Effectiveness of Software Products Development in Nigeria

G.O. Binuyo[a*], T.O. Oyebisi[b], A. Olayinkaka[c] and B.S Afolabi[d]

a. African Institute for Science Policy and Innovation, Obafemi Awolowo University, Ile-Ife, Nigeria.

b. Department of Computer Science and Engineering, Obafemi Awolowo University, Ile-Ife, Nigeria.

a. Email: gobinuyo@oauife.edu.ng

b. Email: tooyebisi@yahoo.com

Abstract: This paper evaluate the effectiveness of software development in Nigeria. The constraint of the effectiveness were examined, the level of acceptability of the locally developed software products were evaluated and Shewa's model was developed to implement the effectiveness of indigenous software developed to compete with their globally counterpart. The ICT firms that specialized in software development, educational institutions and other major stakeholders, including users of software packages were also covered.

Data were collected using sets of questionnaire and from secondary sources. The questionnaire was administered on purposively selected software developers in select ICT firms and elicited information on the level of acceptability and the constraint of locally developed software product in Nigeria. A five-point Likert scale rating of 5 to 1 was used to determine the relative weight of the level of acceptability and constraint variables. The result revealed low level (0.42) acceptability of the indigenous software, the correlate factors of which were reliability (1.17), efficiency (1.45), maintainability (1.29), size/capacity (0.78), functionality (1.04) and extensibility (2.13) at significant difference ($F = 5.55$, $p \leq 0.05$). The major constraints of software development with significant difference ($F = 3.61$, $p < 0.05$) were low spread of ICT, Internet bandwidth restrictions weighted (3.94) and manpower (2.22).

The study concluded that though the Nigeria software developers adopt best practices in their operations, the effectiveness and acceptability of their products are being vitiated by dearth of skill, experienced software professionals and other contingencies such as investment capability. Therefore, it implies that the domestic use of software products perhaps is the most important driver of software industry growth for emerging technologies. Consequently, a proactive interest on the part of government to address the shortcomings is a critical impetus for developing and galvanizing the software industry for global competitiveness.

Keywords: Software Development; software products; software users/stakeholders; Indigenous, Shewa's Model; Effectiveness; Constraint and Nigeria.

1.0 Introduction

Countries around the globe have become more information and knowledge-intensive, giving rise to the phenomenon of the knowledge-based economy [19]. The success of a nation's economy depends on the productivity and the extent of its Research and Development (R&D) activities. It was reported in [18] that 70% of the product development costs are now in software development. It was further, estimated that, software-based product functionality is a relatively new phenomenon and there is every indication that it will continue to grow rapidly, in the amount of software and in its complexity.

The nations that invest heavily in software development R&D have predominantly an in-flow of international payment for technology such as patent royalties and payments for technical expertise. Also, nations that demonstrate the highest innovative performance and investment, and that have necessary infrastructure for Software development/acquisition are most likely to come with new opportunities that could further improve their technological position in the world [26]. Governments, all over the world struggle with the problem of how to ensure that Science and Technology contribute effectively to solving national problems [4]. It is therefore important to understand that software development has the significant engine of R&D organizations and their effective roles in the society.

Software development reflects the ability to respond rapidly through changes in products and processes and also the ability for innovation, which is a flow variable that could provide the cutting edge in competing with developed countries and bring about comparative advantage in the sector [22].

The computer software has become a leading source of employment creation and economic growth in the world [20]. The industry is also a critical factor in knowledge production that is embodied in its products and services Although the computer software industry is dominated by the firms based in major industrialized countries of the world, it continues to offer great prospects for economic growth and industrial development within developing economics.

Similarly, software has become a key facilitating technology making it a major strategic technology choice for growth and development. It underpin the actual creation and efficient utilization of core aspects of modern services and manufacturing of physical products [2]. Furthermore, the current globalization of markets and the knowledge intensive nature of software has made the sector to become one of the most internationally dispersed high-tech industry and an increasingly important complex component, desirable for growth and development, in any economy[21][1].

In addition, application of effective software development approaches improves decision-making and cost management, better resource and service delivery, increased innovation and, ultimately, a competitive advantage [22]. The high growth rate of this sector had resulted in dramatic increase in the spread of software products and services world–wide with a tremendous high level of productivity [13].

It was also observed through this study, that the advent of ICT and software revolution presents Nigeria with an opportunity to take a prominent, if not high-up position in the global ICT value chain. The software opportunities can unleash the potential of the Nigerian nation. With large, youthful, educated and enterprising populace, software provides Nigeria with a unique opportunity niches to diversify Nigerian economy from commerce-dominated nature to high-tech knowledge economy. This is more so that the success of a nation's economy depends on the productivity and the extent of its Research and Development (R&D) activities. [18] averted that 70% of the product development costs are now in software development. He further estimated that, software-based product functionality is a relatively new phenomenon and there is every indication that it will continue to grow rapidly, in the amount of software and in its complexity. Consequently, the nations that invest heavily in R&D for software development are expected to predominantly have an in-flow of international payments for technology such as patent royalties and payments for technical assistance, services and expertise. Also, nations that demonstrate the highest innovative performance and investment, and that have necessary infrastructure for Software development and acquisition are most likely to come with new opportunities that could further improve their technological position in the world [26].

It is for the foregoing reasons that governments, all over the world struggle with the problem of how to ensure that Science and Technology contribute effectively to solving national problems [4]. It is important to understand that effective software development is the significant engine for R&D organizations and their significant roles in the society. Software development therefore signify and reflects the ability to respond rapidly through changes in products and processes and also the ability for innovation, which is a flow variable that could provide the desirable cutting edge in competing with developed countries and bring about comparative advantage in the sector [22].

