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Role of Open Source Software in E-Governance

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Abstract: In day to day activities, e-Governance applications are becoming part of every citizen's life. The models of e-Governance are G2C, G2G, G2B with which the respective stake holders are enjoying the benefits. In the wide spread of e-Governance, it is quite obvious to notice that there are innumerable applications of e-Governance which help the human race for quality life. The major ingredients of e-Governance are Connectivity, Information, Skill set, Budget. The cost of software is the major hurdle in introducing novel beneficial e-Governance applications. This can be mitigated using free and Open Source Software(OSS). Improper implementation of e-Governance activities leads to problems which can be controlled by e-Governance frame work elements like planning, audit on services, social audit, infra structure audit, professional audit, software audit, software down time, budgeting the total projects under the umbrella activities of free and Open Source Software(FOSS). International organizations such as UNESCO, IOSN etc are promoting free and open source software because of its benefits of savings, security, scalability, reliability, precession, interoperability and globalization. The return on investment is the major focus of the governments which is possible with OSS and also this in turn reduces the financial burden on public and makes them enjoy the real fruits of e-Governance applications.

Keywords: e-Governance, Open Source, Free ware, Security, Scalability, Reliability, Interoperability

1. INTRODUCTION

Use of internet by the government to provide its services to customers, business and employees and to promote smooth, comfortable transactions to discharge their needs is the motto of e-Governance. The four models of e-Governance are Government to citizens (G2C), Government to government (G2G), Government to employees (G2E) , Government to business(G2B). The information is made available at door step using latest technology so that the public enjoy the benefits out of it, business gets promoted and employees working potency gets increased and in turn the desired goals gets full filled. In day to day activities, e-Governance applications became part of every citizen's life. Its roots are so deeply penetrated into the society that without it, one can't imagine comfortable human life. In the wide spread of e-Governance, it is quite obvious to notice that there are innumerable applications of e-Governance which help the human race for quality life and these applications do differ in its environment. Much care has to be exercised in transparency of e-Governance applications particularly to the consuming public where in the government being the partner. In this scenario the software audit along with budgeting of an e-Governance application place a predominant role in proper implementation of the system which enhances the quality of life. The focal point of the discussion is to bring out the various elements of open source software, its impact on e-Governance and to minimize the cost.

Elements of e-Governance: The major ingredients of e-Governance are Connectivity, Information, Skill set, Budget. First, the connectivity deals with the networking among the stakeholders and the government services. Components in the networking are responsible for transporting data among all the other subsystems within a system and for transporting data to or receiving data from another system. The communication subsystem is becoming an

increasingly important component of e-Governance systems. The communication subsystem can be subjected to passive or active subversive attacks. One way to reduce expected losses in the communication subsystem is to choose physical components that have characteristics which make them reliable and that incorporate features or provide controls which mitigate the possible effects of exposures. Various communication consideration controls are communication control lines, modems, port protection devices, Multiplexers and Concentrators, error detection and correction circuits, flow controls, link controls, topological controls, poling methods, Internet controls etc. Most of the communication protocols are developed using Open Source Software.

Second, the information which is to be shared to stakeholders should be complete, perfect, latest and should be well organized and accessed from data bases using data mining techniques and even today the concepts of big data are gaining it's strength with suitable application software. Considerable database controls are Access controls, Integrity controls, Distributed database concurrency Controls, Cryptographic controls, File Handling Controls, accounting audit trails, Operations Audit Trail, back up, logging etc. The application software developed using OSS plays a predominate role in providing the needful information to clients.

Third, the Skill set required for smooth operations of e-Governance in technical perspective plays vital role. The operations management is responsible for the daily running of hardware and software facilities so that e-Governance application systems can accomplish their work and the development staff can design, implement and maintain application systems systematically. Operations management typically exercises controls over Computer operations, Communications network control, Data preparation and entry, Production control, File library, Documentation and program library, Help desk/technical support, Capacity planning and performance monitoring, Outsourced operations.

