A FRAMEWORK TO ANALYZE E-GOVERNMENT OSS ADOPTION BENEFITS

Research-in-Progress

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ABSTRACT

Open source software (OSS) previously regarded as a fad by many academics has been rapidly adopted by both public and private sector organizations. The challenge facing most organizations is how to evaluate OSS adoption benefits. OSS adoption is a complex phenomenon which requires an interdisciplinary approach to understand the socio-technical, political, economic and legal benefits. The complexity of the OSS phenomenon has resulted in fiercely contested, contradictory rhetorical discussions among divided parties with no conclusive general agreement. The one size fits all approach is fundamentally flawed for evaluating OSS benefits in organizations as they are both subjective and contextual. In this paper we propose a framework to balance the needs of hard (objective) benefits and soft (subjective) benefits of OSS adoption in public sector organizations. This paper proposes a framework to evaluate benefits of OSS adoption in public-sector organizations, since one-size-fits-all approaches have shortcomings to complex phenomena.

Keywords

Systems Approaches, Soft Systems Approaches, Open Source Software, Emancipatory Systems Approaches, Hard Systems Approaches, Critical Systems Approaches

1. INTRODUCTION

Many organizations are adopting open source software (OSS) to realize a number of benefits, which include cost savings in information technology (IT) expenditure (Nagy, Yassin and Bhattacherjee, 2010). Despite numerous discussions on OSS adoption benefits, many of the debates have remained inconclusive, which is common to social complex phenomena like OSS adoption in organizations (Shaikh and Cornford, 2012). The main challenge confronting organizations is to find ways of understanding the technical, political, economical and social OSS adoption benefits in organizations. The need to balance the hard and soft benefits has remained problematic to OSS adoption in organizations, as neither one on its own is suitable to address challenges of this complex phenomenon.

The popular cost-savings benefit has been found limited and too restrictive by many researchers who suggested organization strategic goals to be the main drivers of OSS adoption (Shaikh et al., 2012). Bruggink (2003) suggests the need of a framework to alleviate the challenges of understanding the OSS adoption benefits in organizations. Shaikh et al. (2012) stress the importance of considering soft benefits when adopting new technologies such as open source software in organizations.

Our paper focuses on public-sector organizations' OSS adoption benefits. The reason for focusing on government organizations is that their decisions are motivated by service delivery rather than making profit. In contrast, private organizations are driven by profit objectives. On that note the results of the research may not be applicable to non-governmental organizations since the motives of adopting OSS may not be the same. The aim of this research is to propose a framework for analyzing OSS adoption benefits in public sector organizations. The main research question is: What would be the properties of a framework to assist public sector organizations to analyze OSS adoption benefits?

This paper is organized as follows: Section 2 gives a brief overview of the literature on OSS benefits to organizations. Section 3 presents a brief background of the systems approaches in addressing complex problem situations. Section 4 presents the proposed framework based on systems approaches. Section 5 briefly discusses the framework and how it will be validated in an organization. Finally, Section 6 gives a conclusion and areas for further study on the research topic.

2. OSS BENEFITS TO ORGANIZATIONS

Figure 1 shows OSS benefits that are important to public sector organizations. It provides a broad scope of open source benefits which have a long-term implication for the public sector organizations. The benefits are divided into four main categories namely political and legal, economic, social and technical. The political benefit component is concerned with political and legal benefits such as avoiding anti-piracy software laws associated with OSS adoption in public sector organizations. The economic-benefit component is concerned with economic benefits associated with OSS adoption in public-sector organizations. The social-benefit component is concerned with social benefits associated with OSS adoption in public-sector organizations. The technical-benefit component is concerned with technical benefits associated with OSS adoption in public-sector organizations.

