues with the business.

Theme 3: Project management. This theme captured participants perception of how Nigerian companies manage outsourcing project. The participants stated that Nigerian companies relinquished control of outsourced projects to the vendors, and that was responsible for the software quality issues. After vendor selection, participants P1, P2, and P20 stated that Nigerian companies relinquished control to the vendor. Participants P1 stated,

Nigerian companies on this side, I think what they have to do is to get a bridge between who they are talking to and themselves. You don't entirely wash off your hands and expect them to deliver. It has to be an ongoing process, so you are involved.

Participant P18 stated that the project should be balanced on both teams. P18 stated,

Balance of resources onsite to resources offsite, in order to ensure that the communication gap is bridged, because when a Nigerian vendor is outsourcing a project to a company probably in India, let's say for instance, even the gap in the use of the language, the different accents that the use, will cause such a trouble in communicating user requirement properly, so you need a pool of consultants from the outsourcing company, onsite in the company.

Participants P20 stated,

You are banking on them to have conscience to give you maximum benefit. That is not necessarily what organizations set out to do. Organizations and these businesses are designed to maximum profit and they are also relying on your ability to pull out the best from them.

Participant P2 stated,

When you are developing software and it is outsourced, that means the control of how the software is being developed, how it is shipped is not in-house anymore. You have relinquished control to other people. You don't have a handle of what the quality is.

Given that the Nigerian company may have relinquished control, participants P11,

P15, P17 and P20 stated that the client did not put good project management in place, with regular meeting to ensure that each party understood what role it played in the project to ensure that the project was on track and a quality product was delivered. P20 stated,

> The job of the client is to have a good enough solution architect, or project manager, implementation partner, or whatever they want to be called, who is knowledgeable enough to challenge, to question, to hold them to account to what has been promised, and that is the balance that needs to exist.

Cost is another factor that affected the quality of a project in Nigeria. Participants P4, P12, P16, P21, and P23 stated that Nigerian companies were interested in opportunities to reduce cost, but they did not consider the additional cost of poor project management, and the effect on quality. For some Nigerian companies, P12 stated,

> Cost is the most important thing, so even when there are trade-offs to be considered, they are not interested. The least possible cost is what is important to you, and at that point it means quality has to drop somewhere in the scheme of things.

If the vendor is aware of this attitude, P16 stated that the vendor thought the process as "let's just make the most of it, and charge them a lot of money. Give them shoddy workmanship, so that they will keep coming back. They are bit stuck. If they have bugs, they can't fix it, so they will come back to us"

Participant P21 stated, "one of the things that is the main focus is typically maximization of profit, Ok! Usually quality and profit don't tend to go very well together."

Project management methodology affected the outcome of a project. Participants

P2, P5, and P20 stated that Nigerian companies put little effort into selecting the correct project methodology. According to P5, the Nigerian client did not ask the necessary questions "Is this going to be a traditional project management, or it is going to be Agile methodology? I would think the outcome could be a lot better if an Agile approach is adopted"

P2 stated,

> You don't have to pick one hard and fast methodology, you can use a blend of both. So, if you use thing like a use case driven approach along with test driven approach, basically that means the developers are building their test cases first. You are handing off use cases. You have development people in-house, they are the one creating the use cases, they are sending them out to these developers. You have an independent validation and verification team that is doing the quality assurance. Once that is done, they hand them over to the developers. Those people also have copies of you use cases, and the test cases have been evaluated in-house. You have found out that the test cases match the use cases. So, you have to find a methodology or a blend of what you want that will work for you. That is key, and that is even when you are doing in-house development when you try to conform to one methodology, in some cases you might be limiting yourself to that methodology, when there are other valuable aspects to other methodologies that you can actually incorporate with the one you currently use

Project managers can use prototypes, hybrid, templates, business configuration sets, or test runs to create a baseline for the development work. Participants P1, P2, P11, P17, P19, and P22 stated that the importance of using templates during System design,

which was missing in Nigerian project. P17 stated,

> Whatever development platform you are doing, whether for Human Resources, Financials, Logistics, and you are related to a country like Nigeria and most of your clients are from Nigeria, you will have to build a country template, which takes cognizance of for instance, if you look at your Analytics for example, Analytics plays a very big role in the Nigerian framework.
>
> Business configurations sets are meant to assist developers, functional consultants to do their development and save it in a template. SAP gives that provision. So, you can do your development and save it in a template. You can even use other platforms where you can create your development and save them

Nigerian company were unable to obtain prototypes due to lack of information. P22 stated,

> Where a company cannot do the hybrid model which helps even have some of control over your resources or your consultants' time, I think for such an organization, look at your deliverables, agree on key deliverables and KPIs and metrics with your consultants, and timelines, and stick to those things.

Project management keeps the project and deliverables on track. The quality of the software is related to how the development process was managed. Participants P3, P8, P10, P19, and P21 stated that companies with no plans for obtaining quality products did not get one. The company must determine where quality stands. P10 stated,

> You can't measure the quality of what you are having and if you can't measure the quality of what you are having, you can have very low-quality services or software solution delivered to you, and later you start having issues, because you

that was looking for the solution never had something to gauge what you want against.

The project management team should put a quality control process in place for any outsourced software project. Participants P2, P3, P6, P7, P8, P13, P14, P16, P20, and P21 stated that quality control process was not in place to determine how the application was tested, how to evaluate the developer, metrics to measure the quality of the product, and outsourced company standard of quality. Nigerian companies relinquished the control of these processes with the assumption that the outsource company will manage everything. P8 stated,

> The client was not experienced in outsourcing. They had employee mindset, and no patience to understand the communication differences, and communication gaps between the people in India and Nigeria, and that maturity of knowing that with outsourcing there are certain things that you must do differently

P7 stated,

> When we started the project in 2015, we had all these Indians that were supposed to be supporting us on BI/BW and so many things. We had a lot of problems, because we left the management of the individuals workstreams outsourced with the client.

Participant P21 indicated that quality control was not an essential part of project, because a certain level of involvement was expected from the Nigerian company, like requesting for feedback during weekly or monthly meetings from the responsible parties and monitoring activities of the teams. P21 stated,

> Level of involvement in you that is outsourcing that work with the development,

> don't just give the requirement, dump it and wait for a finished good at the end. Some others have meetings, depending on the nature of the project, let's have a weekly review session, let's see what's happening. We touch base against the requirement.

Participant P1 stated that Nigerian companies were not actively engaged in the project. P2 acknowledged that the client must have control of the quality expected from the project. This could be by setting up a parallel team, or making sure that the appropriate resource managed each workstream. P1 stated,

> Nigerian companies on this side, I think what they have to do is to get a bridge between who they are talking to and themselves. You don't entirely wash off your hands and expect them to deliver. It has to be an ongoing process, so you are involved.

P2 stated,

> Have a parallel team that is actually working in conjunction with this offshore team. You don't relinquish control completely. What you trying to do is, there is certain aspect of software development that is foundational. To quality product. Requirement is key. The design and architecture are also key. Then the methodology which you adapt in order to actually develop this product is also key.

Participant P2 indicated that when a developer realized that he does not have absolute control of the work and someone was monitoring and evaluating his work, he put more time, and effort into producing quality software. P2 stated,

> You hand the requirement document to somebody who is a programmer, you are doing yourself a lot of disservice. When you hand a requirement document to somebody who is a software architect, you can see the distinction between the roles. The software architect will start with the design of the product and that deign is what will lead to either success or failure.
>
> A developer that realizes that he is not 100% in control. When they know that there is some kind of evaluation and review of the work that they do, they will think twice.