This study therefore investigated the constraints of software development in Nigeria that could culminate into technological capability leading to competitiveness and growth of the software sector. The empirical analyses generated by this research and the shewa's model proposed as practical recommendations that emerged from it would serve as key sources of base data for software developers, corporate managers, government policy and decision makers to design and implement strategies to speed up development in developing countries' software sector.

2 LITERATURE REVIEW

2.1 Software development is the production or creation of software. This software could be produced for a variety of purposes for meeting specific needs of a specific client/business; perceived need of some set of potential users; for personal use and increasing market competition [14].

Software development is an the activity that involves process of writing and maintaining the source code, and in the broader sense, the term includes all that is involved between the conceptions of the desired software through to its final manifestation [27]. Therefore, software development may include research, new development, modification, reuse, re-engineering, maintenance, or any other activity that results in software products [3].

The features were described as characterized of software industry [11]. They include:-

(a) The different segments of the software industry (covering shrink-wrapped products, enterprise products, software services, embedded systems, technology licensing, etc.) have their own methodologies, global marketplace with established players, business methods, and barriers to entry;

(b) Critical mass of multidisciplinary talent and skills make up software development teams in different segment of the industry;

(c) The importance of entrepreneurship, venture capital, the software development experts/professionals and other special support services are vital elements that engender innovative developments;

(d) The peculiarity of infrastructure for software in industry requires the domestic systems to use an industry-standards that meet customers' satisfaction and export requirements for global competitiveness, and

(e) It lacks manufacturing phase for product development, due to the fluidity and unusual volatility of its product specifications, technology platforms and marketing partnerships.

It was avers that software is a critical part of modern industrial infrastructure and an important industry in its own right, but it is also the vehicle for implementing the other key elements of a knowledge economy [11]. He further states that software is a fundamental capability that is deployed across almost all sectors of an economy. Moreover, as a nascent industry and fast-changing technology, market forces alone are often inadequate to harness the industry's potential to address public services and social priorities and to serve the needs of the poor, rural areas, small and medium enterprises (SMEs), and non-government organizations (NGOs).

2.2 Evolution of Software Development and its Impact

Software development was seen to be a creative art-form, and to a degree, experimental. Software development is fast changing in line with technological advancements, global changes in the business environment, changing customer demands and expectations and increasing market competition. It is becoming commonly accepted that software and Information Technology (IT) is no more special than any other business tool. Traditionally, software development was a process of identifying a specific set of requirements and coding to those software development lifecycle, to produce applications that would dictate the business processes [23].

The fundamental change to development is a result of a number of factors, including the increasing reliance on technology, the need to adapt to changing marketplace demands, the issue of maintenance and integrating legacy systems along with a growing requirement for effective management of IT. These issues are the driving force for the extinction of monolithic software systems [28]. The notion of monolithic system is being replaced by the creation of modularized, loosely coupled parts and components that can be re-used and readily integrated across applications. This relatively new and growing requirement for componentization of software is impacting the nature of the global software development industry as it evolves into a manufacturing industry. In turn, this process of software change will affect the development environment and independent software vendors and developers selling solutions in Nigeria.

As businesses become more reliant on technology as a means of gaining competitive advantage for the processes that underpin their services and operations, the complete software 'package' will be dictated by the user. For the developer, this means moving away from basic programming and broadening the process of development to look at software development from a top down perspective. Driven by business model, software developers will need to assemble services to satisfy business processes in a manner that allows access to specific independent 'parts'. Criteria such as flexibility, the ability to fit to the business requirements, the use of standard interfaces and scalability will be more and more important for developers as software will be valued on the 'plug-in-ability' of components to various systems. Common factors of software project's 'failures' are identified in various literatures [12].

Among these factors are unrealistic or unarticulated project goals, inaccurate estimates of needed resources, poorly defined requirements, and poor reporting of project status, unmanaged risks, inability to handle project's complexity, sloppy, immature development practices, poor project management, commercial pressures and preventive Action process highly ineffective [16].
Failure to understand and take preventive actions necessary to resolve problems in the quality system and process for software development behaviour, at the same level that its root cause happened, makes continued project failures a certainty [14]. Society is drawn to know more about failures than best practices or success.

According to Guha best practices that are often specific to software industry include the following: realistic schedules, evolving architecture, faster hardware, retesting/rework, separate users from developers, requirement change, source code control, fix broken code, interfaces, training, user support/ error messages, risk management and static inspection [12]. All these will enhance the productivity and effectiveness of software development in Nigeria.

2.3 Sources of ideas for software development

The need to develop a software often emanated from many sources and the sources of ideas for software products are legion [9]. These ideas can come from market research including the demographic survey of potential new customers, existing customers, sales prospects who rejected the product, other internal software development staff, or a creative third party. Ideas for software products are usually first evaluated by marketing personnel for economic feasibility, for fit with existing channels distribution, for possible effects on existing product lines, required features, and for fit with the company's marketing objectives. In a marketing evaluation phase, the cost and time assumptions become evaluated. A decision is reached early in the first phase as to whether, based on the more detailed information generated by the marketing and development staff, the project should be pursued further [9]. In essence, software product planning is critical to the development success and absolutely requires knowledge of multiple disciplines [10].

Because software development may involve compromising or going beyond what is required by the client, a software development project may stray into less technical concerns such as human resources, risk management, intellectual property, budgeting, crisis management, etc. These processes may also cause the role of business development to overlap with software development.

2.4 Constraints and opportunities in the global software sector

Antonelli avers that the computer software and services industry has had a very low profile and has been largely ignored by policy makers [5]. The development requirements of the industry, despite the fact it is a high technology and knowledge-based industry, centres on long-term, time-consuming and difficult measures that involve creating sound institutional and educational frameworks that are effective at a local scale not on expensive, technocratic schemes. Specifically, the crucial issues to be addressed include the following:-

(i) There have been a wide range of studies examining the impact of information and communication technologies (ICT) on economic development [7][10].