Finally the budgeting plays a pivotal role in promoting e-Governance activities. India being a developing country, a rational budget is suggested for implementation of e-Governance. The Capital can be on public or private partnership. It refers to money used by government to provide their services or to that sector of the economy based on its operation. The estimation of expenditure and comparison of the costs versus the benefits of e-Government is to be established. The estimation of expenditure differs from one application to another application because of the differing installed bases, capital replacement costs and spending requirements on infrastructures for e-Government readiness. As e-Governance is an online activity, the cost incurred for privacy and security should also be considered and to be minimized. Different funding methods in practice are issuing bonds, inventive financing methods like outsourcing, software leasing, rent to own etc.

Open Source Software: The source code of the software is kept visible and open to perform any modifications to it and redistribute it is the concept of open source software. Free open source software as a political idea and as a movement came into force with the founding by Richard Stallman of the Free Software Foundation and its GNU/Linux Project in 1984. The name GNU was chosen following a hacker tradition, as a recursive acronym for "GNU's Not Unix". The benefits of OSS are huge which includes Cost savings, Security, Reliability, Open standards, avoidance of vendor lock-in, Reduced reliance on imports, Developing local software industry, Localization, Zero licensing costs, easier administration, especially with thin-client model, less downtime from security patching. This introduced the concept of Open government where e-Governance process, perform and community software plays a critical role in information management. In this decade, the Open source software revolutionized various fields of public services and the international organization like UNESCO, IFLA, IOSN promoted open source in e-learning, content management, digital library and integrated library management fields. The implementation of OSS in e-Governance applications is gradually gaining its strength.

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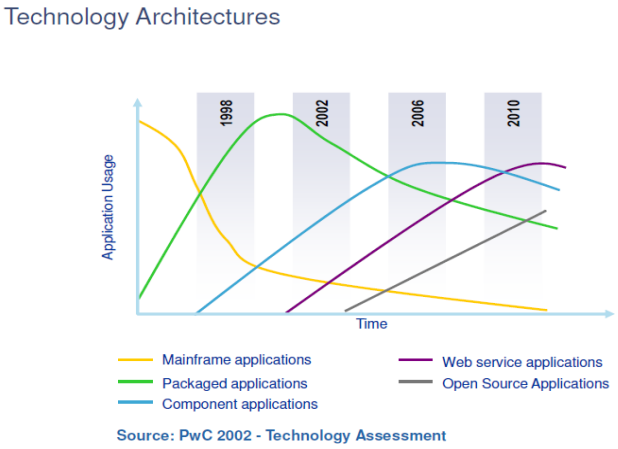

Fig 1. Technology Architecture

In India, knowledge commission under chairmanship of Sam Pitroda recommended open source software for e-governance and information management. In 2001 UNESCO decided to get on this relatively new approach of not only providing the software for free but also making the source codes in principle 'open', i.e. publicly available on the website. This has finally lead to a framework of its wider 'Free and Open Source Portal' approach promoting the idea and adding other software. The Asia Pacific Development Information Programme (APDIP) is an initiative of the United Nations Development Programme (UNDP) that aims to promote the development and application of new Information and Communication Technology (ICT). The International Open Source Network (IOSN) is an initiative of APDIP and supported by the International Development Research Center of Canada. IOSN is a center of excellence for free /open source software, Open content and open standard in the Asia Pacific region. IFLA working group on Open Source Software initiated direct activities of IFLA IT section in promoting standards in open source and publishing open source frameworks for libraries. Also working with other agencies actively engaged in open source to encourage regional support initiatives for open source. The National Knowledge Commission was set up by the Prime Minister Dr. Manmohan Singh under the chairmanship of Sam Pitroda, to prepare a blueprint to tap into the enormous reservoir of our knowledge base so that our people can confidently face the challenges of the 21st century. The commission made various useful recommendations on the e-Governance implementation with OSS.