Efficient testing is another essential part of a project that determines the quality of the product. Participants P1, P2, P4, P7, P9, P13, P14, P16, P18, and P19 indicated the importance of testing to the success or failure of an outsourced project. The Nigerian client expected the developers to manage all the testing, which means giving control to the outsource resources. P9 stated,

> One is effective testing, and at some point, it would also be good to be closer to the developers, just like we have experienced, you will always hear we can do everything, and along the line you begin to pick holes here and there, and even fixing those gaps usually will not come that smooth.

Participant P18 indicated that testing may be affected by constant change to the requirement if the project was not properly managed. P18 stated,

> Requirement may have been understood, but because most of time in software development, there is Scope creep. While you are busy going through the analysis and the design, and then realization, there are changes in user requirement. Those changes in user requirement are sometime assumed and they are not captured as

Scope creep. Which means by the time testing comes, although the outsource company understood the requirement, they are now providing something that the user does not want anymore, or the user wants more.

P19 stated,

When you test, you just test your part. Developer will test. It is part of his responsibility. If you want to ensure that proper testing is done, it has to be given to another third party. The managing party will be there to ensure that he comes back to confirm it that his component is completed.

Participant P7 stated, "they should have their threshold or yard stick to measure quality. They should have a quality assurance in-house, and test, test and test, to the point that they will feel comfortable"

P1 stated,

Test in units, test in sub-modules so that you are carrying the person along until the end. Is not as if when you finish the entire life cycle of the application you are building before you advise them to test.

Testing can also be affected by improper management of the developers' time. P4 stated,

Knowledge of the consultant right there who is developing it. The second is the experience of the testers. That is what I found. They give the developer a task and tell them to have it ready tomorrow for example. The developers offshore are usually in very tight deadline, they work crazy hours, so they don't seat down and test it thoroughly.

When a project runs into a tight deadline, the testing process can be automated. P2 stated,

> You should consider using automated tools to actually do your testing. Your functional testing and performance testing, you can actually automate them these day. In that respect, if you want to, you can outsource the development of the automation as well. But at the end of the day, when it comes to the testcase and quality of tests that need to be done, you have to define the parameters.

Theme 4: Development process. This theme captured participants perception of the outsource software development process. Participants P9, P13 and P22 stated that the software development process was affected by developers working on multiple projects, assigned odd hours, and not compensated adequately. Sometimes, the experienced developers engage in private jobs to supplement their income. P9 stated,

> It will be nice if the outsource company in India can ensure that their staff are not working just for financially driven. At times, what pulls them to the project is usually the money.

P22 stated, "One, it will impact on my health, definitely, because I will sleep odd hours or sleep short and that will impact on my deliverables, yeah. Also, because I am talking on more work, some of them may even have competing time lines, I may not give my best because I am not focusing. When you dissipate work to do multiple things, more often than naught, you are dissipating energy across these things, you are not giving your best"

P13 stated,

> The company that these developers are coming from now can offer them some form of compensation, maybe shares in the company, or some for benefit, that will motivate them to put their best in the work.

Participants P1, P2, P3, P5, P6, P10, P12, P13, P16, P19, P20, P22 and P23 highlighted the strategies that outsourced developers apply during software development. Nigeria companies were engaged in outsourcing with little experience, and some concerns. P22 stated, "as Nigerians and Africans, we haven't gotten to that stage where we totally believe 100% outsourcing offshore. There is that level of comfort and assurance of quality, and services we have received, and we can hold you down and set a discussion one-on-one, than on the phone"

Participant P12 highlighted the proliferation of software development companies who offered to provide the service that Nigerian companies required, and suggested that companies deal with established software companies. P12 stated,

> Dealing with the known names that can keep their brands, because the proliferation of developers with companies, especially with developers struggling to make more money is really becoming so much that everybody seems to do everything.

P16 stated,

> Attention to detail in developing the software in places like India, is not the same that you would get if it was developed somewhere else, due to mass production, they are rushing the work.

Participants P2, P6 and P19 were of the opinion that Nigerian companies should set standard for the developers, or provide them a development template. P6 stated,

> One of the ways to address that is to have the developers sign an agreement with the developers to commit to a period and duration of time to work on a project

within a defined time at which they know that once the work is done they are free to engage in their freelance activities going on.

P19 stated,

> What they need to do, is when different projects are assigned to the developer, there should be someone else, like a lead or project manager who monitors the project. How many projects are assigned to this developer? What does each of these projects require, and in assigning this project what are the time lines, do they conflict? All of these need to be managed by a third party.

Participants P2 stated, "What I am doing is, I have handed to you a sequence diagram to be converted into code. When you finish the code, the sequence diagram has to match exactly what the code is doing. So, you have to build all these checks and balances as you go along, and hopefully you have people on your end who are actually calling people, you will more than likely catch all of these things before you go too far out in the process of developing that product"

Participants P2 and P7 stated that the quality of outsourced software could be improved if the developers improved their skills. P2 stated, "You have to constantly improve your skill as a developer. In order for you to be good at what you do, you have to be knowledgeable. That means that you have to invest in yourself, to make sure that the technologies and expertise that you need to do your work is known and you are good at it. That is going to reduce the time you spend trying to develop a product"

Participant P7 looked at the developer from the perspective of a System Integrator and independent developer. P7 stated,

If I am working for an SI offshore, I need to have skills. Two, I also need to follow standard of quality. Three, I need to follow best practices. Mist times developers just do what comes to their head. They have to follow principles, and laid guidelines that are meant to be followed.

If I am an independent developer, there is a lot to that, because I am by myself, I do what I think is right, I don't follow laid down principles, I do what I feel is best for you the client. There are times when we want to voluntarily add value to the work we are doing. But it may not make sense. Sometimes, the developers are just lazy and want to do whatever they want, since no body will perform quality assurance on them.

Participant P3 stated,

In case of fulltime employee, they work fulltime and generally have a long-term relationship with the vendor. They understand the vendor methodology, the vendor quality expectation. They need to perform so they can get promotion, or bonuses. The other class is where the vendor has to recruit contract staff to develop in an area where they lack resources, or they do not have enough resources to meet the requirement.

Participants P1, P5, P6, P10 and P14 were of the opinion that Nigerian projects were constrained by time management, market differences or concurrent project assigned to the developers. P1 stated,

This is a problem of time management. If you know that you cannot handle this job, because of your commitments, sometimes it is better we just rejecting a job

rather than just taking it on, and just giving it some work that is not quality enough.

Ask questions. Don't assume you understand what they want. Confirm that is actually what they want. As much as possible don't wait until the end of the cycle until the whole application is ready before you test.

Participant P14 highlighted that time difference is an issue. P14 stated,

The timing difference is a huge barrier, because I have dealt with offshore consultant So I know exactly how I feel, because to get an email, sometimes that have to get up in the middle of the night to communicate. That is the huddle.

Participant P10 stated,

What you need to know is what is the difference between the markets. What differs between Nigerian and other countries. That you can get from the process owners, depending on what you are developing, you can always get it from the experts. You don't usually need that knowledge to succeed.

Participant P6 highlighted the problems associated with assigning multiple projects to developers and expecting the quality of their work not to suffer. P6 stated,

When you have concurrent projects going on and the demand on time and the effort of the developers are being made by the product owner or by the project manager, it becomes an issue because deadline will not be met and the quality of work will decrease because of such lack of dedication and commitment to complete an on-going task and be diverted to different activities simultaneously.

Additionally, P6 stated,

> When they realize that their source of income is tied to the quality of work they do, my expectation is that they will start paying attention to quality.
>
> That needs to be part of the mindset of the developer, that they are not hired to work on a project in perpetuity. It's a conditional kind of work, and the condition of quality must be met, for them to be engaged in future projects.

