

ICT Students' Perception Concerning Free and Open Source Software: A Case Study of Central University of Technology

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Abstract— There has been general lack of free and open source software (FOSS) adoption in South Africa (SA), including at Universities of Technology (UoTs'). Even though there are organizations that are championing and encouraging the use of FOSS around the world, adoption rate in SA remains low. To better understand the rationale behind the lack of adoption at UoTs', the perception of students' concerning FOSS products need to be understood. In this paper, key barriers that discourage students from adopting FOSS products will be highlighted. Concentration will be mostly on operating systems, office applications and web browsers.

Keywords— free and open source software, ICT students, software piracy, software adoption, software selection methods

I. INTRODUCTION

Free and Open Source Software (F/OSS, FOSS) is a software that is liberally licensed to grant the right of users to use, study, change, and improve its design through the availability of its source code [1]-[3]. The word FOSS and Open Source Software (OSS) will be used interchangeably in this paper. Basically, the major objective of FOSS project is to provide open access to the source code and enabling innovation in software development. The use of FOSS is not only about utilizing software for free, but also it can offer some benefits such as sharing of resources, faster repairs and high code quality, realization of a total advantage by utilizing shared resources for development and maintenance and, empowering adopters to gain the benefits of using shared software [4]. Although the use of FOSS provides some benefits, currently, it is well known that there is a general lack of FOSS adoption in South Africa (SA).

This seems to be perpetuating. Universities are considered as institutions of higher learning who suppose to support teaching and research activities. In reality, even at Higher Education Institutions (HEI's) in SA the trend tends to be the same (i.e. there is a general lack of FOSS adoption). There is a need to find suitable approaches to address this situation. For

example, Universities of Technology (UoTs') in SA should start leading in adopting FOSS products, as one of their mission is to produce students with relevant technical expertise who are ready for the job market. To further elaborate on the objective of UoTs', SATN [5] stated that:

"UoT engages with government and industry; and it regards communities as end-users".

On the other side, it may well be understandable at Public and Private Sector (PPS) when the FOSS adoption is low; as PPS are not meant to produce knowledge, but to acquire knowledgeable employees who will be shedding a way forward in the industry. Those knowledgeable employees are produced mostly by UoTs'.

Students at HEI's, especially from UoTs' are seen as the future software consumers and developers; and soon will be the ones who will be drivers of Information and Communication Technology (ICT) related economic activities in SA. Some of these students will be managing their own ICT companies, thus necessitate their versatility in software market. The versatility will ensure these crop of new leaders are not only clear on what they were taught during their stay at UoTs', but ensure that they are further equipped to learn innovative ways of conducting business and ability to show the way to their counterparts once they are on job market.

FOSS has being SA government policy since 2007. Therefore it would be expected that the drive towards implementation should be at a peak in SA. Students at HEIs, especially the ones at UoTs' are amongst the pioneers that SA government is looking at to champion the FOSS management and implementation. But the following two main questions need to be answered: (i) are these main players (i.e. UoTs' students) aware of FOSS product(s)? (ii) are these main players (i.e. UoTs' students) being well equipped or prepared in order to champion the FOSS revolution in SA? This paper attempts to answer the two questions listed above. It presents, compares and discusses the result of a survey study that was conducted in the School of Information Technology (IT) at the Central University of Technology, Free State (CUT) in Bloemfontein about IT students' FOSS awareness, and readiness.

II. LITERATURE REVIEW

On 22 February 2007, a policy and strategy for the adoption of FOSS in government was adopted by SA cabinet [3], [6], [7]. In a nutshell, all future software developed by or for SA government would preferably be open source or be based on open standards. This decision of the government of the Republic of SA may impact on the model in which future funding for other state supported institutions like universities and parastatals handles software acquisition. Unless proven otherwise that Proprietary Software (PS) will perform better than FOSS, then FOSS will be prioritized and be encouraged for adoption.

Presently, SA has 23 state subsidized Higher Education Institutions (HEI)'s, which consists of eleven traditional universities, six comprehensive universities, and six UoTs' [8]. Traditional universities are universities with a strong research background. Comprehensive universities are the merger of traditional universities and former Technikons (now UoTs'). UoTs' are former Technikons as were known prior to the transformation of HEI's in SA. Technikons were structured in such a way that they develop vocational students ready for to be absorbed by the job market immediately after completion of the studies.

South African Technology Network (SATN) [5], which is a network of UoTs' in SA defines UoT as addressor of the following:

- UoT offers educational programmes which are technologically driven;
- UoT focuses on problem solving research innovatively; and
- UoT engages with government and industry; and it regards communities as end-users.