OSS Vs Proprietary: Open source software is based around the idea that the user can not only view, but change the source code of an application. Closed source software is hidden to prevent the user either viewing or changing the code. After initial production, open source software is released to the development community and undergoes a secondary phase of evolution. It is scrutinized by thousands of professional developers across the globe that highlights potential flaws, bugs and security glitches. Closed source software is developed in isolation with a small team of developers. It isn't possible to build a team of hundreds to check the code because the code is deemed proprietary and secret. The working model of OSS in relevance with e-Governance is as follows.

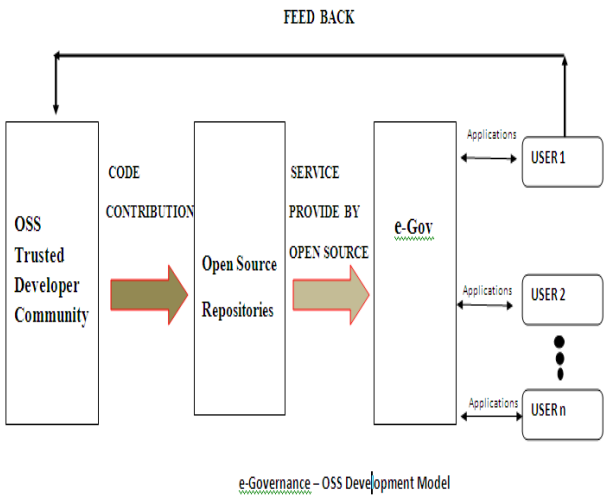

Fig 2. The working model of OSS in relevance with e-Governance

FOSS in e-Governance: Free of cost available Open Source Software is called as Free Open Source Software (FOSS). Free open source software development facilitates sharing, examination, reuse, modification and redistribution of various e-Governance applications with faster development, time saving, low cost or zero cost, shares innovative ideas of one to other which aids in knowledge sharing, forums creations, professional human network, cost cut down to common public in providing services, improved return on investment, leading to profits and prosperity. The benefits of FOSS are one can evaluate in detail, lowering risk, can see if meets needs (security, etc.), can perform mass peer review typically greatly increases quality/security, aids longevity of records, Government transparency, can copy repeatedly at no additional charge, support may

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have per-use charges, share development costs with other users and can control own destiny. Even the software down time is reduced with improved performance of servers, services, database, utility and other application programs. e-Government encourages adoption of e-Commerce, e-Business in government agency operations which can be promoted successfully with high degree of security using OSS. FOSS authorizes interested government employees, contractors and citizens to offer help and capture their contributions for proposing and incorporating enhancements or modifications in the software which democratizes the creation of public. This will codify the processes into high level, user friendly process models. These features made OSS operating system, middle ware and database in e-Governance to gain its strength day by day and is expected to shoot up in near future.

For many Governments the world over, the choice of Open Source is a strategic one. The preference towards Open Source platforms is firstly because, acquiring and upgrading proprietary software is expensive. There is also the proposition that it is safer to entrust knowledge in the public domain to Open Source, which is also in the public domain, than to proprietary platforms. Using open source would enable India to encourage our own software professionals to provide software support in the form of add-on applications that could be written at a cost much smaller than that required to buy multi-featured packaged software. Various open source software products are shown in the table.

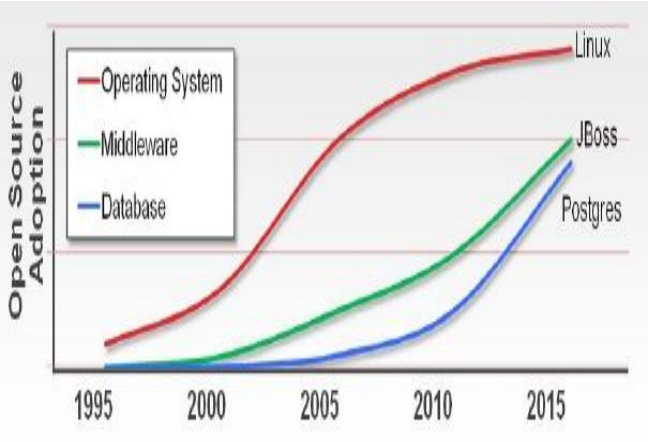

Fig 3. Expected growth of OSS from 1995 to 2015
[Source:Red hat summit 2009]