Participants P17 and P23 highlighted the need for Nigerian companied to put post go-live support in place to ensure that the software was working as expected. P17 stated,

> We found out that support becomes an issue, because the crust of most outsourced solutions, or technical resource, or functional resource or whatever the resource may be, it's not only about delivering the solution, it is also about support, which basically is that final stage of our ASP methodology that we use in SAP. So, you find out that when the product is finally shipped to Nigeria, support becomes an issue.

Summary and Conclusion

The analytic result from SPSS 24 provided an insight into the perception of the IT professionals on outsourcing in Nigeria. First, the years of experience of an outsourced software developer, the number of years employed and the academic qualification was related to the quality of software delivered to Nigerian companies. Secondly, outsource companies provided adequately trained resources throughout the project in Nigeria, and used detailed metrics to track the project. Thirdly, outsource companies defined software development and projects to achieve product quality, by providing proper leadership to coordinate the integration of knowledge between the onsite and offsite teams, and providing quantitative feedback to improve the software development process. Fourthly,

outsource resources were provided the necessary access, development tools, and licenses to facilitate their software development processes, and the developers were accessible for knowledge transfer. Lastly, the requirements were gathered properly, documented and signed-off, and communication was highlighted as very essential for software quality.

SPSS 24 calculated a Cronbach's alpha of .982 to confirm that the reliability of the research instrument was reasonable, and the standard deviation was close to 1 which confirmed that responses to the questions were uniform. The interview of executives, functional, and technical consultants, project manager, and other IT professionals who responded to the open-ended questions generated the data for the qualitative part of the study. The data were transcribed and imported into NVivo 11 for analysis. The coded data provided an insight into the perception of the IT professionals on outsourcing in Nigeria. Four themes identified from the data provided a better understanding of the findings with relation to the quantitative results.

The qualitative study participants shared similar perceptions on the quality of software outsourced from Nigeria and discussed how Nigerian companies trusted the foreign worker more than their employees, which resulted in relinquishing control of the software development project to the outsource company and its developers. The outsourcing company controlled the entire project from requirements gathering to project management, communication, testing and support. Nigerian companies paid too much attention on saving cost, and jeopardized the quality of the software. On most of the projects discussed in the study, the companies paid little attention to in-house capacity building and project management. Communication and cultural differences was highlighted as a major issue that affected the integration of the teams.

Chapter 4 included the presentation of findings from the mixed sample that completed the online survey and open-ended interviews to determine the factors that affected the quality of outsourced software. Chapter 5 involved findings and interpretations, research questions and themes, recommendations for future research, summary, and conclusion.

Chapter 5

Summary, Conclusion, and Recommendations

Chapter 5 included the discussion of the results from the quantitative and qualitative data, collected, collated, and analyzed to examine the factors that affect the quality of software product outsourced from Nigeria. Chapter 5 comprised of research questions, findings and interpretations, recommendations for future research, summary, and conclusion. Survey and open-ended interviews were used for data collections to understand the perception of IT professionals on the quality of outsourced software products in Nigeria. The quantitative data was collected with a Likert-style survey from IT executives, functional, and technical consultants, project manager, and other IT professionals to understand their perception of the research subject. The qualitative data were collected through telephone interview sessions with professionals for a better understanding of their experience with outsourcing in Nigeria.

Research Questions

The results of the research answered the research questions either directly or indirectly: What are the most important factors that affect the quality of software products outsourced from Nigeria? What strategies can outsource companies apply to improve the quality of the software products for companies in Nigeria? What strategies can the offshore developers use to improve the quality of the software developed for companies in Nigeria?

RQ1: What are the most important factors that affect the quality of software products outsourced from Nigeria? The quality of the software outsourced from Nigeria was affected by many factors, but the most significant were vendor selection, capacity

development, communication and culture, developer experience, and project management. Nigerian companies were not heavily involved in vendor selection to identify a credible vendor, investigate the vendor's background and verify their track record before signing the contract. The Nigerian businesses either did not have defined business processes or were unable to document the business processes. The project management team relinquished control of the project to the outsourced resources, and there were no metrics to measure the vendor's performance. Communication was a major issue during outsourcing projects in Nigeria. Communicating with outsourced resources was very difficult during requirement gathering because the outsource resources could not understand the client's needs. The requirement walkthrough session had communication challenges when the resource was offsite. Communication challenges made it difficult to provide feedback to outsource resources during software development, testing, and deployment. Finally, cultural difference and time zones presented a challenge because an average Nigerian prefers face-to-face discussion to telephone communication or any other form of communication.

RQ2: What strategies can outsource companies apply to improve the quality of the software products for companies in Nigeria? Outsource companies provided the resources adequate tools, licenses, and access necessary to produce quality products, but without a good working knowledge of Nigeria and its culture, the project was a challenge, especially where there were no country-specific templates for Nigerian. Documentation process was highlighted as an issue especially where there was no documentation standard. Therefore requirements, test cases, design documents, and timelines that did not meet the standard could not be rejected by either team. The agile

methodology was not applied to ensure that the developers and business-tested each development segment, approved and signed them off before starting the next phase of the project. Analysis of data from the interview showed that outsource vendors assigned their resources to multiple projects without consideration of the impact on the quality of the output.

RQ3: What strategies can the offshore developers use to improve the quality of the software developed for companies in Nigeria? Some experienced developers were assigned to Nigerian projects, but proper communication was a challenge. 73.2% of the participants agreed that business domain knowledge transferred from the clients impacted the quality of software developed offshore. Therefore, it was essential for the developers to understand the business requirement. The analysis showed that some developers did not follow the quality standard, best practices/ principles, and laid guidelines, and it affected the quality of the software. The Nigeria client is very visual, but the developers did not present graphic designs of the work for the client to approve before starting the actual development. Developers did not have approved country-specific template or framework for development, and that affected the quality of the software.

Findings and Interpretations

The purpose of the current mixed methods study included an investigation of the factors that affected the quality of software outsourced from Nigeria and strategies that Nigerian companies, and outsource vendors and developers can adopt to improve the quality. With outsourcing, a company pays for only the needed products, refine competencies, and improve the firm's competitive advantage (Pedersen et al., 2013). Dyer and Singh (1998), stated that the theory of relational view resulted in joint profit

that either companies involved in the relationship cannot achieve in isolation. Further, companies use relational view or outsourcing to clarify competitive strategies and control market opportunities, exchange information or share resources on the market (Turkmen, 2013; Wong, 2011).

The theory of relational view supported the creation of high-quality inter-organizational products and services like outsourcing, which are difficult for competing firms to imitate, because no company is able to provide all the specialized skills and knowledge needed to compete in its network. About 71% of the quantitative data perceived that outsourced software made the company operation easier. Therefore, a successful outsourcing project is a benefit to the company and the economy of the country. The goal of this study was to identify the issues that affected the quality of software outsourced from Nigeria, which included vendor selection, capacity development, communication and culture, developer experience, and project management.

Vendor selection is a complex process that checks for reliability, financial stability, and technical competence, and it has a significant impact on the success of a project (Wadhwa & Ravindran, 2007). Analysis of the quantitative data showed that about 57% of the respondents perceived that the vendor provided adequately trained resources throughout the project. This does not support the purpose of using relational view to fill the gap created by inadequate or missing skillset, because the client expected all the resources to be properly trained and highly experienced.

The result of the qualitative analysis supported the quantitative data because the respondents perceived that Nigerian businesses outsourced their software development

work without going through properly vendor selection process. In most cases the client assumed the vendor was highly experienced, so there was little emphasis on identifying and screening the resources who did the actual work.

The quantitative analysis showed that about 64% of the respondents perceived that detailed metrics were used for the software developers during the project, and the results from the qualitative analysis showed that the metrics was managed by the vendor, not the client, which confirms above assumption that the Nigerian companies delegated the projected control to the vendor. This means that the projects had no check and balances, and the developers were responsible for managing their metrics. The research conducted by Dyer and Singh (1998) strengthened the relational view theory by recommending that survival of a company involves relation-specific resources, knowledge-sharing, complementary assets, capabilities, and efficient governance of processes.

