

# Factors Affecting the Use and Adoption of Open-Source Software Development Process among Nigerian Undergraduate Students

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## ABSTRACT

Using a questionnaire titled “Factors Affecting the Use and Adoption of Open-Source Software Development Process Among Nigerian Undergraduates” to solicit responses in selected Institutions of Higher learning in Nigeria, we investigated the factors that motivate or prevent students from adopting and using the open-source paradigm for software development. Findings from the analysis of data obtained from the research showed that students are keen about using the open source software platforms as a means of developing software system. However, there are concerns among students of the implication of collaborative efforts on open source platforms on project completion time, equitable access to internet facilities and metrics for assessing individual contributions to the success of the final product from such development process. We conclude by making recommendations on how open-source platforms can be used among students

**Keywords:** Open-source, Undergraduates, Nigeria, proprietary, Software and Paradigm

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## 1. INTRODUCTION

Apart from the issue of making robust software products generally available with the additional edge of combined productivity, collaboration remains one the most welcomed advantage of the Free Open-Source Software (FOSS) initiative among programmers. However, associated with this merit are intrinsic concerns regarding the determination for a successful completion of software projects within record time and the challenges of working with faceless individuals on such intense project. Another pressing issues among open-source collaborators include knowing who is doing what in an open-source initiative. Since it has proven remarkably successful in circumstances that are extremely challenging for traditional development methods and environments, open source software development has received the attention of many researchers within the software engineering community (Feller & Fitzgerald, 2001). With almost no face to face communication, and very little use of industry-style project management and coordination, open source developers have built a variety of widely-used, reliable, well-known software systems, e.g. the Apache web server and the Mozilla browser (Mockus et al, 1995).

## 2. THE NATURE OF OPEN-SOURCE SOFTWARE

Open source software development has been described as "extreme distributed software development" (Mockus et al, 1995). The community around an open source software project is usually located around the globe and interacts primarily through asynchronous textual modes of communication, such as email and discussion boards, that are logged in publicly browseable archives. Although open source software projects can vary considerably in their particulars, they do possess a few typical features. According to Anupriya et al (2003) every successful open source software project has a community of people involved with the project at various levels. The largest group within the community is usually the user community, which is primarily

interested in using the Software Some users report bugs, but that is more commonly the domain of a smaller group of 'contributors'.

Contributors are not only users of the software, but are also interested in the general development of the project. They are likely to download the most recent (possibly unstable) versions of the software, actively report bugs, and submit code, either to fix bugs, provide further enhancements to the software or to contribute patches. At the centre of the community lies a small select group, sometimes even a single person, of 'core' developers, who not only contribute code, but also guide the project by reviewing contributed code and selecting a subset to be committed to an 'official' release of the software.

### 3. FOSS – THE NIGERIAN EXPERIENCE

Borrowing from the experience of countries such as India and some parts of the Tiger nations who are making giant strides in foreign exchange earnings from exporting programmers, Nigerian universities are making efforts to embrace the open-source initiative. Although, no large scale FOSS project can be pointed at as at the time of writing, feelers from the universities under investigation showed that the enthusiasm for collaborative FOSS projects is on the increase in computer science and information technology departments. Training in LINUX and UNIX has become part of the curriculum and a lot of training centres are being established for LINUX and UNIX certification.

Talking about the open-source adoption across Africa, John (2003) opined that countries in Africa are gradually adopting strategies that promote the use of Linux (an open source software) as an alternative to Windows, and South Africa is leading the charge, with the government's recent approval of an open source software adoption plan. Meanwhile Nigeria, which had been lagging behind other countries on the continent in terms of open-source adoption, also has made some moves to adopt Linux in the public education sector. Cost saving seems to be the main factor that has fueled these developments.

Besides saving the South African government several billion rand, which amounts to several hundred million dollars, adopting open source software would boost the local software industry, said Mojalefa Moseki, the chief information officer of South Africa's State Information Technology Agency (SITA), when the proposal was put together earlier this year. SITA is a South African government agency that provides information systems and other related services to participating departments.