SATN [5] also mentions the following as key elements of education at UoT:

- Application of technological knowledge;
- Preparation of technicians and technologists;
- A center of attention is on applied research;
- Direct contact with employment providers;
- Provision of multidisciplinary subject or course packages;
- Cost-effective and value career-orientated education;
- Outcomes-based, demand-driven curriculum;
- Stresses on immediate and productive employability and its relationship with industry.

The above mentioned elements should help UoTs' to achieve their intended objective. Du Pre [9] defines objective of UoTs' as to educate and develop students who can engage effectively with real world issues to the benefit of society at large. Additionally to that; [9] emphasised that knowledge gained should enable students to make intelligent decisions and choices about range of issues concerning technology.

According to [10]-[12] the most popular programming languages (PL's) used in OSS projects based on levels of utilisation; includes C, PHP, JavaScript, Extensible Markup Language (XML), C++, C#, Java, Perl, Ruby and lastly Visual Basic (VB). Existing literatures have indicated that the UoTs'

ICT departments are using different PLs to train their students. Consequently, most of PLs used in OSS projects are also taught at most UoTs' in SA. For example, in the School of IT at CUT, students are trained using the following programming languages: C#, JavaScript, Extensible Markup Language (XML), and Java. This shows that UoTs' in SA are in line with the world trend. Therefore; UoTs' in SA will benefit from developing students who are competent learners to use FOSS, and these students will further advance SA government intention on FOSS adoption.

OSS has also proved to be beneficial to educational institutions as it provides platform for innovativeness and allow students and faculties to enhance learning ability through teaching and learning [13]. Adopters of FOSS have also the opportunity to localise software to suite the local market. For example, in India OpenOffice has been localised (software translated to another language) to twenty-six local languages while Microsoft Office Suite stands at twelve [3], [14]. This phenomenon can be adopted and encouraged especially in third world countries as they strive to increase citizen's access to ICT. UoTs' provide a suitable place where this trend should be encouraged.

Based on their intended objectives, UoT's can be regarded as a place where students learn, un-learn and re-learn new ways during their period of studies; but most of time these students come out of UoTs' with expired experiential knowledge as technology has evolved and changed overtime during their university years. Most of the UoTs' have installed Proprietary Software (PS) in their computer laboratories to conduct training and to allow students to do practical work. What seems to be hindrance in learning by students is the cost of PS; these costs makes it sometimes difficult for UoTs' students to study further during their own times, including writing assignments out of campus as they do not have PS. The use of FOSS (i.e. Ubuntu, LibreOffice) will help this student to be able to fully participate; and also assist in the development of software for the market and the community. Viewing the code of particular software assists students' not to re-invent the wheel, but to improve of what is available through the help of the FOSS community (i.e. Open Source Initiative).

As future software developers' trainees, students should be encouraged to join FOSS communities in order to learn, share their innovative ideas, and participate in software development.

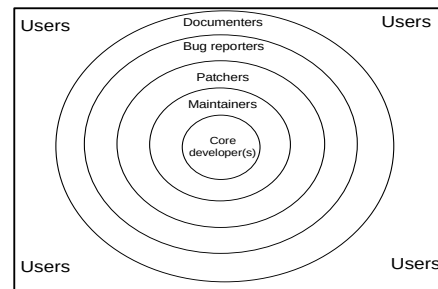


Figure 1. FOSS Community Participation

Figure 1 above illustrates the steps one should take in order to mature in FOSS product participation.

Once the adopters of FOSS joined and became confident on any FOSS product; they would not be a need to pirate or use PS if FOSS product can achieve similar or better standard than PS.

Most of these students are also buying PS to help them to further their studies at HEI's including UoTs', but some of these students resort to pirated software to ensure that they do practical work on their computers at their homes. Furthermore, these lead to increased software piracy.

According to [15], the piracy rate in SA has remained level at about 35% for the last three years, and the value of the software pirated rocketed from R300-million to more than R500-million between 2009 and 2010. Poverty and unemployment cannot be regarded as the only trigger for piracy, as FOSS is free and only need reliable internet connection. Not knowing about availability of FOSS may hinder the adoption and utilisation levels of FOSS products.

Beside FOSS community's support, there are some institutions that are specialized in providing FOSS training. These kinds of institutions are specifically for students who will like to specialize in OSS. Free Technology Academy (FTA) is one example of such institutions. Once students are confident in FOSS development and utilisation, ICT students will be able to further their studies with FTA through e-learning. FTA opened its doors to support specifically OSS in January 2010 and is situated in the United Kingdom (UK) [16]. FTA is supported financially by European Commission under the banner of Life Long Learning Programme (LLP). The establishment of FTA started through the makeup of collaboration between the four universities such as Free Knowledge Institute (FKI), Open Universiteit from Netherlands, University of Agder (UiA) of Norway and Universitat Oberta de Catalunya (UoC) of Spain [4].