The quantitative analysis showed that 65% perceived that outsource developers responded adequately during system failure, which means that 35% of the time, the outsource resources did not respond on time, regardless of the type of system failure. This is unacceptable from a highly experienced vendor, and confirms data from the qualitative analysis that the Nigerian company did not investigate, interview the vendors, or cross-check vendor references. The result showed that Nigerian companies did not participate heavily in vendor selection to identify a credible vendor, pre-qualify the developers after telephone or video conference, investigate the vendor's background and verify their track record before signing the contract.

Analysis of the quantitative and qualitative data showed that 62% of the IT professional perceived that the software fulfilled the user requirement and was delivered on time. The perception was based on vendor-defined requirements. The qualitative segment confirmed that the vendor managed the business requirement with little input from the Nigerian team. Additionally, data extracted from the open-ended interview showed that the local resources lacked the technical skill to define proper business requirement, and were unable to hold the vendor accountable, neither did they have metrics to measure the quality of the product.

According to the research conducted by Mol (2005), relational view of outsourcing to maintain buyer-supplier relations may be an adequate substitute for in-house involvement. Therefore, the Nigerian company relied on long-term, trusted relationship with outsource vendors to achieve competitive advantage, and above average returns. Data from the quantitative analysis showed that 61% of IT professionals perceived that the result of the software was correct and satisfied the integration requirement, but 59% perceived that the software was unlikely to fail or able to withstand system failure. Analysis from qualitative data showed that the developers paid little attention to quality because if the software failed, they were invited to fix it.

This outcome was not expected from highly experienced software designers, but it confirms the research conducted by Edara (2011) that 71% of outsourcing projects failed to meet quality goals. The costs of fixing poor-quality software errors could be 100 times higher than work performed during the development stage (Laporte, Berrhouma, douCet, & Palza-Vargas, 2012). This hidden cost that was not considered during project initiation.

The relational view encompasses the study of transition, managing relationships, and reconsideration phases of outsourcing relationships (Lysne, 2014). Communication was identified as a major issue that affected all phases of the project. Communication between members decreased data irregularity between the manufacturer and suppliers, thereby increasing preparedness (Wieland & Carl, 2013). Haried and Ramamurthy (2010) blamed poor communication for most outsourced software development failures. Data from the quantitative analysis showed that 82% perceived that there was relationship between proper communication and the quality of outsourced software. The qualitative data supported the result and showed that proper communication was important from the planning to execution, and support of the project. The Nigerian culture expects communication to be face-to-face, but distance and time difference made it impossible.

Winkler, Dibbern, and Heinzl (2008) highlighted the increasing importance of recognizing, understanding, and managing the cultural differences between the customer and outsource vendor. About 79% perceived that quantitative feedback could improve the software development process, but this was missing in the Nigerian project because the entire project was managed by the vendor.

The requirement document determines how the software should be designed, and requires the heavy client involvement. Nigerian businesses made the vendor responsible for the business requirement and provided input when needed. According to data from the quantitative analysis, 71% agreed that the stakeholders signed off the requirement, 66% perceived that majority of the user requirements were understood and included in the requirement, 69% perceived that the vendor provided comprehensive documentation of the software, 73% perceived that the outsourced software fulfilled the user requirements.

If the client were heavily involved in the design, the result of the analysis would be better. 74% agreed that country-specific requirement could affect the quality of the product, and 69% perceived that prototypes were created to simulate the requirements. Without adequate client participation, the country-specific requirement was missing, and the prototype excluded essential features.

The result of the quantitative analysis showed that 95% perceived that there was a relationship between developers' experience and the quality of outsourced software, 79% perceived a relationship between developer's years of employment and software quality, and 70% perceived that academic background contributed to the quality of the software. Analysis of data from the qualitative segment showed that the developer might be experienced, but was assigned to multiple projects which will divide their attention. Some of the experienced developers may be doing private work on company time because they were poorly compensated. The vendor did not have quality metrics to guide their work, so they fell short of expectation. About 64% perceived that detailed metrics were used for all software developments projects, but they could not prove that the metrics were adequate or standard.

Vasilieva (2012) stated that project managers experience was required to guarantee project success. Results from the quantitative analysis showed that 78% perceived that proper leadership coordination helped to integrate knowledge between the outsource team and the client. But there were no checks and balances. The project control was relinquished to the vendor because the client assumed that the vendor was the expert and capable of doing a better job. Qualitative data showed that the client cannot control how the software was developed, how it was shipped, and the quality of the software.

About 74% perceived that software and project management processes were defined to achieve product quality, but data from the qualitative analysis showed that the business was unable to determine or define what it wanted, or was unable to document what it wanted in a clear and concise manner for the developers to understand.

Another goal of this study was to provide knowledge about what was required to provide high quality software. IT professionals including IT executives, functional, and technical consultants, and project managers can use the result from this study to refine the project management process aimed at generating better software quality. The aim was to stimulate discourse on software outsourcing among IT professionals and stakeholders, and scholars involved in software outsourcing research.

The first segment of this study involved the participation of 226 IT executives, functional, and technical consultants, project manager, and other IT professionals in a Likert-style online survey. Participants received an email with a link to 47-item questionnaire. The survey contained demographic and relevant questions that collected responses on the perception of IT professionals on factors that affected the quality of outsourced software. IT executives, functional, technical consultants, project manager, and other IT professionals indicated the outsource vendor provided adequate resources and tools required to produce quality software. The statistical result indicated that proper project management and communication, adequate work experience, country-specific user requirements, domain, and software knowledge were essential to the quality of the software in Nigeria.

The second segment of the study involved open-ended telephone interviews with 23 IT executives, functional, and technical consultants, project manager, and other IT

professionals with experience in software outsourcing in Nigeria. Analysis of the interview revealed detailed information about how Nigerian companies manage outsourced projects, including relinquishing control of the business processes, requirements, testing and support to the vendor. Participant responses helped the researcher identify four main themes that addressed the research question directly or indirectly: What are the most important factors that affect the quality of software products outsourced from Nigeria? What strategies can outsource companies apply to improve the quality of the software products for companies in Nigeria? What strategies can the offshore developers use to improve the quality of the software developed for companies in Nigeria?

Prior research about software development success revealed that the probability of offshore projects failing to meet quality business specifications was between 55% and 75% (Khan & Khan, 2013). However, the benefits of relational view are important to the survival of a business. Further quantitative (83%) and qualitative (69.6%) analysis indicated that communication was responsible for most of the issues identified by the respondents. The detailed analysis revealed a cultural disconnect between the teams affected the outcome of the project. Gottschalk and Solli-Sæther (2005) opined that effective and efficient communication between the project teams ensures that individual interest and goals are achieved.

The strength of the current research occurred when a large number of the sample participants (226) out of the anticipated 500 responded to the survey questions which was the source of the quantitative data used in the study. A total of 23 IT executives, functional, and technical consultants, project manager, and other IT professionals out of

the anticipated 50 participated in the telephone interviews, and provided valuable insight into how software was outsourced and managed by Nigerian companies. The first weakness of the study occurred when some of the participants skipped a few questions, but completed the survey. The missing information could have provided additional insight into the software outsourcing process.

The second strength of the research study was the theme from the descriptive analysis generated in the NVivo software, which revealed specific perception about the self-imposed inferiority complex by the Nigerian companies on its local resources, which made it difficult to evaluate the vendor, control the project or hold the vendor accountable for the software quality.

