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Legal Readiness for Open Source Software Adoption in Public Sector

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ABSTRACT

The importance of Open-Source Software (OSS) is growing vehemently in the public sector. OSS has a key role in governments' digital transformation towards achieving Sustainable Development Goals (SDGs) as it reduces the Total Cost of Ownership (TCO), provides the opportunities of economies of scale and economies of scope, and promotes digital infrastructure by adopting Open Stack technology capabilities. However, the OSS adoption readiness has been measured on the basis of technology, organizations, and economic prerequisites, as of now. The current paper reviews the existing literature and suggests most critical factors from the perspectives of legislation, governance, and policy so that the governments which are traversing towards digital transformation can adopt them for social good.

Keywords: Sustainable development goals, Open source software, Readiness factors, Digital government transformation

INTRODUCTION

Open-source software (OSS) is referred to as free and open collaborative software, which can be used, implemented, and changed for any purpose. Today, OSS can be found in many governmental policies, initiatives, and digital masterplans. For example, digital public goods (DPGs), and international collaborations such as GovStack, are the flag bearers of the adoption of OSS solutions in digital government transformation by the world nations to achieve the Sustainable Development Goals (SDGs). The public sector strives to adopt OSS to release themselves from proprietary owned, vendor-locked software to enhance digital autonomy, cost-efficiency and introduce more thorough transparency. To adhere to the OSS approach,

governments have to adjust and examine the level of regulations, infrastructure, potential legacy system exit costs, availability of expert consultants, procurement and acquisition decisions, and maturity of software support (Shaikh, 2016).

OSS adoption readiness has been evaluated chiefly based on technological, organizational, and economic prerequisites (Sánchez et al., 2020). The technological prerequisites tend to include compatibility, reliability, and usability (*Ibid*). The complete switch to a whole OSS approach in the organization during the first phase is highly unlikely; therefore, there is a need to determine if the chosen OSS solution will be compatible with proprietary solutions which are already in place (Sowinska et al., 2021). The organizational prerequisites consist of support, training, and attitude towards change, among others (Sánchez et al., 2020). Training and attitude towards change have a strong correlation with each other, as the first one, in case of a correct delivery, may enhance the attitude towards change and eliminate adverse outcomes (Sowinska et al., 2021). Lastly, economic prerequisites include the total cost of ownership, operational cost, and support (Sánchez et al., 2020). Studies suggest that cost-efficient licensing cost is often one of the main factors for adopting full OSS infrastructure, which still, however, does require sustainable funding and technical support throughout the full OSS lifecycle (Sowinska et al., 2021).

As per the literature review above, one of the main barriers to OSS adoption is the lack of explicit guiding materials and a unified list of accessible prerequisites. In this paper, authors have explored the existing legal prerequisites facilitating OSS policies, regulations in many countries and advise the most critical factors for OSS general regulation. The derived recommendations will be used to formulate a sample regulation that can guide countries' OSS adoption. The authors anticipate that the expected outcome will be helpful in recommending OSS adoption while developing digital public goods, implementing the GovStack approach based digital government transformation.

OPEN SOURCE SOLUTIONS AND SUSTAINABLE DEVELOPMENT GOALS (SDGS)

Most governments are making rapid strides in accelerating the slow rate of achievement of SDGs through digital transformation strategies. UN has noticed the key features of OSS i.e., Sharing, Contributing, Empowering, Sustainability, Security and Decentralization (Karlitschek, 2019), that would play a key role in lowering the digital infrastructure investment costs for the governments. UNCTAD also observes the benefits of the open source in public sectors i.e. (i) lower costs and improve local value creation, (ii) promotion of local learning with universal information and communication technology (ICT) access, (iii) less dependence on specific technologies or vendors (e.g., no lock-in), (iv) easy adaption to meet local needs with customizability to local languages and cultures, and (v) addresses concerns of national security and long-term availability (UNCTAD, 2012).

It has promoted the use of OSS for addressing SDGs through various initiatives such as Open-source appropriate technology (OSAT) and The United Nations Technological Innovation Lab (UNTIL). OSAT is an appropriate technology that contributes to the achievement of sustainable development goals (SDGs) while being designed in ways synonymous with free and open-source software (FOSS) and free and open-source hardware (FOSH) (UNCTAD, 2021). For example, an open-source software application "ImageJ" is developed to examine the microscopic organism, remote sensing work by aerial drones, interim helpful in achieving the targets under SDG15. The Appropedia[1] Foundation is hosting collaborative solutions for achieving the SDGs (Pearce, 2012), which have profound impact on many SDGs. UNTIL has developed the OS Strategy and Policy and suggests that OSS should have no dual licensing, open core, proprietary extensions, and limited access models so that everyone has the same access and capabilities.