Software category	Free & Open Source	Purpose
Operating system	Linux	Desktop & server operating system
Web development	Apache web server, page tool , php, Drupal	Hosting and content management Web development
Office productivity	Open office	spreadsheets and presentations, Word processing
Image processing	GIMP	Image processing
Internet access	Mozilla	Web browsing
Email	Pine, Send mail , Kmail	For email service
Audio / visual player	Helix , ogg Vorbis	Audio / visual players
Anti – virus	Clam , ClamWin	Worms and Trojans detection and cleaning
Database management systems	Mysql	Database development and management

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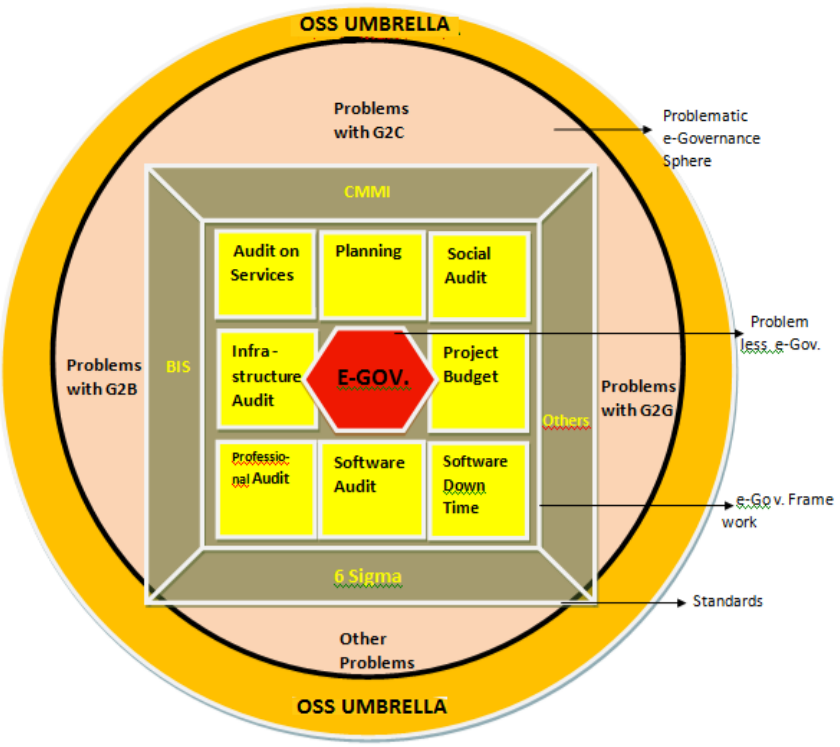
The scope of global participation in incorporating the suggestions in the form of code, transparency in military and security applications is added benefit of FOSS. The role of FOSS is vital in e-Governance framework and is discussed below.

e-Governance Frame work: Issues of e-Governance can be classified under three heads Government to Citizen (G2C) issues, Government to Business (G2B) issues and Government to Government (G2G) issues. To mitigate the issues the following frame work activities are proposed under umbrella of free and Open Source Software.



e-Governance Framework using Free & Open Source Software

Framework Activities: The e-governance framework components are planning, audit on services, social audit, infra structure audit, professional audit, software audit, software down time, budgeting the total projects.

Planning: Determining the goals, functions of the e-Governance and the means of achieving these is done in planning phase. Every e-Governance activity commences with planning phase and it is followed by different phases like Organizing, Leading and Controlling. In the planning phase itself pave the way with OSS or FOSS for the proposed applications. The merits and demerits of OSS and proprietary software is to be planned.

Audit on Services: An e-Government service is defined as an application, or series of applications, on the internet that provides a specific service to a citizen or business. The applications are interactive and transaction based. The goal of an e-Service is to provide a start-to-finish solution to the customer. Coverage of Critical citizen services is the prime criteria for selection of an e-Governance project for audit. Evaluation of Quality of service with end user satisfaction is the scale for measuring performance of e-Governance projects. The peek standards of quality can be achieved with services provided by FOSS.