The final strength of the mixed method study was in the analysis of the quantitative and qualitative data. The data from the quantitative segment provided a general perception of the IT professionals' experience on outsourcing in Nigerian, and the SPSS software provided the statistical breakdown of the responses. The outcomes that emerged from the descriptive analysis provided visible insight into software outsourcing activities, and possible shortfalls. The qualitative and quantitative results strengthened the study and supported the purpose of the research that there were factors that affected the quality of software outsourced from Nigeria.

Limitations

According to Creswell (2012), a mixed method study could be limited to the absence of participation, minimum sample size, and data collection process. The pilot study led to the modification and improvement of the instruments to increase their reliability. The Cronbach's alpha of the study was .982 which confirmed that the

reliability of the research instrument was reasonable. The study was limited to the geographical boundaries of Nigeria, and the population was limited to the IT consultants with outsourcing experience. Achieving the minimal sample size for the quantitative part of the study was a limitation. There may be additional individuals who could inform the study but were beyond the reach of the researcher. The questionnaire was updated to measure the perceptions of the IT managers but the 47-item format may be a limitation to some participants.

The use of online data collection tools allowed for the involvement of a dispersed sample from the population but prevented opportunities to follow-up on answers to the survey and interviews questions. Data saturation from the qualitative data may require more participants, but reaching data saturation depended on the prudent opinion of the researcher. Comparisons of the results of the descriptive statistics to the qualitative data helped to strengthen the trustworthiness of the study findings (Anney, 2014). Interview transcript was verified with interviewees to enhance the accuracy of the data and lessen interviewer bias. The information provided by the participants was limited by the credibility and trustworthiness of the responses.

Recommendations for Future Research

The current mixed methods descriptive study concentrated on IT executives, functional, and technical consultants, project manager, and other IT professionals in a small section of the IT industry. This research did not focus on the actual cost of outsourcing considering that hidden cost may not be considered during the initial estimate. Further quantitative research should investigate total time and cost of software outsourcing in Nigeria, including cost related to communication issues, cost of

identifying and fixing bugs, lost revenue during the period, cost of poor project management, and the economic impact on the company.

The second recommendation for future research should focus on a comparative study of insourcing (including cost of capacity building) and outsourcing (including hidden cost) software products in Nigeria. The research should assume that the collaborative activities of outsourced and local resources helped team integration, and improved the knowledge base of the local resources to take up more complex projects currently controlled by foreign workers.

Summary

Outsourcing software development enables companies to benefit from the large pool of skilled workers in other countries, save cost, and the company's long-term strategic goals (Abdul-Halim et al., 2016; Lahiri, 2015). Nigerian companies were eager to embrace and consume the advancements in technology without proper preparations. The focus of the study was to identify those factors responsible for the continuous delivery of poor quality software to Nigeria. Failure of Nigerian companies to benefit from outsourcing constituted an economic setback for the country, and a financial setback for the company, IT managers, and employees.

Software outsourcing failed in Nigeria because there was a clear disconnect between the Nigerian companies and their outsourcing partners due to communication issues, and inadequate experienced local resources to define and manage the project expectations. Existing literature blamed lack of understanding of customer requirement for some outsourced software development failures. There was no literature on the competence level of the IT project managers in Nigeria. This research focused on

software outsourcing projects for companies in Lagos, and Port Harcourt, Nigeria. The research investigated the factors responsible for the failure of outsourcing in these companies.

The researcher used mixed methods study to explore and explain the factors that affected the quality of outsourcing software development in Nigeria. The mixed methods study collected quantitative data through the survey, and qualitative descriptive telephone interviews to validate the outsourced software quality issues. Two hundred and forty-nine executives, functional, and technical consultants, project manager, and other IT professionals participated in the study. The study included findings and interpretations, generalizations, and recommendations for future research.

Conclusion

Four important lessons were learned from the research results. First, the interview sessions with the Project manager and IT professional revealed that communication plays a very important role in the success of any software outsourcing project, especially Regarding the company engaging in outsourcing. Many Nigerian companies that engaged in outsourcing ignored the impact of the time difference on the project, especially when working with resources in India, and the infrastructure in Nigeria was still evolving, communication outside the work environment was usually a big challenge. This means that the Nigerian partner had three hours to work with their outsourcing partners every work day. During project team sessions, understanding the outsourced partners was equally a challenge because of the difference in accent and culture. The project manager should bridge the communication gap between the outsource team and the client, and monitor the project to avoid scope creep and to ensure that the resource interviewed for

the work will be the person doing the work. This project manager must understand the business requirement and bring the team together at short notice.

Secondly, the research revealed the need for corporative management of the outsourcing project by the Nigerian client and contractor. The Nigerian client must encourage in-house capacity building by exploring the skillset of its employees to evaluate their capabilities, to manage such products with little training from offshore experts. This skillset will enable them to define the business process of the company with adequate clarity, such that can be presented in a requirement document very concisely in both functional and technical language, and that can be easily understood by the outsourcing partner. The company should be able to conduct a requirement walkthrough with the partner to ensure that all ambiguities were addressed and clarified, before the document was signed-off and shipped to the development team.

Thirdly, the Nigerian client has the 'expatriate-syndrome' which can be eliminated by ensuring that all resources that will work on the project are properly vetted, interviewed, and their references are verified. This includes but not limited to online verification, validation of past project, scope, duration, the role played by the resource on those projects. The fourth and final lesson the researcher learned from the results were that outsourced software development work should be done in phases, probably using Agile methodology (Dingsøyr et al., 2012) and be tested by both teams. During the selection process, the vendor must agree that part of the payment be withheld until the application is properly tested and delivered.

The individual analysis presented the personal experience of the obstacles and remedies that Nigerian companies can implement to guarantee a good quality outsourced

software product. Majority of the Nigerian companies engaged in outsourcing without adequate knowledge of how the process may help or hurt their business processes, thereby relying on another customer's perception or experience. The data collected and analyzed validated the existence of poor quality software in Nigerian companies, over budget, poorly executed, and under the control of the outsourced company. The researcher's intention for this mixed method study was to elevate the discussion on the importance of quality of software products outsourced from Nigeria, and the socio, cultural, economic, political, and ethical impact on the Nigerian IT industry, academia, and the family as a whole.

Chapter 5 concludes this research study. The findings produced four themes that revealed software implementation milestones; a) business process, b) requirement gathering, c) project management and d) development process. Recommendations encourage Nigerian businesses to be involved and take control of the software development process and suggested additional research to be conducted on a comparative study of outsourcing.

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APPENDIX A: PREMISES, RECRUITMENT AND NAME USE PERMISSION

University of Phoenix®

PREMISES, RECRUITMENT AND NAME (PRN) USE PERMISSION

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(Insert Name of Facility, Organization, University, Institution, or Association)

Please complete the following by check marking any permissions listed here that you approve, and please provide your signature, title, date, and organizational information below. If you have any questions or concerns about this research study, please contact the University of Phoenix Institutional Review Board via email at IRB@phoenix.edu.

☑ I hereby authorize [redacted], a researcher from University of Phoenix, to use the premises (facility identified above and address below) to conduct a study entitled Effect of outsourcing on software quality – a quantitative descriptive study.

☑ I hereby authorize [redacted], a researcher from University of Phoenix, to recruit subjects for participation in a study entitled Effect of outsourcing on software quality – a quantitative descriptive study at the facility identified above.

☑ I hereby authorize [redacted], a researcher from University of Phoenix, to use the name of the facility, organization, university, institution, or association identified above when publishing results from the study entitled Effect of outsourcing on software quality – a quantitative descriptive study.