(ii) (ii) The computer services industry was reported to increasingly rely on high-speed telecommunications networks and the Internet to transfer code, data and information across borders.

(iii) Broadband/ISDN networks which can handle the data traffic associated with such data and Internet traffic are restricted in most developing countries, thereby restricting Internet use [9].

(iv) The pool of scientific and technical professionals available in developing countries and its power as an attracting force in software development should not be underestimated [17].

(v) There is a large manpower gap in the global software industry and these pools of scientific and technical labour remain ever attractive to computer software and information technology firms [15].

(vi) The national education system, particularly further and higher education, is crucial in generating skilled professionals suitable for software and computer service activities [27].

The most obvious obstacle developing countries like Nigeria encounter in establishing a successful computer software and services industry is lack of financial capital. This is most evident in the number and distribution of computers within developing countries and more indirectly to the availability and cost of advanced telecommunication services. Software development and the provision of computer services require access to a computer, whereas the diffusion and availability of computers in developing countries still remains low [25].

A study revealed a key factor in outsourcing information systems work overseas was due to cost reductions associated with lower salaries [6]. The importance of low labour costs has also benefited the growth of India's software industry, although India's cost advantage over other low cost countries is narrowing. On average, Indian software engineers earned about $2400 per month in 2010, which is still a tenth of the wages of their United States counterparts [8].

From the foregoing that it is imperative that developing countries adopt distinctive and independent development trajectories as regards software and computer services activity. However, developing countries need to be flexible in their policies in order to pursue development paths suited to their own specific requirements and capacities that may vary significantly from those of India and some other countries that are in the lead of software development products.

3.0 Research Methodology:

The study covered some selected software development firms, users and educational institutions in the six geopolitical zones of Nigeria. The seventy-five small, medium and large ICT firms (Lagos 70; Abuja 2; Port-Harcourt 2 and Kaduna 1) involved in software development and other ancillary firms published by Software Development Association in the Goldstar directories of 2007/2008 were purposively selected for the study. Data were collected using sets of questionnaire and from secondary sources. The questionnaire administered on software developers in select ICT firms elicited information on the constraints and effectiveness of indigenous software development. The questionnaire for educational institutions who are both developers and users covered Heads of Computer Departments of Polytechnics (5) and Universities (6) purposively sampled from the selected tertiary institutions involved with software development in Nigeria. Two hundred and fifty questionnaire were administered out of which 230 (92%) were retrieved and 182 (79%) found useful and analysed.Secondary data was collected from publications on the operations and competitiveness of software development in Nigeria. Descriptive and inferential statistics were employed for data analysis. Reliability and validity test were carried out and the results obtained from the test showed that all the items had an alpha above standard guideline of 0.70. It implies that the scales are suitable for analysis with acceptable reliability. For the study, Cronbach's alpha score of 0.746 was obtained for the entire scale. This indicated that there was internal consistency of the entire variable scale as that variable construct enabled strong internal reliability. These results, therefore, confirmed that the instrument used for the study had satisfactory construct validity which included consistency [21].

4.0 Results and Discussion

4.1 Acceptability of Locally Developed Software in Nigeria

Table 1 shows that most (57.4%) users preferred foreign developed products while 42.4% a low level of acceptability of locally developed software. Table 2 shows the reasons adduced for low level of acceptability of locally software. This include capacity to meet the organizational needs better (28.7%). This is in spite of poor (19%) ease of acquisition. Similarly, most locally developed software were observed to crash too often (23.1%), fail to take care of peculiar need (21.5%) and too expensive to deploy (12.8%).

Table 2 (Appendix 1) presents the descriptive analysis of the measure of attributes of level of acceptability of software which include software reliability, software efficiency, software security, software maintainability, software size, software functional quality and software extensibility. In consonance with Table 4.2, software reliability has weighted average of 1.17, software efficiency (1.45), software security (1.46), software maintainability (1.29), software size (0.78), software functional quality (1.04) and software extensibility (2.13). The level of acceptability of these attributes of software evaluated is ascertained using Analysis of Variance (ANOVA). Five of the attributes of software considered acceptable were statistically significant at 5% level. There was a significant difference in the software reliability based on software standards, ($F = 210.96$, $P < 0.05$), software efficiency ($F = 42.81$, $P < 0.05$), software maintainability ($F = 5.55$, $P < 0.05$), software size ($F = 26.46$, $P < 0.05$) and software functional quality ($F = 82.49$, $P < 0.05$) (Appendix 3).

4.2 Factors affecting General Acceptability of Locally Developed Software

Table 3 in Appendix 2 shows that general constraints affecting the acceptability of the locally developed software include lack of effective policy for software development in Nigeria (56%), lack of development requirements (50%), lack of sound and effective educational and institutional frameworks (38.9%), lack of ICT infrastructure (55.6%), lack of access to low cost ICT network facilities, dearth of critical mass of scientific and technical professional in software development.

Table 1: Level of acceptability of locally developed software

Type of software developed	Frequency	Percentage (%)	Chi square
Foreign	112	57.6	
Local	83	42.4	3.223E2*
Total	195	100.0	

* Significant at 0.05 level of significance.

