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# Free and Open Source Software Adoption in Emerging Markets: An Empirical Study in the Education Sector

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## Abstract

The adoption of Free and Open Source Software (FOSS) in the education sector in emerging markets holds much promise, but should be accompanied by a well-informed decision to ensure that the potential value is realized. The research conducted provides insight into the pragmatic factors driving the adoption of FOSS in the education environment, as well as those aspects inhibiting adoption. This study indicates an increasing readiness to accept FOSS in the education sector, where the more successful organizations show a readiness to adopt a comprehensive decision model to ensure the installation of appropriate ICT infrastructure, including FOSS, for the future.

## 1 Introduction

One of the business sectors that could benefit considerably from Free and Open Source Software (FOSS) is the education sector [3], in particular educational institutions within the developing world. This is mainly due to the fact that education systems around the world are experiencing a range of drivers for fundamental change, including (but not limited to) globalization, changing concepts around the role of knowledge, knowledge workers, knowledge citizens, innovation systems and

learning organizations, the widespread need for quality life-long learning, and the relentless emergence of new information and communication technologies coupled with their growing penetration of, and impact on, all sectors of society, including the most disadvantaged [5].

The study by Satyarajan and Akre [6] analyzes the differences between the implementation of FOSS and proprietary software in educational institutions. According to them there are two distinct views on the academic acceptance of FOSS. One view favors the use of FOSS, while the other shows hesitancy about FOSS, suggesting that it could suppress the creativity of individuals. The study by Lakhan and Jhunjhunwala [4] focuses on open educational resources and open source learning management systems. They argue that, despite continuing technical challenges, FOSS offers an approach to addressing the technical problems by providing optimal delivery of online learning.

However, the factors influencing and inhibiting FOSS adoption in the education sector in the emerging markets has received significantly less academic attention. To the best knowledge of the authors of this paper, no published research exists in the context of FOSS adoption in the education sector of emerging markets. It therefore focuses primarily on the pragmatic reasons for adopting FOSS.

The paper is organized as follows: The research methodology adopted in this paper is described in Section 2. Section 3 elucidates the factors that influence the adoption of FOSS in the education sector of emerging markets. Section 4 presents the set of factors that inhibit the adoption of FOSS in the education sector of emerging markets, followed by concluding remarks in Section 5.

## **2 Research Methodology**

A flexible research design was developed for this study with the purpose of exploring FOSS adoption in the education sector of emerging markets.

The research was completed in two phases. During the first phase, existing literature on FOSS adoption was reviewed and a set of structured questions was designed based on adoption factors identified during the literature review. The validity of the questions that emerged from the literature review was tested by conducting preliminary interviews with knowledgeable individuals in the areas of information and communication technology and FOSS. In the second phase, the questionnaire was emailed to the representatives of 40 universities and higher education institutions in emerging markets, including India, Brazil, Russia, South Africa, and China.

Queries from interviewees arising from the e-mail interviews were handled by the authors: respondents were contacted by telephone to discuss any points requiring clarification.

The small sample size of this study presents limitations in generalizing the results to all educational institutions in emerging countries. In addition, the authors recognize that different factors could prevail when considering the adoption of different types of FOSS and that these differences were not addressed in this study. Finally the impact of FOSS on the education process and the pedagogical considerations that should be brought into reckoning when doing an in-depth analysis of FOSS adoption did not form part of this research.

### **3 Factors Favoring the Adoption of FOSS**

Several factors that favor the adoption of FOSS in education institutions of emerging countries were identified in the survey. Here follow summaries of responses favoring adoption, with accompanying discussions.

#### **3.1 Software Code Access**

Access to source code is an important adoption factor identified from the research. Users value the ability to change the source code. However, in general, educational institutions do not change the source code unless they want to become part of the FOSS development community. It is interesting to note that the majority of respondents do not want to become part of the FOSS community. None the less, they state access to source code as an important motivating factor. There are limited instances where access to source code is seen as an opportunity to extend and develop software to suit an organization's particular needs. One example is the facility to customize software in local languages, although well-designed proprietary software provides the same facility.

#### **3.2 Software Costs**

The lower cost associated with adopting FOSS is the most common factor in favor of FOSS adoption, according to this research. The initial acquisition cost of FOSS is negligible and it is usually possible to download FOSS without any application cost, except the cost to download the data. Another cost benefit cited by respondents is that FOSS adheres to open standards and can be run on different platforms, thus reducing the reliance on a single vendor. This increases competition and further reduces adoption costs. The reduced cost of FOSS remains a contentious issue. There are immediate cost benefits in the adoption of FOSS. Educational institutions would be wise to obtain a fully inclusive view of the costs debate, since this complex issue remains at the forefront of the motivations.