[redacted]
Signature

18/Nov/2016
Date

[redacted]
Name

[redacted]
Title

[redacted]

[redacted]
Email Address

[redacted]
Phone Number

[redacted]

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University of Phoenix®

PREMISES, RECRUITMENT AND NAME (PRN) USE PERMISSION

[redacted]

(Insert Name of Facility, Organization, University, Institution, or Association)

Please complete the following by check marking any permissions listed here that you approve, and please provide your signature, title, date, and organizational information below. If you have any questions or concerns about this research study, please contact the University of Phoenix Institutional Review Board via email at IRB@phoenix.edu.

X☐ I hereby authorize [redacted], a researcher from University of Phoenix, to use the premises (facility identified above and address below) to conduct a study entitled *Offshore outsourcing: A study of the quality of software development*

X☐ I hereby authorize [redacted], a researcher from University of Phoenix, to recruit subjects for participation in a study entitled *Offshore outsourcing: A study of the quality of software development* at the facility identified above.

X☐ I hereby authorize [redacted], a researcher from University of Phoenix, to use the name of the facility, organization, university, institution, or association identified above when publishing results from the study entitled *Offshore outsourcing: A study of the quality of software development.*

[redacted]
Signature

11/16/2016
Date

[redacted]
Name

[redacted]
Title

[redacted]
Address of Facility
(include URL if Website)

[redacted]
Email Address

[redacted]
Phone Number

APPENDIX B: SURVEY INSTRUMENT

Dear Participant,

The purpose of the research study is to study how outsourcing can reduce operational expenses, and improve corporate profits, but the quality of the software may be disappointing. The study is significant for the executives and IT professional to consider the impact of outsourcing on the software quality.

In this research, there are no foreseeable risks to you. You can decide to be a part of this study or not. Participation entails answering this 10-15-minute web-based questionnaire about quality in the outsourcing of software development. If you chose to participate in the survey, you will be unable to participate in the interview process. Once you start, you can withdraw from the study at any time without any penalty or loss of benefits, by sending an email to me at xxxxxxxxxxxxxxxxxxxx.

The results of the research study may be published but your identity will remain confidential and your name will not be made known to any outside party. You will have an assigned pseudonym for the purposes of completing surveys. Although there may be no direct benefit to you, a possible benefit from your being part of this study is an improved understanding of issues that can improve the performance of support teams in the Information Systems and Technologies industry.

If you have any questions about the research study, please call me at xxx-xxx-xxxx. For questions about your rights as a study participant, or any concerns or complaints, please contact the University of Phoenix Institutional Review Board via email at IRB@phoenix.edu. As a participant in this study, you should understand the following:

You may decide not to be part of this study or you may want to withdraw from the study at any time. If you want to withdraw, you can do so without any problems.

1. Your identity will be kept confidential.
2. The researcher, has fully explained the nature of the research study and has answered all your questions and concerns.

3. Data will be kept in a secure and locked safe. The data will be kept for three years, and then destroyed by shredding, or deletion.
4. The results of this study may be published.

Based on your experience with businesses in Nigeria, rate the following statements by choosing among Strongly disagree, Disagree, Neutral, Agree, Strongly agree as responses to each statement below:

No	Survey Question	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
1	Outsourced software fulfills the user requirements					
2	Outsourced software is delivered on time					
3	Outsourced software provides accurate results					
4	Outsourced software satisfies the integration requirements					
5	Outsourced software is stable and unlikely to fail easily					
6	Based on your experience, the software could withstand System failures					
7	After System failures, the software could return to optimal performance					
8	The software exhibited reliable result under different conditions					
9	Based on your experience, outsourced software included change management features					
10	Outsourced software is scalable					
11	Based on your experience, making changes to outsourced was software easy					
12	You received comprehensive documentation of outsourced software					
13	Based on your experience, the users find outsourced software easy to understand					
14	In your opinion, users appreciate the software interface					
15	Do you agree that it was easy for different users to learn the software?					
16	The software made the company operation easier					

17	Based on your experience, users find it easy to install the software					
18	In your opinion, the software included adequate security features for its use					
19	Do you agree that failures in outsourced software are easy to troubleshoot and detect?					
20	In your opinion, the response time of outsource developers satisfies user expectation during software failure					
21	Based on your outsourcing experience, proper tools were used to convert client needs to requirements specifications					
22	Do you agree that majority of the user requirements was understood and included in the requirements at the early stage?					
23	Based on your opinion, established processes identified during requirement gathering were applied during the software development					
24	Do you agree that standard development practices and tools were applied to trace and track the requirements?					
25	In your opinion, prototypes were created to simulate the requirements					
26	Do you agree that stakeholders sign off on all requirements on time?					
27	In your opinion, offshore outsource employees provided requisite access to necessary resources and production data					
28	Offshore outsource resources were provided necessary licenses needed for technology available to them					
29	Do you agree the developers were provided access to the development tools they needed?					
30	Based on your outsourcing experience, existing application or system knowledge impacted the quality of software development projects					
31	Do you agree that technical knowledge of the software can impact the quality of software developed offshore?					
32	Do you agree that county-specific requirements can affect the quality of software development projects?					
33	Based on your experience, business domain knowledge transferred from the clients impacted the quality of software developed offshore					

34	In your opinion, the creative ideas developed through the interaction of offshore and on-site project teams, led to improved knowledge transfer and integration					
35	Proper leadership coordination helped to integrate the knowledge between offshore and onsite resources					
36	In your opinion, software development and project management processes were defined to achieve product quality					
37	Do you agree that detailed metrics were used for all offshore software development projects					
38	Quantitative feedback can improve software development process					
39	In your opinion, outsourcing providers set higher levels of process maturity than the customers expected					
40	Offshore resources set processes for knowledge transfer to make it available when required					
41	Based on your experience, were trained personnel always available to implement the project?					
42	Additional resources were recruited to take up the project when necessary					
43	Do you agree that the outsourcers provided adequate resources throughout the duration of the project?					
44	There is a relationship between the developer's years of experience and the quality of outsourced software product					
45	There is a relationship between the developer's years of employment and the quality of outsourced software product					
46	Based on your experience, there is a relationship between the developer's academic background and the quality of outsourced software product					
47	Do you agree that there is a relationship between proper communication and the quality of outsourced software product					

APPENDIX C: PILOT STUDY ANALYSIS

Table 10

Pilot Study Results with Weighted Average Below 3 points

#	Survey Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total	Weighted Average
2	Outsourced software is delivered on time	0	6	5	4	0	15	2.87
3	Outsourced software provides accurate results	1	3	9	2	0	15	2.8
4	Outsourced software satisfies the integration requirements	3	1	5	6	0	15	2.93
5	Outsourced software is stable and unlikely to fail easily	3	7	3	0	1	14	2.21
7	After System failures, the software was able to return to optimal performance	2	6	2	4	1	15	2.73
8	The software exhibited reliable result under different conditions	0	5	9	1	0	15	2.73
9	Based on your experience, the outsourced software included change management features	3	9	1	2	0	15	2.13
10	Outsourced software is scalable	3	4	5	3	0	15	2.53
11	Based on your experience, making changes to outsourced was software easy	6	4	0	4	0	14	2.14
12	You received comprehensive documentation of outsourced software	3	6	4	1	1	15	2.4
13	Based on your experience, the users find outsourced software easy to understand	2	6	4	2	0	14	2.43
14	In your opinion, users appreciate the software interface	1	3	7	4	0	15	2.93
15	Do you agree that it was easy for different users to learn the software?	1	2	10	2	0	15	2.87
17	Based on your experience, users find it easy to install the software	1	3	7	3	0	14	2.86