Table 2:Factor affecting acceptability of locally developed software (descriptive)

Constraints of locally developed software	Frequency	%
Crashes too often	45	23.1
Capacity to meet the organizational needs	56	28.7
Too expensive to deploy	25	12.8
Fail to take care of peculiar need of clients	42	21.5
Poor ease of acquisition	27	13.9
Total	195	100.0

Table 3 showed the analysis of variance of the assessment of impact of constraints on the growth and development and services industry. There was significant difference in assessing their constraints, ($F = 24.71$, $p < 0.05$). The mean rating of low spread of ICT network, internet and bandwidth restrictions (3.94), lack of effective policy for software development and service industry (3.67), lack of sound and effective educational and institutional framework (3.67), and existence of large manpower gap in the global software development (2.22). These constraints made the locally developed unacceptable and motivate the customer to preferred foreign software.

The analysis of the effect of these constraints was analyzed inferentially using Analysis of Variance (ANOVA). The result is presented in (Appendix 2) and indicates that lack of development requirements ($F(1,17) = 16.00$, $p \leq 0.01$), lack of sound and effective educational/institutional frame works ($F(1,17) = 7.467$, $p \leq 0.015$) and lack of ICT infrastructure ($F(1,17) = 10.667$, $p \leq 0.005$).

Similarly, lack of access to low cost ICT network facilities ($F(1,17) = 9.011$, $p \leq 0.008$), lack of critical mass of scientific and technical professional in software development ($F(1,17) = 5.333$, $p \leq 0.035$), existence of large manpower gap in the global software industries ($F(1,17) = 4.598$, $p \leq 0.0035$), low level of remuneration for in house software engineers in organization which encourages outsourcing on non-availability of skilled workforce ($F(1,17) = 53.33$, $p \leq 0.000$) are the statistically significant factors influencing the level of acceptability of locally developed software in Nigeria.

Table 3: Assessment of impact of Constraints on the growth and development industry

Constraints	Mean Rank
(i) Low spread of ICT network, internet and bandwidth restrictions	3.94[a]
(ii) Lack of effective policy for software development and service industry	3.67[ab]
(iii) Lack of sound and effective educational and institutional framework	3.67[ab]
(iv) Low level of diffusion and availability of computer	3.56[b]
(v) Lack of financial capital for establishing computer software and service industry	3.56[b]
(vi) Lack of ICT infrastructure	3.53[b]
(vii) Lack of access to low cost ICT network facilities	3.11[c]
(viii) Lack of critical mass of scientific and technical professional in software development	2.89[c]
(ix) Lack of development requirements	2.50[d]
(x) Low level of remuneration for in-house software engineers in organization which encourage outsourcing of non-availability of skilled workforce	2.28[d]
(xi) Existence of large manpower gap in the global software development	2.22[d]

[a, b, c]; Means with different superscripts are significantly different (F = 24.71, P<0.05)

Key: No impact = 1, Low impact = 2, Medium impact = 3, High impact = 4 and Very high impact = 5

4.3 General constraints to the growth of local software industries in Nigeria by the Software Developers

Table 4 shows impact of the general constraints to the growth of local software industries in Nigeria. There was a significant difference ($F = 0.84$, $p \leq 0.05$) in the factors influencing the growth of local software industries in Nigeria by the developers. Lack of effective policy on software development and service industry has a mean rating of (3.55), lack of ICT infrastructure (3.49) and lack of access to low cost ICT network facilities (3.36).

Similarly, lack of development requirements has a mean rating of (3.33), lack of financial capital for establishing computer software and service industry (3.29), low level of remuneration for in-house software engineers in organization which encourage outsourcing of non-availability of skilled workforce (3.29), low spread of ICT network, internet and bandwidth restrictions (3.28), low level of diffusion and availability of computer (3.26), lack of sound and effective educational and institutional framework (3.24) and existence of large manpower gap in the global software development (3.19). However, lack of critical mass of scientific and technical professional in software development (3.18) is not significantly different.

4.4 Assessment of Best Practices in Software Development in Nigeria.

Software development in Nigeria shows that the developers adopted best practices and the variables were measured and ranked to determine the extent of usage of the practices. The mean rating of the practices (Table 4) include Protect the brand your customers trust (11) that has the highest rank. Others are Know your business and support it with secure solutions (10), Understand the technology of the software (4.03), Memory limit

Table 4: General constraints to the growth of local software industries in Nigeria by the Software Developers

Constraints	Mean Rank
(i) Lack of effective policy for software development and service industry	3.55[a]
(ii) Lack of ICT infrastructure	3.49[a]
(iii) Lack of access to low cost ICT network facilities	3.36[a]
(iv) Lack of development requirements	3.33[a]
(v) Lack of financial capital for establishing computer software and service industry	3.29[a]
(vi) Low level of remuneration for in-house software engineers in organization which encourage outsourcing of non-availability of skilled workforce	3.29[a]
(vii) Low spread of ICT network, internet and bandwidth Restrictions	3.28[a]
(viii) Low level of diffusion and availability of computer	3.26[a]
(ix) Lack of sound and effective educational and institutional framework	3.24[a]
(x) Existence of large manpower gap in the global software development	3.19[a]
(xi) Lack of critical mass of scientific and technical professional in software development	3.18[a]

[a, b, c]; Means with the same superscript are not significantly different (F = 0.84, P<0.05)

Key: No impact = 1, Low impact = 2, Medium impact = 3, High impact = 4 and Very high impact = 5

Table 5: Assessment of Best Practices in Software Development Firms ANOVA result

Practice	Mean Rank
Protect the brand your customer trust	4.11[a]
Know your business and support it with secure solutions	4.10[a]
Understand the technology of the software	4.03[ab]
Memory limit set	3.91[abc]
Application pool not shared	3.88[abcd]
Development life cycle	3.62[abcde]
Ensure compliance to Governance, Regulations and Piracy	3.38[abcdef]
Ensure protection of sensitive information	3.31[bcdef]
Design software secure features	3.24[cdef]
Develop software secure features	3.19[cdef]
Configuration management	3.13[edf]
Educate yourself and others on how to build secure software	3.02[ef]
Measure development process	2.98[ef]
Know the basic tenets of software security	2.91[ef]
Deploy software secure features	2.89[ef]