Additionally to FOSS specialized institutions, other companies like IBM and Obsidian in SA help to increase critical mass by providing training to FOSS users and developers as to allow them to support FOSS products. These companies furthermore, provide training and allowing individuals to write certification exams.

Similar to others technologies, FOSS also faces some challenges. For example, there are myths concerning FOSS products. The study by [17] indicates that, there are several myths associated with the FOSS products which include the following:

- If software costs nothing, it's no good;
- FOSS is inferior to PS;
- FOSS is piracy (or at least encourages it);
- FOSS has no support;
- FOSS is only for developers;
- Having the code freely available makes it less secure than proprietary code.

One of the reasons for the survey conducted was to check whether these myths also apply to students at UoTs' and how wide spread they are.

III.METHODOLOGY

The following steps were followed to ensure the success of the study.

A. Determine the Sample (Step 1)

The target population was students from UoT's at CUT in SA, and they were randomly chosen from courses with programming stream. Total number of students who participated in the survey was 87. Table 1 below shows breakdown of student participation, and the expected number of participation based on CUT student ratio at sampled faculty.

Table 1. OBSERVED AND EXPECTED NUMBER OF STUDENTS

	Observed N	Expected N	Residual
Female	30	29.58	0.42
Male	57	57.42	-0.42
Total	87		

Note: Observed N indicates actual number of students that have taken part in the survey, whereas Expected N indicates number of student that were expected to take survey.

B. Data Collection (Step 2)

Focus of data collection was on recent adoption levels of FOSS among target population. Both qualitative and quantitative data was collected to carry out the study.

The following main data collection techniques were utilized to gather both qualitative and quantitative data from target population:

- Online Survey – Questionnaire was made available to students on www.freeonlinesurvey.com on controlled environment (computer laboratory). Survey was de-activated once students have finished filling the questionnaire.

Based on Table 1 results on section 3.1, authors can safely indicate that the survey data is reliable.

C. Pilot Study (Step 3)

A pilot run with an initial sample of eleven students was conducted to fine tune the data collection methods mentioned in step 2 at CUT before running full fledged survey.

D. Data Analysis (Step 4)

Data was analyzed using common statistical tools like Online Survey Tool (www.freeonlinesurveys.com); Statistical Package for Social Science (SPSS); and spreadsheet to identify trends, causes and interpretations.

E. Conclusion (Step 5)

Conclusions were drawn based on the results obtained from step 4. Additionally, set of recommendations were formulated.

IV.FINDINGS

Data shown in this section is a presentation of the results from the online survey and interview. There were 87 survey respondents. All the survey respondents are students from School of IT at CUT. The survey questionnaire consisted of six sections. These include professional experience, computer

experience, FOSS general awareness, FOSS policy, product selection methods, and PS vendors' aggressive marketing. The results of each of the six named sections are elaborated below.

A. Professional Experience

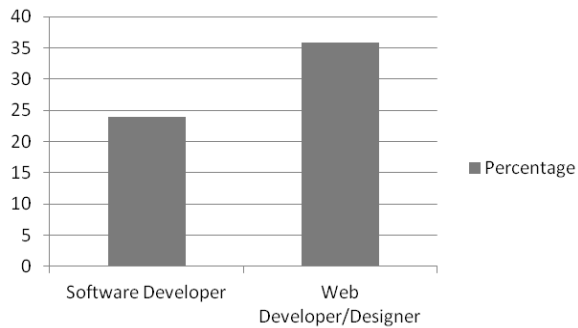


Figure 2. Professional Experience

As shown in Figure 2 above, 24% of respondents regarded themselves as software developers and 36% consider themselves web developers. The response was because the most students preferred web development than hardcore software development. And also the preference increased on the web development stream as during their second year of study at CUT, students have to choose which stream that they are comfortable with.

B. Computer Experience

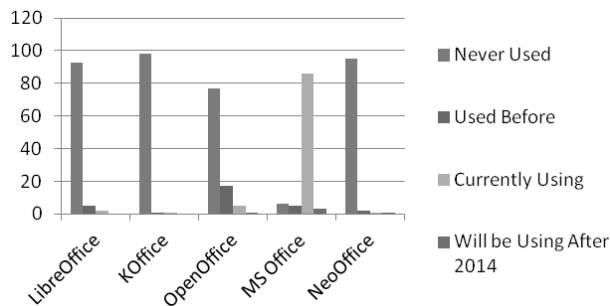


Figure 3. Computer Experience

As shown in Figure 3 above, it was found that up to 82% of respondents have not used any FOSS operating systems compared to 90% who are currently using Microsoft (MS) operating system. Additionally, the findings revealed that close to 75% of the students were familiar with MS office applications; compared to average of 4% that were familiar with FOSS related office applications (i.e. LibreOffice, K-Office, OpenOffice and NeoOffice).