19	Do you agree that failures in outsourced software are easy to troubleshoot and detect?	1	9	2	3	0	15	2.47
20	In your opinion, the response time of outsource developers satisfies user expectation during software failure	1	5	5	4	0	15	2.8
21	Based on your outsourcing experience, proper tools were used to convert client needs to requirements specifications	1	4	6	3	0	14	2.79
22	Do you agree that majority of the user requirements was understood and included in the requirements at the early stage?	1	7	3	4	0	15	2.67
24	Do you agree that standard development practices and tools were applied to trace and track the requirements?	1	5	4	4	0	14	2.79
25	In your opinion, prototypes were created to simulate the requirements	8	6	1	0	0	15	1.53
26	Do you agree that stakeholders sign off on all requirements on time?	1	4	6	4	0	15	2.87
37	Do you agree that detailed metrics were used for all offshore software development projects	1	8	3	3	0	15	2.53
39	In your opinion, outsourcing providers set higher levels of process maturity than the customers expected	2	7	4	2	0	15	2.4
40	Offshore resources set processes for knowledge transfer to make it available when required	1	8	4	1	0	14	2.36
43	Do you agree that the outsourcers provided adequate resources throughout the duration of the project?	0	6	6	3	0	15	2.8

Table 11
Pilot Study Result with Weighted Average of 3 points

#	Survey Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total	Weighted Average
6	Based on your experience, the software was able to withstand System failures	0	5	7	1	2	15	3
42	Additional resources were recruited to take up the project when necessary	2	2	5	6	0	15	3

Table 12
Pilot Study Result with Weighted Average Greater than 3 points

#	Survey Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total	Weighted Average
1	Outsourced software fulfills the user requirements	0	3	3	9	0	15	3.4
16	The software made the company operation easier	1	1	4	9	0	15	3.4
18	In your opinion, the software included adequate security features for its use	1	3	5	6	0	15	3.07
23	Based on your opinion, established processes identified during requirement gathering were	0	3	5	7	0	15	3.27

	applied during the software development							
27	In your opinion, offshore outsource employees provided requisite access to necessary resources and production data	0	2	10	3	0	15	3.07
28	Offshore outsource resources were provided necessary licenses needed for technology available to them	0	4	4	7	0	15	3.2
29	Do you agree the developers were provided access to the development tools they needed?	0	4	7	3	1	15	3.07
30	Based on your outsourcing experience, existing application or system knowledge impacted the quality of software development projects	0	1	2	6	6	15	4.13
31	Do you agree that technical knowledge of the software	0	0	2	5	8	15	4.4

	can impact the quality of software developed offshore?							
32	Do you agree that county-specific requirements can affect the quality of software development projects?	0	0	4	5	6	15	4.13
33	Based on your experience, business domain knowledge transferred from the clients impacted the quality of software developed offshore	0	1	4	8	2	15	3.73
34	In your opinion, the creative ideas developed through the interaction of offshore and on-site project teams, led to improved knowledge transfer and integration	1	4	5	3	2	15	3.07
35	Proper leadership coordination helped to integrate the knowledge between	0	1	5	7	2	15	3.67

	offshore and onsite resources							
36	In your opinion, software development and project management processes were defined to achieve product quality	1	4	3	7	0	15	3.07
38	Quantitative feedback can improve software development process	1	0	2	8	4	15	3.93
41	Based on your experience, were trained personnel always available to implement the project?	0	3	8	4	0	15	3.07
44	There is a relationship between the developer's years of experience and the quality of outsourced software product	0	1	0	4	9	14	4.5
45	There is a relationship between the developer's years of employment and the quality of outsourced	0	1	2	5	7	15	4.2

	software product							
46	Based on your experience, there is a relationship between the developer's academic background and the quality of outsourced software product	1	1	8	3	2	15	3.27
47	Do you agree that there is a relationship between proper communication and the quality of outsourced software product	0	0	4	6	5	15	4.07

Table 13
Question with Highest Number of Respondents that strongly disagree

#	Survey Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total	Weighted Average
25	In your opinion, prototypes were created to simulate the requirements	53.33%	40.00%	6.67%	0.00%	0.00%		

Table 14

Question with Highest Number of Respondents that strongly agree

#	Survey Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total	Weighted Average
44	There is a relationship between the developer's years of experience and the quality of outsourced software product	0.00%	7.14%	0.00%	28.57%	64.29%		

APPENDIX D: SURVEY INVITATION LETTER

Dear Participant,

My name is xxxxxxxxxxxxxxx a Doctor of Business Administration and Information Systems student at the University of Phoenix. The purpose of this letter is to invite to participate in my study titled "Offshore outsourcing: A study of the quality of software development"

This research will study how outsourcing can reduce operational expenses, and improve corporate profits, without affecting the quality of the software. The low cost of foreign workers in developing countries is encouraging companies to outsource their software development work, regardless of the quality, cost, or benefit to the company. The study is significant for Nigerian Executives and IT professional to consider before investing in outsourcing.

Your participation in my study will involve responding to an Online survey by choosing one of alternative responses to each question. The survey questions will be delivered by SurveyMonkey. The survey questions will take 10-15 minutes complete, and will be focused on your perception of outsourcing and the quality of software delivered to companies. Your participation in this study is voluntary, and you can withdraw at any time. Your response will be kept confidential, during and after the study is published. You are qualified for this study if you meet all the following:

- You must have graduated from a university, tertiary institution, or its equivalent
- You have at least two years of software outsourcing experience, either as a manager, or administrator

This study is for learning purposes only and will not be shared with your employer or any third party. If you have any questions or concerns, contact me at xxxxxxxxxxxxxxx. You may request for a copy of this study. You may indicate your willingness to participate by clicking on the link to the SurveyMonkey below:

Survey Link: https://www.surveymonkey.com/xxxxxx

With kind regards,

xxxxxxxxxxxxxx

APPENDIX E: INFORMED CONSENT

INFORMED CONSENT: PARTICIPANTS 18 YEARS OF AGE AND OLDER

Dear Participant,

My name is xxxxxxxxxxxxxxxx and I am a student at the University of Phoenix working on a doctoral degree. I am doing a research study entitled *Offshore outsourcing: A study of the quality of software development*. The purpose of the research study is to study how outsourcing can reduce operational expenses, and improve corporate profits, but the quality of the software may be disappointing. The study is significant for the executives and IT professional to consider the impact of outsourcing on the software quality.

In this research, there are no foreseeable risks to you. You can decide to be a part of this study or not. Participation entails answering 30-minute web-based questionnaire about quality in the outsourcing of software development. If you chose to participate in the survey, you will be unable to participate in the interview process.

Once you start, you can withdraw from the study at any time without any penalty or loss of benefits, by sending an email to me xxxxxxxxxxxxxxxxxx.

The results of the research study may be published but your identity will remain confidential and your name will not be made known to any outside party. You will have an assigned pseudonym for the purposes of completing surveys and participating in the interview.

Although there may be no direct benefit to you, a possible benefit from your being part of this study is an improved understanding of issues that can improve the performance of support teams in the Information Systems and Technologies industry.

If you have any questions about the research study, please call me at xxxxxxxxxxx, or xxxxxxxxxxxxxxx. For questions about your rights as a study participant, or any

concerns or complaints, please contact the University of Phoenix Institutional Review Board via email at IRB@phoenix.edu.

As a participant in this study, you should understand the following:

1. You may decide not to be part of this study or you may want to withdraw from the study at any time. If you want to withdraw, you can do so without any problems.

2. Your identity will be kept confidential.

3. xxxxxxxxxxxxxxxx, the researcher, has fully explained the nature of the research study and has answered all your questions and concerns.

4. Data will be kept in a secure and locked safe. The data will be kept for three years, and then destroyed by shredding, or deletion.