[a, b, c]; Means with different superscript are significantly different (F = 3.61, P<0.05)

Key: Never = 1, Rarely = 2, Occasionally = 3, Sometimes = 4 and Always = 5

set (3.91), Application pool not shared (3.88), Development life cycle (3.62), Ensure compliance to Governance, Regulations and Piracy (3.38), Ensure protection of sensitive information (3.31), Design software secure features (3.24), Configuration management (3.13), Develop software secure features (3.02), Measure development process (2.98), Educate yourself and others on how to build secure software (2.91) and Deploy software secure features with the lowest rank of 2.89. The analysis shows the variance of the assessment of best practices in Software development firms and there was significant difference of (F = 3.61,P<0.05). They are in conformity with the global trend.

4.5 Development of Computer Software to Evaluate the Effectiveness and Efficiency of the Approaches Used

In order to develop computer software for the evaluation of effectiveness and efficiency of various approaches used, the study used the flowchart in figure 1 which was designed to write the algorithm.

4.5.1 Model of Software Design (Shewa's Model)

A combined approach was used to desgn this model (Shewa's model) bearing the weakness of these approaches, (Table 6) any of these approaches can be applied for this model either singly or interchangeably.

An algorithm was written using visual basic programming language. The outputs were displayed in figures 3 and 4 showing the influence of factors (internal and external) on approaches.

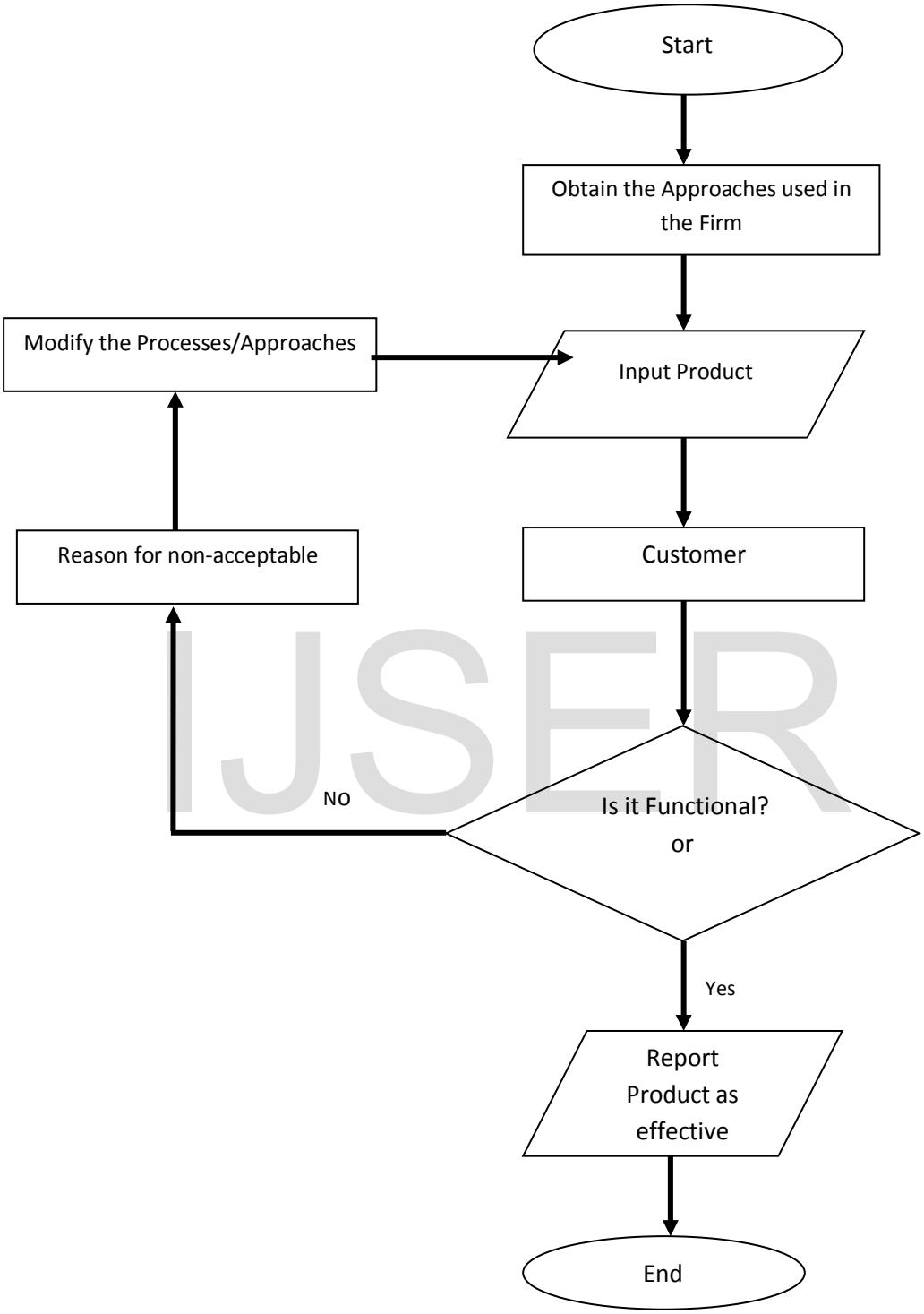
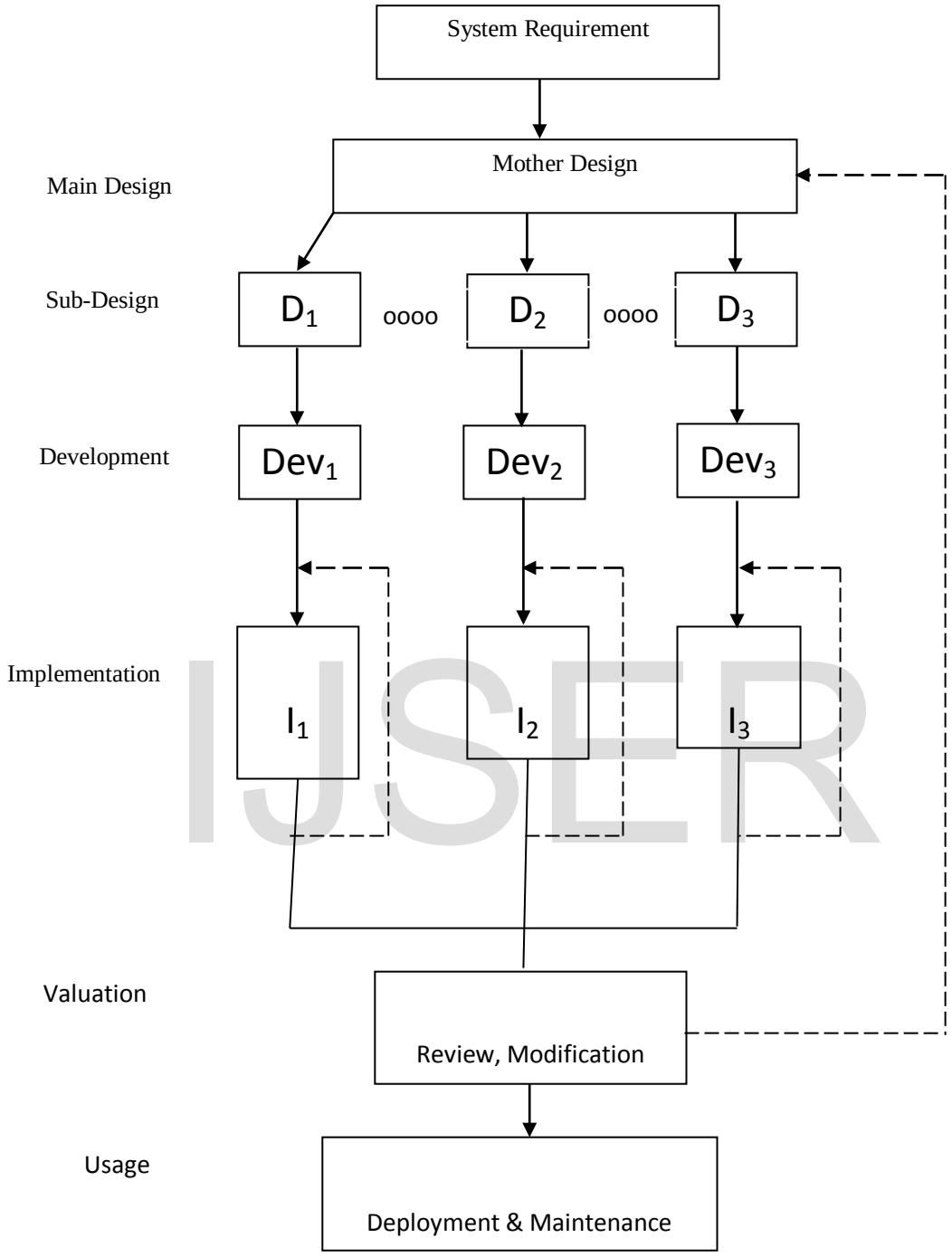


