SSRG International Journal of Economics and Management Studies
ISSN: 2393 – 9125 / https://doi.org/10.14445/23939125/IJEMS-V7I5P116

Volume 7 Issue 5, 98-101, May, 2020

Review Article

Free and Open Source Software in e-Governance

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Received Date: 04 April 2020
Revised Date: 17 May 2020
Accepted Date: 21 May 2020

Abstract *- E-governance is a process that helps to provide government services to the citizens as earlier as possible through technology without visiting government offices. Therefore by using this system, government activities will speed up dramatically. In everyday activities, e-governance applications are becoming part of every citizen's life, and in the widespread of e-governance, it is quite obvious to notice that there are many applications of e-governance that help the human race in their daily life. The major ingredients of e-governance are Connectivity, Information, Skillset, Budget. The cost of software is the major obstacle in introducing novel beneficial e-governance applications. This can be mitigated using free and Open Source Software.*

The term free and open-source refers to something people can modify and share because its design is publicly accessible. Open source can be seen as a technical expression of democratic government as open source is a result of public accessibility, open exchange, and collaborative participation. It thrives on transparency and community development, and Free and open-source software promotes savings, security, scalability, interoperability to create a better future. The paper provides an analysis on why governments should use open source and why the government should invest in open source to let the citizens enjoy the real fruits of e-Governance applications.

Keywords *- E-governance, Open Source software, Security, Scalability, Interoperability.*

I. INTRODUCTION

E-Governance is the application of Information & Communication Technology by the government into the delivery of government services, exchange of information, integration of different systems, etc. [1]. E-Governance consists of various types of interactions with various stakeholders such as other government departments, citizens, businesses, and employees[2].

The application of computing technology has improved the speed and reliability of government as well enabled the governments to include a larger number of deserving people under the ambit of their welfare and social programs. As such, many governments have become more and more dependent on the software systems they are using for their implementation of e-governance. Many of the largest technology companies derive a major part of their annual revenue through government contracts[3], [4]. As the cost of such e-governance solutions is massive because of the licensing norms usually practised in the industry, it is important that governments use Free and Open Source Software (FOSS) in order to gain control over their information infrastructure as well as reduce their operational costs.

The FOSS, by definition, is software that is free for users to copy and re-use as well as open-source, meaning the source code of the software is open for scrutiny by the public[5]. As the government uses the tax revenue collected from the citizen in order to fund e-governance initiatives, it can be argued that products of public money be available for the public to evaluate and scrutinize in a meaningful way.

II. CHARACTERISTICS OF FOSS

Open source and propriety software are similar in one respect, they are both copyrighted intellectual property licensed under certain conditions to users, and they differ in many others.

But they have their own differences in various ways, which these differences make open-source particularly useful and appealing to IT organizations. There are the most relevant open source characteristics for enterprise IT organizations:

- ***Expansive licensing****:* Proprietary software licenses have their own restrictions in terms of use, limits on the number of users or type and number of machines the software may be installed, and of course, there is a fee associated with obtaining a license. While open-source licenses are very expensive but it does not impose any restrictions or limitations on the number of users or type and number of machines that may have the software installed, and there is no fee associated with open-source software.

- ***Development transparency****:* While developing, most of the product decisions are discussed mostly on mailing lists or in forums. All codes will be examined. Reported bugs are listed and available for inspection.

The development process will be carried out in public with all code check-ins and also available for inspection. It is easy for a software user to know the current state of the product, and users can easily contact product developers to understand their product decisions and give their feedback about the functionality.

- ***Ability to inspect source code:*** Because open source licenses mandate source code availability, it is easy to study the product's code and learn from it. It is very helpful to review the source code of a product to enable better integration with another product or to better understand how the product operates.

- ***Ability to modify source code:*** open source code is not only available for inspection, but it enables anyone to add new functionality that better meets user needs. Furthermore, the code can be contributed back to the mainstream code base, which means that code modifications are automatically carried forward in subsequent releases, thereby reducing downstream maintenance efforts.

- ***Community:*** Foundation for successful open source projects in the community. Community is the combined pool of product developers and users. Users can easily share their thoughts about the product with developers, which leads to improved functionality and ease of use. Community allows peers to help one another solve problems, offering quick support and knowledge sharing.

- ***Redistribution rights:*** Open source licenses allow users to distribute open source products to third parties as part of the license conditions without requiring permission from the original product distributor. Redistribution can be of the original form of the product or a modified form that contains code modified by the original code recipient. It helps with the growth of the community and also allows product users to create innovative business offerings without having to signal an intention to product creators via a redistribution request.

III. FREE AND OPEN SOURCE SOFTWARE IN E-GOVERNANCE

***A. United States of America*:** The first free and open-source movement started in North America, in the United States of America by Richard Stallman. North America still remains the biggest contributor to the growth of free and open-source in the world. The USA successfully deployed open source projects in recent years, like migrating the white house website in 2009 to Linux servers using the Drupal content management system. [6]

In August 2016, the United States government announced a new federal source code policy. This policy mandates that at least 20% of custom sources developed by or for any agency of the federal government must be released as open-source software [7]. In addition, the policy requires that all source code be shared between agencies. The public release is under a three-year pilot program, and agencies are obliged to collect data on this pilot to measure its performance.