The Current Status of OSS Policies in the World

Countries have understood the importance of OSS and have issued various forms of legislations, strategies, and directives since 1999. It is observed that there is a growing increase in the number of policies[2] from 354 in 2010 (Lewis, 2010) to 669 policies in 2022 (Eugenia Lostri, 2022). These have been prepared and issued at national, state, local level governments and have different statuses such as 'Approved', 'Proposed' and 'Failed'.

Row Labels	Africa	Asia	Central America and the Caribbean	Europe	Middle East	North America	Oceania	South America	Grand Total
Approved	14	171	21	168	36	32	6	91	539
Failed		2	3	16	1	20	1	49	92
Proposed	1	10	1			7	1	5	25
Replaced		1	2	1		4	1	4	13
Grand Total	**15**	**184**	**27**	**185**	**37**	**63**	**9**	**149**	**669**

Figure 1: Regional wise break-up of OSS policies[3] (Eugenia Lostri, 2022).

The below diagram indicates regional-wise break-up for the OSS policies, as of 2022.

As we see in Figure-2, there were a total of 35% support documents, 21% strategy documents, 20% bills, and 15% directives and regulations, out of these 669 policy documents.

The Figure-3 indicates the region-wise break-up of the stated objectives of OSS policies. The analysis also informs us that the chief stated objectives of the OSS policies are cost, sovereignty, support for industry, modernization, transparency, and security (Eugenia Lostri, 2022).

The paper continues to explore the main reason why the governments sought to promote OSS, for each of the above-specified objectives. Digitization, eGovernment, Interoperability, capacity building/training, and awareness,

[1] www.appropedia.org

[2] The term "policy" has the broad coverage of regulations, bills/laws, strategy documents in this article.

[3] The CSIS website has shared the open data excel sheet and the authors of this article has prepared the above Figure-1.

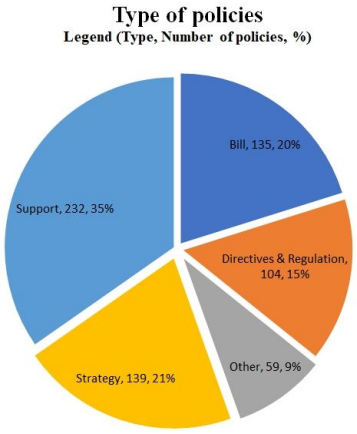

Figure 2: Types of OSS policies[4] (Eugenia Lostri, 2022).

Table 1: Regional Breakdown of Stated Objective* (overlap)

	Cost	Sovereignty	Support for Industry	Modernization	Transparency	Security
Africa	4	1	5	14	1	0
Asia	58	10	82	107	5	14
Central America and the Caribbean	4	4	5	13	1	4
Europe	32	8	35	168	20	3
Middle East	12	3	25	31	3	7
North America	12	2	5	25	13	17
Oceania	3	0	2	9	1	0
South America	58	26	48	64	35	13

*Aggregate polices do not equal 669 as policies were often categorized with more than one objective

Source: CSIS.

Figure 3: Regional wise break-up of the stated objectives of OSS policies (Eugenia Lostri, 2022).

are the keywords under the "Modernization" category. Cost savings/optimization, bringing transparency, technology sovereignty and security are the important reasons for promoting the use of OSS.

Research Gap for Laying the Foundations of Legal Prerequisites

While the current literature provides a strong base for the promotion of OSS, it is not very clear how this knowledge is expected to be aligned w.r.t digital transformation and achieving SDGs, in the backdrop of GovStack initiative.

[4]The CSIS website has shared the open data excel sheet and the author of this article has prepared the above Figure-2.

Towards addressing this concern, the authors have chosen the nations listed in Table 1, using a random sampling technique and collected the data to understand the existing regulatory set-up, compare the OSS maturity levels of GovStack's participating countries, evaluate the most important factors for OSS general regulation and propose the finalized research outcomes for the public sector's use. The expected outcome will be effective while adopting the OSS and drafting the OSS-related strategies, thus harnessing the digital transformation. It is important to mention that documents in the English language are only referred for this study.

Key Recommendations

The following recommendations are greatly useful for the countries who are going to adopt the GovStack approach in their digital government transformation. It is pertinent to mention that some of the parameters such as capacity building, quality control, do come under the preview of Governance but not under the legal ambit. However, the authors suggest having a holistic approach in establishing a facilitating ecosystem. Therefore, the legislation division is assured of the governance division's readiness.

1. **Overarching Legislation**

There shall be accommodating/overarching legislation for the electronic records, data protection, and privacy in the nation. This helps clarify the issues between OSS and Non-OSS data related legal, execution related issues. The Information Technology Act (2000, 2008) by the Government of India, and The Electronic Government Act 2008 by Bulgaria, are a few examples. Further, reusable software components can come under the legal ambit. Ownership, Intellectual Property rights related issues may also be addressed. A mechanism for dispute resolution and grievance redressal must be provisioned.