Fig1: Flowchart to Evaluate the Effectiveness of Software Development



Key: - - - -: The loop is meant for checking or re-working any troubleshooting issue

Ooooo: This represent Inter-related Components of Mother Design

Fig 2: Shewa's Model Designed in support Ph.D Thesis on Evaluation of CSWD in Nigeria

Source: Author's Concept, 2011

4.5.1a Approaches Adopted for the Model Software Design from the study (Shewa's Model)

Table 6: Suggested approaches adopted for the design of "Shewa's model" for software development

Software Approach	Weakness e.g.	Advantages e.g.	Implication	Remarks
Waterfall	Require full knowledge of the system No change is allowed	The process of development is faster if all the requirement are known	Any company that uses waterfall approach to develop its software cannot use it for any expansion programme/project.	It cannot accommodate any modification at any of the stages of development
Incremental	System requirements and resources are broken down into too many blocks which makes it difficult to manage	The development process is faster than waterfall It allows new features to be added easily	Upgrading of the system is possible and cost effective	It allows extensibility of the system and future expansion to accommodate new programmes and projects.
Prototyping	The system is neither linear nor integrated. But every stage is undertaken separately as a "job" that must be completed before going to the next stage.	It allows proper studying of various stages of the system as each stage is independent of one another.	Each unit stands on its own and has no link one another.	It consumes more resources (time, labour, cost) because no rework is allowed at any stage of the development process until the process is complete.
Spiral	The prototyping is build in chunks (bit) which consumes more time and resources than others	Extensible. It can accommodate expansion of work	Very flexible for upgrading.	Allow upgrading of the system at any stage of development and at usage levels.