A new website code.gov provides an online collection of tools, best practices, and schemas to help agencies implement this policy. It also provides the primary discoverability portal for custom-developed software intended both for Government-wide reuse and for release as open source. [8]

***B. Uganda*:** The population in Uganda has been growing rapidly. The country has 44 million people. In order to provide quality services to its citizens, the government has adopted free and open-source software as the preferred mode of operation for e-government services and platforms. According to National Information Technology Authority – Uganda assessment in 2012, the government agencies have been majorly dependent on proprietary software. 98% of respondents have word processing applications, with 85% having web-based applications, and 75% having accounting and database applications.[9]
So the government reached the point where they have realized that going by the market prices, the government cannot afford to foot the cost of proprietary software, especially in licenses. The government of Uganda has been spending 8 million US dollars on the procurement of Microsoft software and applications. But later, by negotiating a bulk procurement order with a spending of 3 million US dollars annually, the Uganda government adopted open-source, that cost is projected to decrease.

***C. Estonia*:** is a European country and frontrunner of a country aiming to modernize the public sector and make governance more transparent. The government services offered online are truly accepted and used by the people. Digital identification is the backbone and mandatory for all residents. In 2014 it was utilized more than 80 million and 35 million times for authentication and digital transactions, respectively. 95% person of all revenue tax statements are filled online, and 33% of citizens are engaged in online voting.

It is said that 99% per cent of government services are offered online, and note one hundred because the government wants people to marry and divorce in person and for real estate transactions to not be digital. [10]

D. OpenForge (INDIA): OpenForge is a platform of the Indian government for open, collaborative development of e-governance applications [11]. Through this platform, the government wants to promote the use of open-source software and promote sharing and reuse of e-governance related source code. In 2015, the Department of

Electronics and IT, Government of India, rolled out the "Policy on Collaborative Application Development" by opening the source code of government applications, which provides a framework for archiving government custom-developed source code in repositories and opening these repositories for promoting reuse, sharing and remixing. Using this platform total of 240 projects are completed where 189 projects are in progress. 23 central ministries department's agencies are covered, including 18 states of the Indian Government.

IV. ECONOMIC BENEFITS OF FREE AND OPEN-SOURCE SOFTWARE

Free and open-source software produces a high level of economic benefits that apply to society and business in many ways. That's one of the reasons where a large number of organizations in both public and private sectors have already adopted free and open-source, or they are in migrating phase. Various studies have established that the adoption of open source solutions by an organization results in reduced expenditure compared to an equivalent proprietary solution [12] [13]. As a result, it is desirable for the government departments to consider adopting as well contribute to the open-source software they are using based on their experiences in usage. As such, there is a need for government policies to incentivize the adoption of open software and standards in order to encourage citizens to contribute to the working of the government. This will enable different viewpoints as well as a large number of volunteers to attempt to solve a problem that may be difficult to do in a small team that is common in proprietary software development. The ability to do code audit is an added advantage as the security of critical systems can be verified by unbiased experts. According to the examples given above, many of the governments have been able to take advantage of the large talent pool each country already has to contribute to the development of the e-governance system as well as achieve dramatically reduced operational and development costs.

Another important economic benefit of free and open-source is developing local software capacity. There are three arguments for this as follows: [14]

A. Low barriers to entry: free and open source is very easy to get, use and learn from. However, proprietary software has certain limitations and restrictions for the source code through intellectual property rights. Free and open-source gives an opportunity to build or modify existing software very easily.

B. Free and open source as an excellent training system: It allows students and anyone who wants to build software, to train with software concepts without any cost.

C. Free and open source as a source of standards: Free and open source becomes an effective standard by virtue of its dominance in a particular sector of an industry or a region.

V. CONCLUSION

Globally open source community shows the real power of open-source software worldwide, and now many governments are willing to migrate to open source because of the enormous size and scope of the e-Governance effort in any government and because of the availability of globally recognized software, the community of open source developers.

The governments should work for their citizens and provide different e-Governance applications, and it helps them to bring the public closer to their government. Even a government must target to generate revenue through its services and return on investment policy.

We have seen that free and open-source software has many characteristics that allow it to be a great candidate for e-governance systems. Its properties of openness, community, etc., make it a secure as well as a transparent option for systems that handle citizen data as well. Many countries such as Estonia, Uganda, the US, and India have adopted OSS into their e-governance systems and have reported benefits such as reduced expenditure and the ability to do code audit. There are many arguments in favour of OSS that governments may take into consideration when they are in the market for a software solution.

In view of the study findings, there is a need for governments lagging in adopting free and open-source, trying to implement FOSS policies to outlaw the use of commercial software, governments must initiate FOSS communities and local FOSS projects. They can raise awareness about FOSS projects by providing resources for their own local developers so that they can migrate themselves from commercial software to Open Source Software, and most importantly, governments must incorporate FOSS in the college curriculum for computer studies.

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