### **3.3 Technological Factors**

Technological factors relevant to FOSS adoption in the education sector identified from the research include software maturity, performance, stability, usability, security and availability. Respondents' opinions were divided on whether access to source code improves or degrades the security of FOSS. The usability of FOSS is generally considered by respondents to be either better or worse than proprietary software, again depending on the application.

### **3.4 Support Factors**

The availability of support is an important factor in all technology adoption decisions. The responses indicated that educational institutions with a strong ICT capability were able to use FOSS without external support. Where they did not have the capabilities to support the FOSS themselves, institutions that adopted vendor-based FOSS obtained support similar to proprietary software solutions. Institutions with the appropriate skills and resources have taken the responsibilities of the software vendor upon themselves.

### **3.5 Human Factors (*Supporting*)**

An important supporting factor is that a great deal of innovation traditionally originates from universities. In academic environments, where FOSS had its beginnings and where interested engagement with this technology is more likely, staff and students can tinker and experiment with, and participate in, its continued development. The return of FOSS to its original crucible for growth may eventually lead to further innovative solutions.

## **4 Factors Inhibiting the Adoption of FOSS**

Several factors that inhibit the adoption of FOSS in education institutions of emerging countries were identified in the survey. The opinions of respondents, given in answer to the questionnaire, are summarized below.

### **4.1 Migration and Operation Cost**

Although FOSS has a significant upfront cost advantage and in certain instances an operational cost advantage, the costs of migrating from proprietary software to FOSS could be substantial. It is especially the unknown, or hidden, costs within this

transition that are cited as an inhibitor of FOSS adoption. Indeed, this study has revealed that institutions that have migrated to FOSS for the purpose of cost-efficacy have experienced the cost of migration and maintenance operation to often exceed expectations. The fact is, deep-rooted educational systems, sometimes rife with self-interested reasons to maintain the status quo, are difficult to replace.

#### **4.2 Lack of Resources**

It is widely believed that FOSS has vast market potential in emerging countries. However, very few FOSS programmers are present in these countries. According to this study, the lack of adequately skilled FOSS resources in emerging countries hinders the implementing of FOSS. A few major vendors dominate the higher education domain [1,7]. This creates the risk of monopoly in the future. Transitions are thus rendered even more difficult as the skills in these vendors dominate the market, and will continue to do so.

#### **4.3 Satisfaction with Existing Software Products**

Many of the educational institutions responding to the questionnaire stated that they were satisfied with existing non-open source or proprietary software products. Hence, they claimed to have no reason to migrate to FOSS. In addition, the challenges presently faced by these institutions are centered around servicing the growing and diverse needs of a technologically illiterate constituency. Institutions, with their limited resources and budgets, can ill afford to spend time and resources on new, unproven products to replace that which is currently meeting their requirements.

#### **4.4 Human Factors (*Inhibiting*)**

The foremost human barrier to any technology adoption is resistance to change, a concept very well researched in the ICT sphere. Different models of technology adoption are widely used by practitioners. Skeptical users remain a significant barrier to FOSS adoption, especially in large scale migrations [2]. This factor is confirmed by the respondents in this study and remains a stumbling block for FOSS adoption. Unfortunately, it seems from the responses obtained by this research that certain top managers within the academic environment refuse to acknowledge that the learning landscape has been fundamentally altered (by the advent of FOSS).

#### 4.5 Other Factors (*Inhibiting*)

Some additional factors were listed by respondents as barriers to FOSS adoption, but not with the same frequency or level of importance as those highlighted above. These include the following:

- Poor integration with other software (software incompatibility)
- Incompatibility with different hardware platforms (hardware incompatibility)
- A lack of information on FOSS products
- A lack of case studies of successful FOSS adoption by similar organizations
- Bureaucracy in ICT decision-making

### 5 Concluding Remarks

Given the complexity of the arguments presented, it is highly unlikely that a wide adoption of FOSS to replace incumbent systems will sweep through educational institutions in emerging markets. What is more likely is that new ICT initiatives will give advocates of FOSS an equal voice at the table. Just as FOSS has matured over the past decade, so will those making decisions about new ICT adoptions – they will become more sensitive to the value contribution and challenges associated with FOSS, since this innovation has the potential to deliver considerable benefits for educational institutions in emerging markets.

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