Fig 3: The output of software designed from the project using Shewa,s Model

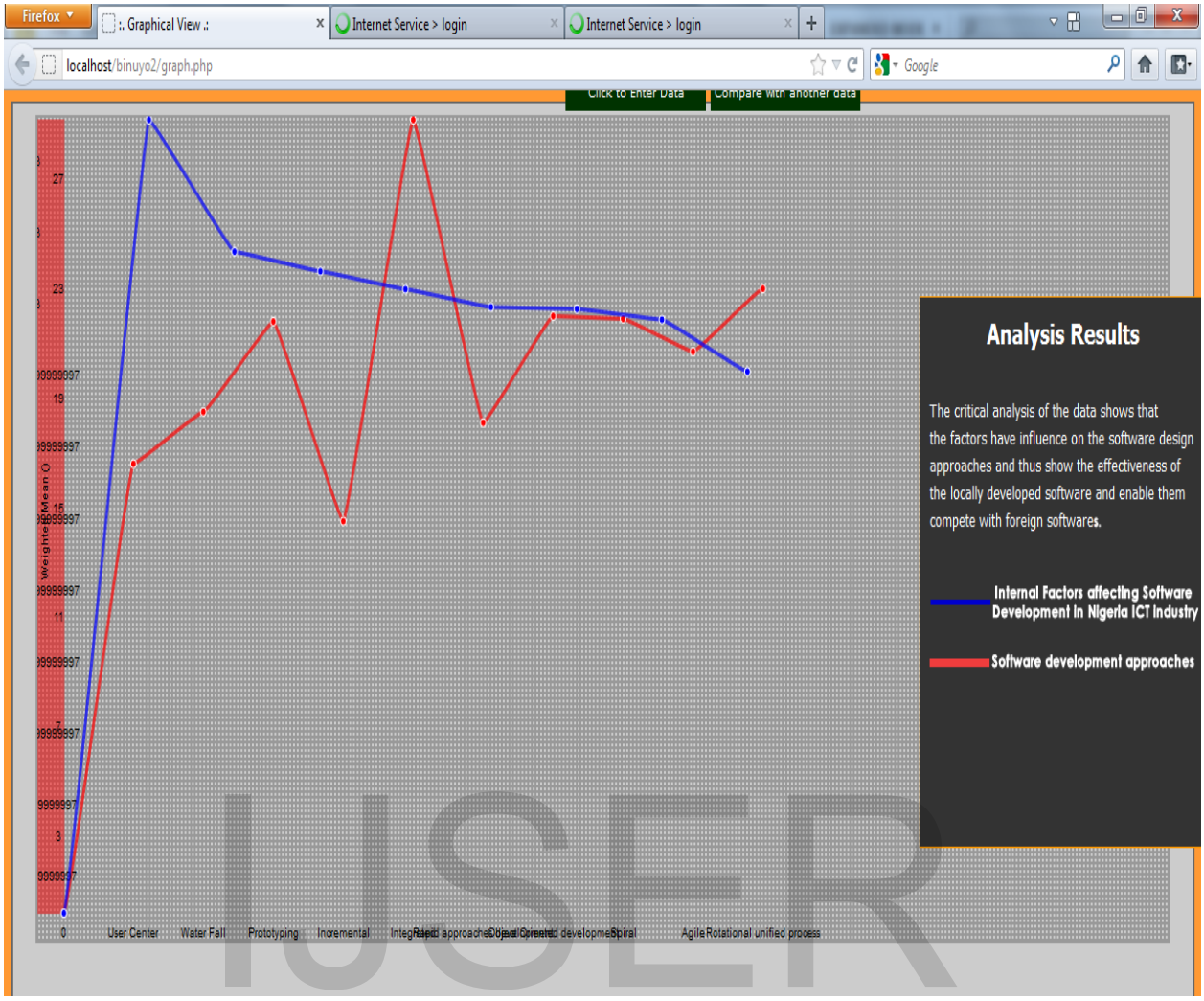


Fig 4: The output of software designed from the project using Shewa,s Model

5.0 Conclusion

From the study, it can be concluded that Nigerian software developers develop a good software. The study demonstrated that the lack of financial capital for establishing computer software and service industry, low spread of ICT network, internet and bandwidth restrictions, lack of sound and effective educational and institutional framework, existence of large manpower gap in the global software development were significant except lack of critical mass of scientific and technical professional in software development that did not have significant influence on software development in Nigeria. However, the implementation of Shewa's model played a significant role on the effectiveness of software development and the study underscored the expected role of government which is currently lacking. This seems to have impacted negatively on the effective attraction of private sector investments in the software industry. Hence, the government's seemingly passive role has somehow stunted the growth and development of the software industry in Nigeria.