Social Audit: e-Governance is the process designed for public benefit. Hence while designing the e-

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Governance applications, it the responsibility of government to make people participate in its design and implementation. A social audit is a process in which the people work with the government to monitor and evaluate the planning and implementation of a scheme or program, or indeed of a policy or law.

Infrastructure Audit: e-Governance projects with transparency and decreasing corruption is catching eye of public. The infrastructure includes all the physical and abstract elements which are involved in developing and implementing the e-Governance applications using FOSS. As multiple elements are involved in the development of e-Government projects, the infrastructure is habitually the element most open to compromise and this is the one that frequently presents the greatest risk to e-Government projects.

Professional Audit: Professional audit is one of the key points in e-Governance framework. As per this the skills of various IT professional are audited to see whether they have in depth knowledge in FOSS software, they obey certain standards to fit into the work to produce quality E-Governance applications. As most of the e-Governance applications are online, and many of the citizens, organizations and others interact with these applications, the professionals who develop these applications should possess certain qualities to receive the appreciations.

Software Audit: The software which is used for the e-Governance applications should be audited for correctness, perfectness, scalability and availability which are available to precession in FOSS. The software audit comprises Application software audit, Database audit and System software audit. In Application software audit, programs which are developed for e-Governance applications, the purchased programs, network protocols, the related packages and utilities are to be audited by auditors. In Database audit, the data which is acquired through application programs are stored in database and audited. In System software audit, the operating system, firmware, hardware that permits sharing and resources within a computer system are audited.

Down Time Audit: Performance audit reports concern the efficiency, effectiveness, economy of a particular government activity. The performance is directly related to downtime of e-Governance application. The measure of e-Governance performance is the citizen satisfaction in terms of convenience, increased transparency and protection of the confidentiality, integrity and the reliability of the information stored and processed by the e-Governance FOSS applications.

Budgeting: The estimation of expenditure and comparison of the costs versus the benefits of e-Government is to be established. The estimation of expenditure differs from one application to another application because of the differing installed bases, capital replacement costs and spending requirements on infrastructures for e-Government readiness. As e-Governance is an online activity, the cost incurred for privacy and security should also be considered. The cost cut down can be down drastically using FOSS software.

Standards: A standard is defined as a technical specification or other document available to the public, drawn up with the cooperation and consensus or general approval of all interests affected by it, based on the consolidated results of science, technology and experience, aimed at the promotion of optimum community benefits and approved by a body recognized at the national, regional or international level.

Quality of software is the major considerable factor in e-Governance activities. The quality is maintained by following certain global standards which play an important role in building the architecture of e-Governance involving free or Open Source Software.

Myths & Realities of OSS: There are some misconceptions in public on OSS and the realities are presented below.

Myths on OSS	Reality
Open source is a niche IT sector	Perhaps this was a fair comment when Linux and Apache were in their infancy, but now open source has established a firm foothold in the data centre, and this statement could not be further from the truth.
Open source cannot support mission-	Many opponents to open source fuel the idea that open source is not reliable enough to run mission-critical applications, and that the quality of open-source products is poor. Yet

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critical applications	open-source products are subjected to the same levels of performance, stress, functional, security and regression tests that closed source products are. In addition, an advantage of the open source development model is that it enables collaboration with the end-user very early in the development cycle, allowing bugs and design flaws to be identified early.
Open source companies do not own their intellectual property	This is a misconception. The truth is that open source software is subject to the same copyright laws as closed-source software, but open source software suppliers choose to share their IP with others. So, products are brought to market faster, open source software cannot be monopolized, no one organization can control the price for support and services for open source solutions, and the competition to provide support services at an attractive price-point makes it more cost-effective for customers. We think it is time now to call the bluff on closed-source vendors.
Open source technology does not offer professional level support	Today, open source providers offer professional support, and make it possible for the software to run mission-critical applications for major, global companies. Indeed, the business model for most open source software providers depends on customers buying support and services.
Open source is unregulated and anyone can contribute code	Some opponents of open source propagate the myth that anyone can access and change open-source code, which makes it unsecured and unreliable. However, the truth is that access to open source code is controlled, and any changes to the source must either address a problem, or enhance the product.
Open Source software is not secure	A common misunderstanding is that open source software is more vulnerable to exploitation than closed-source software, simply because code that is exposed is more likely to be hacked. Open source software is secure by design and uses standard software development methodologies and secure coding techniques. All source code changes are subjected to rigorous peer review before acceptance. Because of this review, more proactive checking for vulnerabilities occurs, bringing to light any exploits in the code, and providing built-in security from the ground up.