2. **Economy and OSS**

Mandatory procurement policies have the highest policy rate failures (Eugenia Lostri, 2023). The public procurement policy should find the root

Table 1. List of countries and their policy documents.

Country	Open-source software regulation/policy
Bulgaria	The Electronic Governance Act (article 58a)
Canada	Directive on Management of Information Technology, Annex C
EU	Open Source Software Strategy 2020 – 2023
India	Policy on Adoption of Open Source Software for the Government of India
Italy	Guidelines on the acquisition and reuse of software for public administrations
New Zealand	NZGOAL Software Extension Policy
Singapore	Digital Government Blueprint
UK	UK Government Licensing Framework, Open Software Licences; Open Standards Principles
USA	Securing Open Source Software Act

cause and see how the policy can become successful, economically. The institutions shall also focus on market creation; and provide support for industry, modernization (digitization, interoperability) of governments, and transparency (on government's procurement). Where relevant, the economic vitality shall be oriented towards the public good since OSS is an integral part of digital infrastructure and is expected to reduce the Total Cost of Ownership (TCO) of public projects. Further, the OSS must be royalty-free, mandatory, and reusable.

3. **OSS and SDGs (Particularly for Developing, Low-Income Nations)**

The OSS strategies might consider looking at the UN initiatives such as OSAT, UNTIL; and leverage the best advantages of them. This will avoid the initial cost of investment, time delays. Further, it is also important to see how re-usability can achieve the SDG 17.14 "Policy Coherence for Sustainable Development". The countries shall identify the common areas (such as cross-border services); conceptualize and implement "Technology Transfer" programs. Sustainability (green procurement; re-usability of softwares components) shall be ensured. For example, the technological capabilities in the GovStack initiative have been developed by using OSS, to the extent of the highest feasibility.

4. **Institutions**

There shall be an institutional set-up and leadership team to direct the operations i.e., policy framework conceptualization, implementation, monitoring, related to OSS. The existing institutions (Director of the Cyber Security and Infrastructure Security Agency, as in the case of the USA), may undertake these operations.

5. **OSS and Public Policy**

The policy conceptualization shall involve key stakeholders including active open communities, citizens, public and private sectors. The policy shall reflect the legal, political (digital sovereignty), socio-economic context and technology maturity of a nation. Industrial competitiveness, economics of OSS shall be considered. It is equally important to align the OSS policies w.r.t national level Digital Transformation or SDG plans.

6. **Emphasis on Security**

The OSS policies shall be inclusive of cyber security and information security. The compatibility, local language, usability shall be ensured.

7. **Quality Control**

The quality of the OSS shall be assessed. The standards shall support interoperability, data exchange (Govt of UK, 2018) and other digital transformation features.

8. **Research, Development, and Innovation**

The institution shall focus on performing R&D activities, particularly on developing OSS or Open Stacks of emerging information and communication

technologies such as Artificial Intelligence, Internet of Things, Blockchain, Quantum computing; evolution of Open Source Hardware (OSH), Open Data Formats and so on. Also, Open Coding, Bug Bounty events shall be conducted to promote the awareness of the OSS. Students, private sector, academic research communities may identify to leverage the advantages of both OSS and Open Data. For example, how OSS (Machine Learning Algorithms) can identify the patterns in open data sets (health) and offer suggestions to the Department/Ministry of Health on a disease pattern. Entrepreneurship shall be encouraged. It is also important to see how the OSS research and innovation is aligned w.r.t Science and Technology policy of the country.

9. **Human Capital Development**

A Skill Development centre shall be established, and sufficient funding must be ensured for fulfilling its objectives. The centre must focus on building the capacities, increasing the digital competitiveness of public administration, small and medium scale enterprises (SMEs) and key stakeholders including citizens (to reduce the digital divide). The topics can be inclusive of public procurement, OSS advantages, digital infrastructure, scaling, Intellectual Property Rights, Open communities, security. Communities of Practice (CoP) or Knowledge Management systems may be created for exchanging knowledge, technologies within a nation or among nations.

CONCLUSION

The journey of OSS legislation will continue and will experience diverse approaches and angles towards the ways of potential regulation within the public sector. Based on the researched materials, it is a fact that OSS will continue to be an irreplaceable part of public sector policies and governments' strategies which strive to implement digital transformation into daily function. The authors suggest nine key recommendations while conceptualizing OSS legislation by a country. Countries adopting the digital transformation through GovStack approach are recommended to undertake the above nine key recommendations into consideration and test mentioned policies approaches adapting them to their own distinctive needs.

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