Various private organization and government officials across the continent, in countries including Kenya, Uganda, Namibia, and Senegal, are pushing state agencies to consider adopting Linux and open source software. In June Nigeria also got into the act, with three organizations -- SchoolNet Nigeria, the Federal Ministry of Education and the Education Tax fund -- pushing the use of Linux, according to Emmanuel Otokhine, who reports on IT for Punch, one of Nigeria's large circulating newspapers. (Adaora, 2006). The three organizations have provided 35 Nigerian high schools with Internet access and other educational technologies built on Linux. Aside from that, they are helping to incorporate the study of Linux in the curriculum of those 35 high schools, Otokhine told the IDG News Service.

Like South Africa the government is pursuing Linux because it finds it a cheaper alternative to Windows. The Open Source Networking Group has also been established as a subset of the ngNOG (the nNigerian ICT Forum) for cooperation and the exchange of technical information between operators of Internet-connected networks in Nigeria. Its focus is to accelerate capacity building in networking with a focus on Free and Open Source software and technologies whilst ensuring adequate participation of Nigerian Academic Network Operators. Lately, the ngNOG called for Collaborators on VSAT monitoring using Free and Open Source Software.

The ICT forum is interested in monitoring VSAT links of member institutes using free and open source software which will be non invasive and have no impact on the VSAT bandwidth. The information to be extracted from the data includes; the bandwidth utilization of the VSAT link, the various software applications in use and other relevant network traffic characterization such as the source and destination address, data volume, the protocol used etc.

### 4. CURRENT CHALLENGES IN THE OPEN SOURCE DOMAIN

In a Federal survey on FOSS projects carried out in the US ([www.networkworld.com](http://www.networkworld.com)) while findings showed that open source projects were coming into their own, many challenges are afoot. For example, those agencies who have implemented an open source project, the greatest challenges are:

- 34% security issues
- 30% concerns that proprietary applications won't work/port to open source
- 27% lack of trust of open source vendors
- 25% lack of consistent established standards

For those agencies who have not implemented open source, the greatest challenges are:

- 42% Organization reluctance to change from status quo

- 40% Security
- 28% Lack of consistent standards
- 26% Lack of tech support
- 25% Lack of open source knowledge on site
- 20% Lack of senior management support

For those agencies who have implemented open source, the top benefits have been:

- 30% Ability to access advanced and multi-leveled security capabilities
- 17% Data center consolidation
- 17% Ability to customize applications
- 12% Ability to enable cross –system, cross-agency applications and process sharing
- 9% Cost savings from application and operating system software

## 5. THE CHALLENGES IN PERSPECTIVE

According to Anupriyal et al (2007), each open source project defines its own community, which is a ‘community of interest’ or a ‘community of practice’, in that it brings together people who are interested in the same domain and issues and share similar practices. Today’s undergraduate, constitute tomorrows manpower. Therefore, if we are to reap the benefits of the FOSS initiatives in Nigeria in the future, we must as a matter of urgency begin to sow the seeds today. The internet has dissolved virtually all limitations within academic communities, enhancing collaboration and creating the right atmosphere for FOSS projects to breed. The major challenge therefore is to find deal with other psycho-academic tendencies that can serve as delimiters to the evolution of the FOSS paradigm among Nigerian undergraduates include creating a development environments that will support collaboration among developers, dealing with the fears of failure, supporting new and potential contributors, and in bringing users and developers together.

## 6. RESEARCH DESIGN

### 6.1 Research Questions

Based on the foregoing, this paper wishes to provide answers to the following research questions that have emanated:

- (1) What are the levels of acceptance of the FOSS initiative among Nigerian undergraduates?
- (2) What are the perceptions of these undergraduates about the adoption of this method of software developments?

### 6.2 Research Hypotheses

The following null hypotheses were formulated for the purpose of this research

**Hypothesis I:-** There is no perceived significant difference related to project success in their expectation of project completion time.

**Hypothesis II:-** There is no perceived significant difference related to project success among students resulting from being credibly supervised on Open-Source projects.

**Hypothesis III:-** There is no perceived significant difference related to project success based on access to internet facilities

**Hypothesis IV:-** There is no perceived significant difference related to project success based on the measurement of member contribution to the open-source software development process.