This revelation is to the fact that most of the respondents heard about FOSS for the first time during the participation in the survey. One of the students commented on the survey:

"I have no knowledge of FOSS so I can't adopt something I know nothing about, but it sounds interesting. If I get proper knowledge I would adopt it".

This statement indicated that most of these students are not aware of the existence of FOSS products.

C. FOSS General Awareness

Additionally to that; Figure 4 below provides the summary of FOSS general awareness according to respondents. Some of the key barriers for adoption mentioned included lack of FOSS general awareness; FOSS not been taught at schools and universities; limited FOSS publications including seminars, workshops and conferences; and slow or lack of internet.

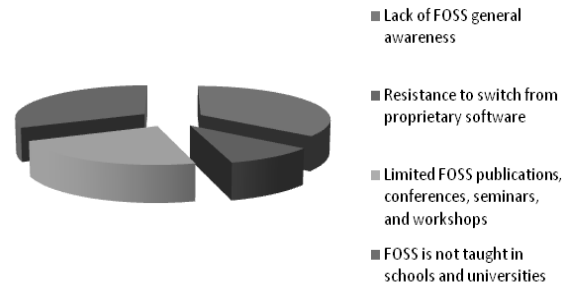


Figure 4. FOSS General Awareness

D. FOSS Policy

92% of respondents were not aware of the policy that governs FOSS within the university as shown in Figure 5 below. Furthermore Figure 6 indicates that 75% were not sure whether the university was intending to adopt FOSS soon.

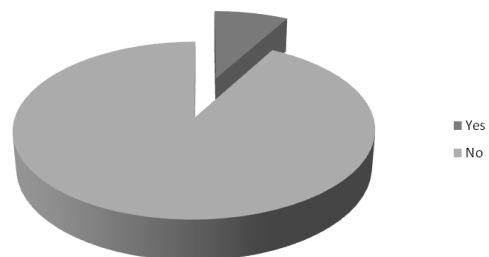


Figure 5. FOSS Awareness Policy

These statistical facts as displayed in Figure 5 and Figure 6 are attributed to the emphasis as mentioned by one of the participants as indicated on Computer Experience section.

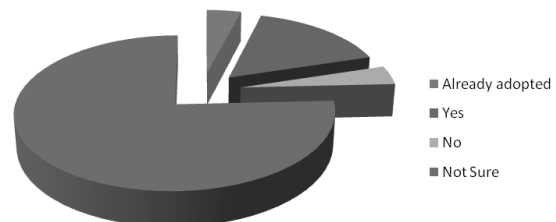


Figure 6. UoT Intention to Adopt

E. Product Selection Methods

On the issue of the method which participants are using to select or adopt software products. According to Figure 7 below, more than 85% of the respondents have indicated that they have not used software selection method before to adopt software. This lead to the assumption that users are adopting the software which they hear about or which are other people are using.



Figure 7. Product Selection Method

F. PS Vendors' Aggressive Marketing

As shown in Figure 8 below, the effective marketing drive of software vendors like Microsoft ensured that their products are consumed by the vast market around the world. This was pointed out by the participants' response that indicated that Resistance to switch from proprietary software (79%) and Aggressive marketing of proprietary software (49%). This shows that most of these users relied on Microsoft products as are the ones which they are familiar with.

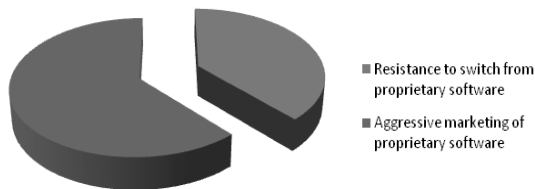


Figure 8. PS Vendor's Aggressive Marketing

V. CONCLUSIONS

This paper has highlighted policy concerning FOSS that SA government has adopted. And it furthermore explained the relationship between SA government, government parastatals and HEIs. UoTs' as part of SA HEIs landscape teach learners programming languages which are mostly used in FOSS products. Because UoTs' are supposed to be producing student ready to be absorbed by the market, therefore it was necessary to conduct this research to look at the level of FOSS awareness and adoption by UoTs' and students studying at UoTs'.

Based on data collected during the survey, analysis and summary provided above, authors can safely conclude that lack of FOSS general awareness has led to the poor adoption levels, effective marketing campaigns and popularity of Microsoft products, lack of FOSS policy, and not using proper

method to selecting software implemented by organization seem to have effect on adoption levels. Notwithstanding above, more has to be done in order to aggressive market FOSS products and encouragement of their use.

Furthermore, we recommend that FOSS popularization be seriously considered; and stakeholders in education, private and public sector get involved to encourage FOSS adoption. This is not the matter of whether certain FOSS product is more reliable than PS, but the matter of knowing about the existence of FOSS and advantages it provides.

Once the popularity increase, it may be then the masses begin to take FOSS seriously and staying away from pirated software.

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