Cost cut down: It is noticed from the past five years there is increasing demand for e-Governance applications and the budget allotments could not reach the expectations because of financial constraints. In this regard the governments of various countries are seriously focusing on the pivotal element of budget allotment to e-Governance to cut down the cost and the ultimate choice is FOSS.

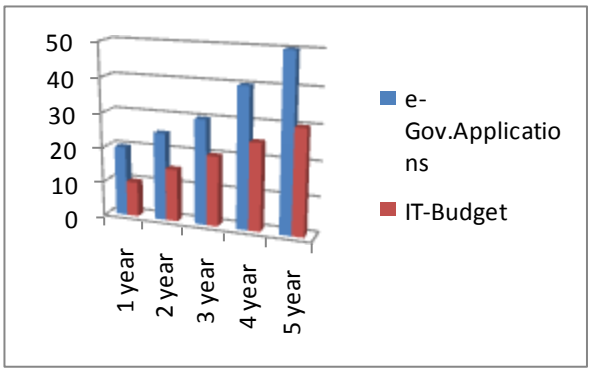

Fig 5. Growing importance of e-Gov Applications and Budget allotments

It is estimated that the licensing cost per system, per year on average is Rs.15300 which includes licensing cost of operating system, application software, data base and cost of various system utilities, excluding the hardware maintenance cost. The pricing of the popular operating system like windows, application software like visual studio.net, Microsoft Office, back end database like oracle and various antivirus utilities like Avast, K7 etc is high and causing inconvenience to the stack holders. The expenditure for a 1000 seated organization goes upto Rs.1.5 crores only on software licensing which excludes hardware, operational, capital, marketing, ads and other overheads.

FOSS can be obtained free of cost, where a manufacturer charges for the delivery. One pays for the sharing or network connectivity cost of download. Apart from that no loyalty or licence fees apply and one copy is enough for unlimited installations and distribution. The options are using Ubuntu or Linux which cost max of Rs.50 paying for download, operations cost. If the proprietary software Microsoft Windows.8 is purchased it costs around Rs.3000 and can be noticed a drastic savings of Rs.2950 on one installation and that too on operating system. In addition a system needs an application software, database, utilities which are provided as bundle by FOSS and the most popular LAMP Linux operating system, Apache server, MySql database, PHP web technologies comes in this category. Higher end i7 processor system with latest specifications costs Rs.70000 approximately needs the change of proprietary software with latest versions which again involves cost. The FOSS can efficiently run on old processors with least replacement of hardware components with a minimum expenditure of Rs.5000. This makes FOSS more cost saving option opposed to proprietary solutions. The new release of proprietary operating system operating systems means more processing power, RAM, and storage space is demanded than the previous version. Specifications required for Windows XP need to be doubled for an efficient Windows 2008 ultimate installation. This means continuous costly hardware upgrades for e-governance systems set up on proprietary software which increases investment and hampers the returns.