The survey method employed in this project is the use of questionnaire which solicits information from respondents.

### 6.3 Population

The population consists of 250 students stratified into 3 groups viz: diploma students, degree undergraduate and other certificate undergraduate students from five institutions in South Western Nigeria. 223 Questionnaires were returned out of which 200 were selected that satisfy the stratification for research purposes.

### 6.4 Sampling Technique

The sampling technique used in this research work is the stratified sampling method in combination with simple random sampling. The simple random sampling technique is a method employed in selecting a sample of considerate size from a given population of data used in the survey, we find the estimate from the population in simple random sampling, sample size got from the given population is one in which every response has the same probability of being chosen.

## 6.5 Research Instruments

The research instrument titled “Perceptions of the Proprietary and Open-Source Software Development Process Among Nigerian Undergraduates” on a three point Lickert Scale, was self-constructed and administered to evaluate the respondent’s perceptions. The research instrument was partly administered by the researchers and partly distributed to respondents through the Internet.

### DATA PRESENTATION AND ANALYSIS

*Table 1: General Awareness of FOSS*

	RESPONSES		
	High Awareness	Aware	Not Aware
Diploma Students	40	34	30
Degree Undergraduate Students	89	61	65
Others	36	20	25
Total	165	115	120
Average	82	58	60

*Table 2: General Acceptability of FOSS*

	RESPONSE		
	Highly Acceptable	Acceptable	Not Acceptable
Diploma Students	20	42	30
Degree Undergraduate Students	99	73	65
Others	48	35	25
Total	168	150	110
Average	53.10.	50	36.67

S/N O	H YPO THE SIS (H <sub>0</sub> )	Compu ted x <sup>2</sup> va lue	Ta ble Va lue 3 df	Co mpa ri son	D eci sion at 0.05 leve l of Si g.
Hypo the sis 1	<b>Hypo thesis II:-</b> There is no perc ived significant diffe rence re lated to projec t success in their expe ctati on of projec t com pleti on time .	6.63 5	9.21	$\chi^2_{cal} < \chi^2_{(3, 0.05)}$	Ac cept the Null Hypo the sis
Hypo the sis 2	<b>Hypo thesis I:-</b> There is no perc ived significant diffe rence re lated to projec t success among studen ts resu lting from being cre dibly supe rvi sed on Open-Source p rojects.	55.9	9.21	$\chi^2_{cal} > \chi^2_{(3, 0.05)}$	Rej ect Nu ll hypo thesis
Hypo the sis 3	<b>Hypo thesis III:-</b> There is no perc ived significant diffe rence re lated to projec t success ba sed on access to inte met fa ci lit ies	152.6	9.21	$\chi^2_{cal} > \chi^2_{(8, 0.05)}$	Rej ect the Null hypo thesis
Hypo the sis 4	<b>Hypo thesis IV:-</b> There is no perc ived significant diffe rence re lated to projec t success ba sed on the mea su rement of mem ber con tri bu tion to the ope n-sou rce soft wa re devel opment process.	38.11	9.21	$\chi^2_{cal} > \chi^2_{(8, 0.05)}$	Rej ect the Null Hypo the sis

**Table 3: Decision Based on Chi Square Analysis**

## 6. FINDINGS

From Table 1 the computed average revealed a generally high awareness of the FOSS initiative among Nigerian undergraduates. Table II also showed a generally high acceptance of the FOSS initiative. Chi square analysis of research data at 0.05 level of significance revealed that there is no perceived significant difference among students in being credibly supervised on Open-Source projects. However, there is perceived significant difference in their perception of project completion time, access to internet facilities and measuring member contribution to the open-source software development process.

## 7. CONCLUDING REMARKS

Given the current enthusiasm and impetus for the FOSS initiative in Nigeria, one can predict that the benefits of this approach to software development will payoff in our nation in the very nearest future. Although there seem to be diverse set of challenges, better integration and presentation of information from the various tools in open source projects may address some of the limitations of open source software development. Furthermore, increased visibility of the social network within a project community and improved possibilities for social interaction between members of the community would ease a new developer's initiation into the culture and the community of a project.

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## Author's Briefs



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