Trends in Open Source Software Adoption in Indian Educational Institutions

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Abstract — **The Indian educational system caters to a diverse population. This diversity adds to the complexity and hence requires the support of technology to reach out to the masses. The Government has launched a lot of initiatives for the adoption of technology in education. Despite these efforts, there has been a gap in the actual adoption. In this paper we present the results of our study of current trends in the use of technology in academic institutions. We specially focus on openness to Open Source Software usage and try to understand the factors that influence educational institutions against open source software adoption.**

Keywords: ICT in Indian Education, Open Source Software Adoption, Learning Management System

I. INTRODUCTION

India, after China, has the largest educational system in the world. There are nearly 1.3 million schools with more than 200 million enrollments in the country [1]. India has about 700 Universities, with more than 35000 affiliated colleges. The enrollment in higher education institutions is nearly 20 million [2][3]. These large numbers have made the Indian educational system extremely complex to manage. Such complexities can be better managed through the use of Information and Communication Technology (ICT). ICT can impact various aspects of education including academic and administrative aspects. Though the government and industry have been actively promoting the use of ICT in education, there seems to be a gap in the actual implementation. Some reasons for this gap could be:

- Cost of implementation
- Scale of implementation
- Availability of resources in terms of trained man power, infrastructure etc

This gap, we believe, can be bridged by adopting open source software solutions for education. In this paper, we present the results of our study of ICT adoption by educational institutions. The aim of the study is understand the actual trends in adoption of ICT and how many of these ICT tools are open-source.

Our paper is organized as follows. In Section II we present background information on ICT in Indian education and discuss related work. In Section III we present details of the study conducted. In Section IV we present analysis of results. We present recommendation in Section V and conclude in Section VI.

II. BACKGROUND AND RELATED WORK

Adoption of ICT has helped educational institutions move from teacher-centric to learner-centric systems. This has been possible mainly because of the kind of educational resources that are accessible through technology enablement.

The Indian government has been one of the early adopters of ICT in education. Recognizing the imminent need to bridge the digital divide among students of various sections of the society, Ministry of Human Resource Development (MHRD) launched the Information and Communication Technology (ICT) scheme in 2004. The aim of the scheme was to enhance the quality of education by helping schools establish ICT infrastructure. In the Indian context we see that large scale implementations need scalable and cost-effective solutions. Open Source Software (OSS) can offer scalable, reliable, cost effective and flexible solutions which can have a direct and deep impact on Indian academic institutions[4][5].

Collis and Wende have presented their insights on the current and future use of ICT in education in [6]. They have identified that educational institutions are slow in their adoption of technology and they do not consider it be revolutionary for their businesses. They also add that ICT adoption is limited to certain areas and has not changed the way education is offered. However, this was presented in 2002 and many things have changed since then. Kenan et al have identified barriers like management barriers, technology barriers and cultural barriers to the adoption of ICT in Libya [7]. Gulbahar in [8] has presented his study on the ICT usage in higher educational institutions in Turkey. He has observed that lack of teacher training and infrastructural support are key factors influencing ICT adoption. A similar study has been carried out by Usluel et al in [9]. Oliver has presented the impact of ICT on learning and how ICT support knowledge construction and access to resources in [10]. These related works have helped us to
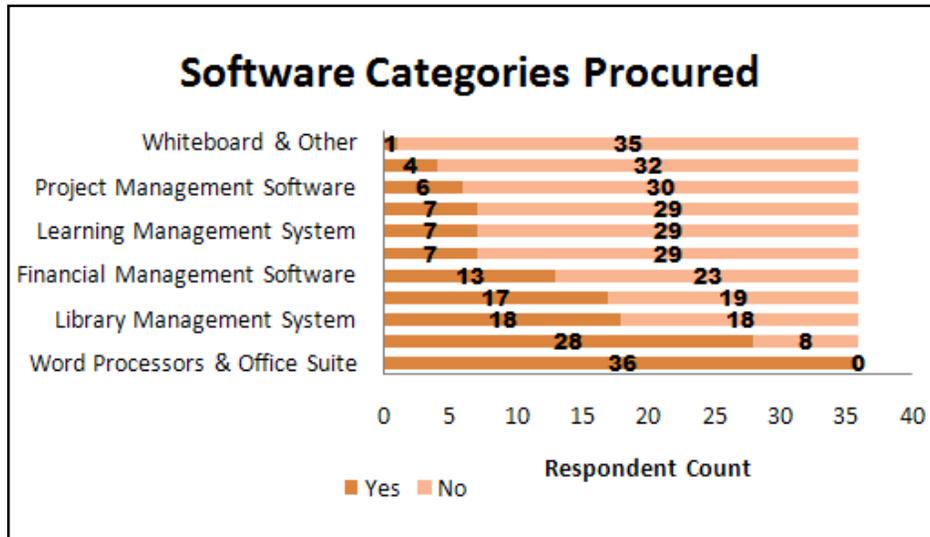
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Figure 1: Trends in Software Applications Procurement