REFERENCES

1. Abran, A.; LaFramboise, L.; and Bourque, P. "A Risk Assessment Method and Grid for Software Measurement Programs", Software Engineering Management Research Laboratory, 3 October, 2000. Http://www.Irgl.uqam.ca/publications/pdf/271.pdf Retrieved on November, 2009.
2. Alic, J. A. "Technology in the service industries", *International Journal of Technology Management* 9 (1), pp. 1-14, 2005.
3. Anderson, E. E. "Managerial Consideration in Participative Design of MIS/DSS."*Information and Management.* 1985, Vol . 9, pp. 201-207, 2005.
4. Animalu, A.O.E. 'Technology Policy and Funding in Nigeria' in Bonkat, B . N.and Dagogo-George, A. (Eds.), *Science and Technology News: a quarterly Publication of the Federal Ministry of Science and Technology*,, 40 – 45, 2002.
5. Antonelli, C. *The Diffusion of Advanced Telecommunications in Developing Countries.*Development Centre Studies (Paris: OECD), 2006.
6. Apte, U. M., M. G. Sobol, Shimada S. Hanaoka, T. Saarinen, T. Salmela and A. P. J.Verpsalainen "Is outsourcing practices in the USA, Japan and Finland?: a comparative study", *Journal of Information Technology*, 12, pp. 289-304, 1999.
7. Avgerou, C. "How can IT enable economic growth in developing countries?"*Information Technology for Development*, 8, pp. 15-28, 2007.
8. Balasubramanyam, A. and V. N. Balasubramanyam "Singer, services and software",*World Development*, 25, pp. 1857-1861, 2010a.
9. Bagchi, S. "India's software industry: the people dimension", *IEEE Software*, May/June.,pp. 62-65, 1999.
10. Bedi, A. "The role of information and communication technologies in economic development: a partial survey", ZEF-Discussion Papers on Development Policy No.7, Center for Development Research, ZEF, Bonn, 1999.
11. Boehm, B. *Software Engineering Economics*, Englewood Cliffs, NJ: Prentice Hall, 1998.
12. Guha, K. "Indian groups face struggle to protect their software arms", *Financial Times*, 28 August, 1998.
13. Hullet, D.T. "Key Characteristics of a Mature Risk Management Process", Fourth European Project Management Conference, PMI Europe 2001, 7 June 2001.
14. Jones, C. " Determining Software schedules," *Computer*, February, pp. 73-75, 1998.
15. Kazmin, A. L. "Infosys Technologies profit more than doubled", *Financial Times*, 22 April 2008.
16. Marquis, D. G. `The Anatomy of Successful Innovations-" Innovation . November 1999 .
17. Nasscom , *Indian Software Scenario*, National Association of Software and Service Companies, 1999.
18. Nicholas, J. M. Project Management for Business and Technology. Prentice – Hall,Inc., Upper Saddle River, New Jersey 07458, 2001.
19. OECD Organization for economic Co-operation and Development. The Measurement of Scientific and Technological activities Proposed Guidelines for Collecting and Interpreting Technological Innovation data Oslo Manual European Commission, 2005
20. OECD Science, Technology and Industry Scoreboard 2007, Innovation within Companies pp 34, 2007a
21. Pallant, D.L. Four common misconceptions in exploratory factor analysis In Statistical and methodological myths and urban legends: Doctrine, verity and fable in the organizational and social sciences. Lance, Charles E. (Ed.); Vandenberg, Robert J. (Ed.). New York: Routledge. pp. 61–87, 2004.
22. Pressman, R. S. *A Manager's Guide to Software Engineering*, New York: MsGraw Hill, 19999.
23. Rakos, J. J. *Software Project Management for Small to Medium Sized Projects*,Englewood Cliffs, NJ: Prentice Hall, 1999.
24. Schware, R. "*Software Industry Entry Strategies for Developing Countries*:A "*Walking on Two Legs" Proposition*", World Development, Vol. 20 No.2.pp. 143 – 164. Pergamon Press, 2000.
25. United Nations Development Programme (UNDP). *Human Development Report:* (Oxford: Oxford University Press), 2007.
26. Vigder, M.; Gentleman, M. and Dean, J. COTS *Software Integration*: *State of the Art.* Technical Report NRC No. 39190, 2008.
27. Werner, M. *Empowering Socio-Economic Development in Africa using InformationTechnology: A Critical Examination of the Social, Economic, Technical and Policy Issues in Mozambique.* Report for the African Information Society Initiative, 2006.
28. Whitten, N. *Managing Software Development Projects*, Second Edition, New York:John Wiley & Sons, Inc, 2005.

APPENDIX 1

Table 2: level of acceptability of locally developed software

Variables	Responses of respondents										
	Strongly agree		Agree		Strongly Disagree		Disagree		Undecided		Weighted Average
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	
Software Reliability	48	24.6	98	50.3	10	5.1	21	10.8	18	9.2	1.17
Software Efficiency	57	29.2	96	49.2	15	7.7	17	8.7	10	5.1	1.45
Software Security	15	7.7	35	18.0	60	30.8	16	8.21	19	9.7	1.46
Software Maintainability	22	11.3	51	26.2	31	15.9	27	13.9	14	7.2	1.29
Software size	14	7.2	64	32.8	40	20.5	15	7.7	12	6.2	0.78
Software functional quality	11	5.6	28	14.4	63	32.3	24	12.3	19	9.7	1.04
Software Extensibility	7	3.6	10	5.1	53	27.2	47	24.1	28	14.4	2.13

APPENDIX 2

Table 3 Descriptive analysis of Impact of Constraints to general acceptability of locally developed software

	%				
Constraints	Very high impact	High impact	Medium impact	Low impact	No impact
Lack of effective policy for software development and service industry	-	16.7	55.6	27.8	-
Lack of development requirements	-	50.0	50.0	-	-
Lack of sound and effective educational and institutional frameworks	-	-	38.9	61.1	
Lack of ICT infrastructure	-	-	44.4	55.6	-
Lack of access to low cost ICT network facilities	-	5.6	77.8	16.7	-
Dearth of critical mass scientific and technical professional	-	11.1	88.9	-	-
Manpower gap in software industry	-	77.8	22.2	-	-
Lack of financial capital for establishing computer software and service industry	-	-	44.4	55.6	-
Low level of diffusion and availability of computer	-	5.6	33.3	61.1	-
Low level of remuneration for in-house software engineers	-	72.2	27.8	-	-
Low spread of ICT network, internet and band waves restrictions	-	5.6	94.4	-	-

APPENDIX 3

ANOVA for Table 25 : Analysis of Variability on acceptable software standards

S/N	Propositions	Mean Square	F	Sig
I	Software Reliability	247.648	210.957	0.000*
		1.174		
Ii	Software Efficiency	61.948	42.805	0.000*
		1.447		
Iii	Software Security	0.127	0.087	0.769
		1.463		
Iv	Software Maintainability	0.712	5.551	0.003*
		1.293		
V	Software size	20.527	26.458	0.000*
		0.776		
Vi	Software functional quality	85.773	82.493	0.000*
		1.040		
Vii	Software Extensibility	1.103	0.519	0.472
		2.125		

Source: Field survey, 2011 *, significant at 5%