5. The interview sessions will be recorded and you consent to the recording and transcription of the session.

6. The results of this study may be published.

"By signing this form, you agree that you understand the nature of the study, the possible risks to you as a participant, and how your identity will be kept confidential. When you sign this form, this means that you are 18 years old or older and that you give your permission to volunteer as a participant in the study that is described here."
(☐) I accept the above terms. (☐) I do not accept the above terms. (CHECK ONE)

Signature of participant _____ Date _____

Signature of Researcher _____ Date _____

APPENDIX F: INTERVIEW LETTER OF INVITATION

Dear Participant,

My name is xxxxxxxxxxxxx a Doctor of Business Administration and Information Systems student at the University of Phoenix, and the final requirement of doctoral program, is to complete a doctoral dissertation and research study. The purpose of this letter is to invite to participate in my study titled "Offshore outsourcing: A study of the quality of software development"

The purpose of the research study is to study how outsourcing can reduce operational expenses, and improve corporate profits, but the quality of the software may be disappointing. The low cost of foreign workers in developing countries is encouraging companies to outsource their software development work, regardless of the quality, cost or benefit to the company. The study is significant for the executives and IT professional to consider the impact of outsourcing on the software quality. Some studies exist on outsourcing, but none addressed the quality of software delivered to the outsourcing company.

Your participation in my study will involve a 30-minute interview focused on your perception of outsourcing and the quality of software delivered to companies. Your participation in this study is voluntary, and you can withdraw at any time. Your response will be kept confidential, during and after the study is published. You are qualified for this study if you meet all the following:

- You must have graduated from a university, tertiary institution, or its equivalent.
- You have at least two years of software outsourcing experience, either as a manager, or administrator

This study is for learning purposes only and will not be shared with your employer or any third party. If you have any questions or concerns, contact me through email _____ or _____. You may request for a copy of this study. Please reply this email to indicate your voluntary acceptance to participate in the interview.

With kind regards,

_____

Email: _____

Name of Interviewee: _____

Signature of Interviewee: _____

APPENDIX G: CRONBACH'S ALPHA OF THE INSTRUMENT

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q2	173.29	744.115	.675	.982
Q3	173.31	745.622	.696	.982
Q4	173.35	745.161	.723	.982
Q5	173.36	742.094	.759	.982
Q6	173.48	736.853	.748	.982
Q7	173.42	737.461	.847	.981
Q8	173.34	743.398	.746	.982
Q9	173.39	741.910	.786	.981
Q10	173.40	738.490	.749	.982
Q11	173.45	739.385	.801	.981
Q12	173.46	737.364	.707	.982
Q13	173.42	729.405	.816	.981
Q14	173.35	741.024	.772	.982
Q15	173.41	737.619	.778	.981
Q16	173.32	745.924	.682	.982
Q17	173.44	733.896	.842	.981
Q18	173.42	737.904	.836	.981
Q19	173.25	746.108	.655	.982
Q20	173.51	734.035	.817	.981
Q21	173.45	738.146	.808	.981
Q22	173.43	737.121	.821	.981
Q23	173.32	739.299	.816	.981
Q24	173.38	730.102	.858	.981
Q25	173.56	719.838	.863	.981
Q26	173.39	746.819	.620	.982
Q27	173.42	735.291	.843	.981
Q28	173.36	742.346	.736	.982
Q29	173.16	749.975	.666	.982
Q30	173.10	754.501	.556	.982
Q31	173.03	755.744	.468	.982
Q32	173.22	748.900	.585	.982
Q33	173.27	744.185	.662	.982
Q34	173.16	749.092	.651	.982
Q35	173.17	748.823	.702	.982
Q36	173.16	748.592	.649	.982

Q37	173.27	741.662	.774	.982
Q38	173.15	749.698	.603	.982
Q39	173.41	738.812	.675	.982
Q40	173.45	730.339	.810	.981
Q41	173.40	739.548	.793	.981
Q42	173.41	733.005	.883	.981
Q43	173.44	735.918	.832	.981
Q44	173.36	737.164	.823	.981
Q45	172.92	755.630	.464	.982
Q46	173.18	742.024	.582	.982
Q47	173.19	735.736	.692	.982
Q48	173.01	755.739	.493	.982

APPENDIX H: STATISTICAL ANALYSIS OF SURVEY QUESTIONS

Table 15
Mean and Standard Deviation of the Variables

	Valid	Mean	Std. Deviation
Outsourced software fulfilled the user requirements	226	3.72	0.826
Outsourced software was delivered on time	225	3.74	0.795
Outsourced software provided accurate results	226	3.69	0.774
Outsourced software satisfied the integration requirements	224	3.64	0.840
Outsourced software was stable and unlikely to fail easily	224	3.49	0.966
Outsourced software was able to withstand System failures	224	3.59	0.858
After System failures, outsourced software was able to return to optimal performance	224	3.69	0.757
The outsourced software exhibited reliable result under different conditions	222	3.64	0.800
The outsourced software included change management features	225	3.60	0.906
Outsourced software is scalable	225	3.55	0.850
Based on your experience, making changes to outsourced software was easy	225	3.53	1.009
Vendors provided comprehensive documentation of the outsourced software	225	3.58	1.066
Users appreciate the software interface	225	3.64	0.882
It was easy for different users to learn outsourced software	225	3.58	0.898
Outsourced software products made the company operation easier	222	3.67	0.810
Users find it easy to install the software	225	3.53	0.945
Users find outsourced software easy to understand	225	3.55	0.880
The software outsourced offshore included adequate security features for its use	222	3.81	0.786
Failures in outsourced software are easy to troubleshoot and detect	223	3.43	0.983
The response time of outsource developers satisfies user expectation during software failure	226	3.50	0.901
Majority of the user requirements was understood and included in the requirements at the early stage?	225	3.53	0.916
Established processes identified during requirement gathering were applied during the software development	226	3.71	0.856

Standard development practices and tools were applied to trace and track the requirements?	225	3.62	1.015
Prototypes were created to simulate the requirements	226	3.46	1.219
Stakeholders sign off on all requirements on time?	225	3.66	0.882
Proper tools were used to convert client needs to requirements specifications	225	3.56	0.957
Offshore outsource employees provided requisite access to necessary resources and production data	225	3.63	0.877
Offshore outsource resources were provided necessary licenses needed to complete their task	225	3.92	0.728
Offshore developers were provided access to the development tools they needed	224	3.91	0.767
Technical knowledge of the software can impact the quality of software developed offshore?	225	3.97	0.876
County-specific requirements can affect the quality of software development projects?	226	3.79	0.846
Business domain knowledge transferred from the clients impacted the quality of software developed offshore	224	3.74	0.917
Existing application or system knowledge impacted the quality of software development projects	223	3.83	0.855
Creative ideas developed through the interaction of offshore and on-site project teams, led to improved knowledge transfer and integration	225	3.83	0.817
Proper leadership coordination helped to integrate the knowledge between offshore and onsite resources	224	3.88	0.777
Software development and project management processes were defined to achieve product quality	225	3.75	0.840
Quantitative feedback can improve software development process	223	3.82	0.851
Outsourcing providers set higher levels of process maturity than the customers expected	226	3.53	1.046
Detailed metrics were used for all offshore software development projects	225	3.52	1.086
Based on your experience, were trained personnel always available to implement the project?	224	3.61	0.856
Offshore resources set processes for knowledge transfer to make it available when required	225	3.55	0.949
Additional resources were recruited to take up outsourced project when necessary	226	3.58	0.902
Do you agree that the outsourcers provided adequate resources throughout the duration of the project?	224	3.61	0.906

There is a relationship between the developer's years of experience and the quality of outsourced software product	226	4.07	0.843
There is a relationship between the developer's years of employment and the quality of outsourced software product	223	3.75	1.043
There is a relationship between the developer's academic background and the quality of outsourced software product	223	3.79	1.051
There is a relationship between proper communication and the quality of outsourced software product	225	4.04	0.737