understand the challenges and opportunities for ICT, especially OSS in education. With this background information, we have studied a few Indian academic institutions to understand the current trends.

III. DETAILS OF THE STUDY

A. Objectives

Understanding the ICT adoption among educational institutions and the willingness to supplement education delivery and administrative processes are the key questions researched upon, in this study. In addition, openness to Open Source based ICT solutions is also a key research objective. The component questions under this research objective are:

1. What are the application software used by educational institutions and how do they implement and maintain them?

2. What are the key factors that influence decision-making at educational institutions during a software purchase?

3. What is the ratio of open-source to closed-source software at educational institutions and what are the reasons to refrain from usage of open-source based solutions?

B. Methodology

The approach to our study is a hybrid of both qualitative and quantitative methodologies. Expert Interviews were also carried out to garner insights from technology champions. In-Depth Interviews (IDI) were carried out with administrative heads of educational institutions and other equivalent decision-makers. The Conversational Interviewing technique was used in the IDI, wherein non-directive conversational resources were used by the interviewer to propound upon complex questions to better the comprehension of the respondent. This was necessary as

decision-makers did not necessarily posses the needed technological background to differentiate open-source and proprietary solutions.

The above mentioned qualitative methods were exercised to better postulate the hypothesis to be tested through a further quantitative study. A questionnaire-based Survey was carried out to understand the factors considered during software procurement and the factors prohibiting the adoption of Open Source based ICT solutions for both academic and administrative purposes. The sampling point for the study was a Tier-II city and the surrounding suburbs. The sampling technique was a hybrid of convenience sampling, snowball sampling and purposive sampling. The justification for using these techniques is that, contacts through referrals would have exhibit openness to the study and honestly reply to the questions. A total of 22 institutions participated in the survey and 36 responses were collected in total as 36.11% of the responses belonged to Multi-Campus institutions. 77.8% of the responses were from Higher Education and 22.2% from Secondary Education. All the responses were from ICT heads of educational institutions or their equivalents.

IV. ANALYSIS OF RESULTS

The qualitative studies resulted in the generation of some key insights. The perception of what is "Open Source Software" seemed to be different among various decision-makers and in many cases the technology was quite misunderstood. There was also a very good reception among decision-makers to augment their processes with ICT solutions. The adoption of open-source based solutions also was different at different places. The reasons attributed to not choosing open-source alternatives also seemed to be an important question to study.

Based on all these insights a questionnaire was designed incorporating the findings from the qualitative stage. The descriptive analysis based on the survey revealed three main findings. Among the software procured by educational institutions, Word Processors and Office Suite category was the most purchased. Webmail Systems and Library Management Systems were among the other software, relatively better procured. Educational institutions seem to seldom procure interactive tools such as Whiteboards & Others. This study does not include System Software such as Operating Systems but only Application Software. Figure 1 charts the various applications procured by the respondents.

It was also found that the implementation and support for these tools were largely outsourced. 77.78% of the institutions resort to outsourcing as one among their strategies for implementation and support of application software. 44.44% of respondents had also their teaching faculties at the Computer Science or Information technology, tasked with implementing and maintaining software. Interestingly there were also 19.04% cases where even the students manage these operations. Figure 2 captures the degree to which institutions adopt different strategies to implement and maintain application software.
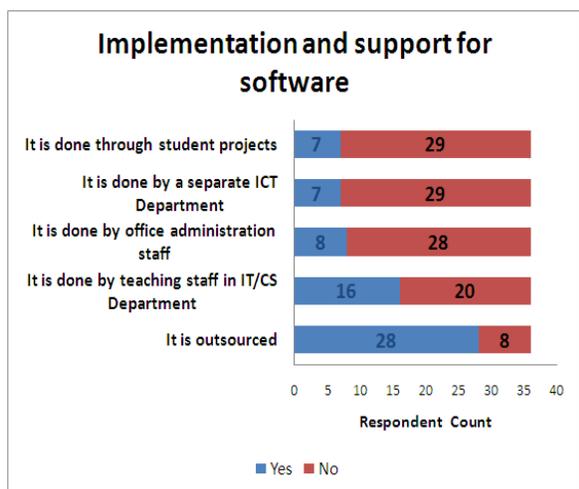