The other negative shade to be noticed with proprietary software is the support team reduce or stop their support for older versions once a new version or product is released and this indirectly pressurizes the user to purchase the new product which involves huge cost. The load on government to invest for e-Government is one side of the coin and on the other side it burdens common man in terms of service charges. The only solution for this is FOSS, where the total software cost can be enormously reduced which leads to savings and profits. Linux for e-governance benefits both government operations and the citizens by lowering the cost of operations, providing scalability for future growth, interoperability, providing a robust and stable system to support ongoing government, reliable e-Governance, simplifying system maintenance and management. Regarding Licensing GNU opts for "General Public License" (GPL), that is no standard open source license, but GPL is most widely used (roughly 85% of open source software). The terms include, User freedom to distribute and/or modify, Requirement that original and modified source code be always made available to the world under the terms of the original license, Must retain copyright notices and warranty disclaimers, does not include grant of patent licenses.

OSS Global revolution: USA formed a task force to identify and implement priority actions that achieve strategic improvements in government and set in motion a transformation of government around citizen needs using Open Source Software. In the recent past the governments of United Kingdom came out with a document "e-Government: A Strategic Framework for Public Services in the Information Age" and introduced various projects using OSS. In December, 2013, the Italian government issued final rules implementing a change to procurement law that now requires all public administrations in the country to first consider re-used or free software before committing to proprietary licenses. Free Software Foundation Europe offers a good explanation of the changes in its press release. New Zealand Government came out with its e-Government vision document 'E-Government Unit' was established by the State Services commission. South Africa, realized the cost benefits of FOSS and the development of a local information and communication technology skills. Key strategies in support of open source have included government procurement policies that favor open source software

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for government services such as schools, hospitals, public works etc. In South Africa, the government approved the proposal that when proprietary and open source are equal, open source will be given preference owing to the improved returns on investment associated with the elimination of licensing and the endless maintenance agreements that lock government into expensive long-term contracts. In Nigeria, an SMS Helpdesk Application developed with open source is in use to provide helpdesk functionality to citizens in Lagos. In India, Delixus, Inc., a private IT company, implemented, the Delixus e-Governance platform that enhanced the features of Linux to provide improved services to poor formers, pensioners and widows in the state of Karnataka. Venezuela adopted an official policy to use FOSS in their government based on the principle: "Open Source whenever possible, proprietary software only when necessary". This arose from the concern that 75% of the funds for software licenses went to foreign nations, 20%to foreign support agencies and only 5% to Venezuelans. The German government uses the GNU/Linux operating system to run application software for the German parliament. France's culture, defense and education ministries and the British police and intelligence agencies also use GNU/Linux. The Finnish Ministry of Finance has estimated that annual savings of 26 million euros could be made by using Linux in state agencies. The Chinese government has consistently promoted GNU/Linux for cost cut down and security reasons. In developing countries, Government beneficiary scheme can be reached to the lowest pyramid of society efficiently by implementing E-Governance projects using FOSS. The applications developed using free Open Source is bridging the gap between rich and poor. Globally, various countries gradually discarding the proprietary software and opting for free and Open Source.

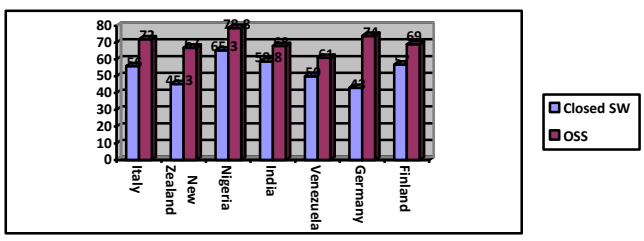

Fig 6. Country wise Closed Software and OSS applications

CONCLUSION:

International organizations such as UNESCO, IOSN etc are promoting free and open source software. Because of the colossal size and scope of the e-Governance effort in India and because of the availability of globally recognized software talent of Indians, one must actively encourage open source software implementations and open standards wherever possible. This will allow having cost-effective solutions and helping with standards. The governments should serve the public with various e-Governance applications and also should target to generate revenue through its services and return on investment policy. Unless and until the invested funds are returned, the new e-Governance activities cannot be under taken. Even considering the government as a service provider and business organization, it should also aim at profits out of its investments. The Free Open Source Software gives a clear solution for this and it also helps with added benefits of security, scalability, reliability, precession, interoperability and globalization.

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