Figure 2: Prominence of Outsourcing as an Implementation Strategy

The ratios of open source and proprietary software as declared in the responses revealed the following. Among the educational institutions 25% declared that they use only proprietary closed-source solution. 43.75% stated that their ratio is such that mostly proprietary solutions and some open-source solutions are used at their institutions. Only 6.25% among the respondents are resolute to use only open-source solutions.

Inferential analysis on the importance of factors while procuring software was carried out (refer Table 1). The statistical analysis performed was a One-sample T-Test with 95% confidence interval. Interoperability with other tools and previous expertise of staff were the only two factors that were considered not important. The other factors that were deemed of importance listed in the descending order of

means include: Cost of Ownership/License, Ease of Usage, Support & Maintenance Costs, Staff Preferences, Performance of Software, Availability of Support, Migration Costs and Ease of Customization.

Another key inferential analysis (refer Table 2) was carried out to understand the key factors leading educational institutions to decide against using open source software. The statistical analysis performed was a One-sample T-Test with 95% confidence interval. This question was not mandatory and so the sample size varies in Table 2. The study revealed that lack of support, migration problems, cost of time and efforts and lack of staff expertise were the key reasons for the decisions against open-source adoption. The other factors that did not influence their decisions are Poor Documentation, Scalability Issues, Unmatched Needs and Poor quality software.

V.   RECOMMENDATIONS

There has been a lot of research showing the reduction in Total Cost of Ownership when Open Source software substitutes closed or proprietary software. But the adoption still is in a nascent state. This research has unearthed the extent of OSS adoption and the key constraints that have led to a slowdown in the adoption. The following are the recommendations that we make based on our study.

- The ICT policy of educational institutions must incorporate formal evaluation of OSS alternatives while purchasing application software. For instance, Moodle is an excellent Learning Management System which can be used as a student information system [11][12]. Koha is an OS Library Management System and this can be seamlessly integrated with OS digital repositories like DSpace. This will help decision makers take well-informed choices. This should also be a practical solution as there is enough evidence in our research that the teaching community too is involved in implementation and support processes.
- There is abundant room for intermediaries to reduce the gaps identified such as lack of support, migration problems and cost of time and efforts, in order for better adoption of Open Source based solutions. Educational Institutions are recommended to demand their technology service providers to evaluate and present the possibilities for customizing existing solutions.
- The OSS development community must understand the migration problems that occur in choosing OSS solutions and focus on appending their tools with provisions to reduce those efforts. This can be done by making OS repositories more accessible and creating more easy-to-install software.

VI.   CONCLUSION

In this paper we have presented our study of ICT adoption in academic institutions. We see that the

actual adoption is minimal and there is lot of scope for improving various aspects of education with technological support. The use of open-source is very less and significant efforts may be required in spreading awareness of the benefits of open-source.

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FACTOR	N	MEAN	P-VALUE	CONCLUSION
Cost of Ownership/License	36	4.58	.000	Reject
Support & Maintenance Costs	36	4.31	.000	Reject
Migration Costs	36	3.75	.000	Reject
Ease of Usage	36	4.39	.000	Reject
Ease of Customization	36	3.67	.000	Reject
Performance of Software	36	4.06	.000	Reject
Interoperability with other products	36	2.89	.457	Do not reject
Availability of Support	36	4.03	.000	Reject
Staff Preferences	36	4.08	.000	Reject
Staff Previous Expertise	36	3.33	.090	Do not reject

Table 1: Factors Influencing Procurement of Software in Academic Institutions

FACTOR	N	MEAN	P-VALUE	CONCLUSION
Poor quality software	14	2.29	0.055	Do not reject
Poor Documentation	14	3.21	0.426	Do not reject
Scalability Issues	12	3.17	0.504	Do not reject
Unmatched Needs	11	2.73	0.493	Do not reject
Lack of staff expertise	15	3.93	0.01	Reject
Lack of Support	15	4.6	0	Reject
Cost of Time & Efforts	14	4.71	0	Reject
Migration Problems	14	4.64	0	Reject

Table 2: Key Factors influencing decisions against Open Source Software