Political Benefits	Economic Benefits
•Vendor independence •Software piracy •Customization	•Cost savings •Develop local industry • Promote competition
Social Benefits •Reduce digital divide •Create employment •Develop local skills	**Technical Benefits** •Improve interoperability • Support open standards •Improve security

Figure 1: OSS Benefits to Organizations

2.1 Political Benefits

Haider and Koronios (2009) note that some OSS advocates believe that public support for OSS has a political aspect because some governments may choose OSS over proprietary software to address software industry market failures. McNaughton (2010) adds that government attitude towards independent foreign software vendors makes it necessary to support OSS. The OSS philosophy of free licence fees is seen as a way of reducing the digital divide. Some governments have seen open source as a way to reduce inequality in the society. McNaughton (2010) points out that government involvement in OSS has a political implication in its perception. Political benefits have been seen to have an influence on OSS adoption by many governments. The most common political benefits for OSS adoption include vendor independence, avoiding software piracy and customization of software to meet local needs.

Vendor Independence
McNaughton (2010) notes that many governments have seen OSS adoption as one way of promoting democracy in the software industry. Many governments view OSS as a way of achieving technology sovereignty and independence from foreign software vendors. Most Latin American governments' OSS adoption initiatives were politically motivated by the idea of national freedom, vendor independence and social inclusion (McNaughton, 2010). The adoption of OSS may result in governments having a self-autonomy perspective with regard to their needs of software. The public-sector organizations could be able to build software they want rather than relying on foreign international companies to satisfy their software needs. The access to large OSS community resources will also reduce the cost of software (McNaughton, 2010).

Software Piracy
Most developing countries' OSS adoption initiatives are motivated by reducing copyright infringement (Valimaki, Oksanen and Laine, 2005). Skidmore (2005) notes that breaching of software-agreement licences have forced some governments to consider OSS as a way to avoid legal issues regarding proprietary software. Wong (2003) adds that software piracy in a country has a negative effect in attracting foreign investors. The increasing political pressure from the World Trade Organization is likely to reduce software piracy rates in the software sector. Wong (2003) adds that software piracy has a negative effect on a local software industry as it reduces the incentives for local software development. The software piracy problem has been seen as a major driver for Asian countries to adopt OSS (Valimaki et al., 2005).

Customization
The ability to customize OSS empowers the local society to use software written in local languages (McNaughton, 2010). The OSS philosophy is to treat software as a social value over profit (McNaughton, 2010). Dedrick and West (2004) add that governments are likely to benefit more from adopting OSS in the long run because they can customize the software to meet their local needs and be less dependent on foreign software companies. Many proprietary software vendors often ignore the needs of local countries in order to maximize profit. Wong (2003) points out that many non-English speaking countries feel disadvantaged by proprietary software that does not cater for their needs and that they consider OSS as an alternative. The access to source code is a major technical benefit for most developing countries who feel that their local needs are being neglected by the foreign proprietary companies.

2.2 Economic Benefits

Wong (2003) claims that most software used globally by organizations is produced in a few developed countries with the USA controlling the major market share of the software industry. The economic benefit of OSS adoption is its free availability and access to source code (McNaughton, 2010). Developing countries which do not produce software end up paying licence fees for imported software (Wong, 2003). The adoption of OSS increases competition in the software industry resulting in cost reduction.

Cost Savings
Although many OSS advocates have downplayed the importance of cost, in much research lower cost is the most cited benefit of OSS adoption in organizations (Dedrick et al., 2004). Most developing countries have seen OSS as an alternative way to reduce the financial burden of software costs and demand for foreign currency. Developing countries which do not produce software end up paying for importing software licences. Haider et al. (2009) point out that the total cost of ownership between OSS and proprietary software is still debatable. They note that while acquiring OSS can be free, the debate of total cost of ownership is not easy because of other hidden costs associated with OSS, which are difficult to quantify.

Developing Local Industry
Haider et al. (2009) add that OSS will help developing countries build their information technology capabilities. The development of a local software industry has been an economic motivating factor for many developing countries to adopt OSS (Wong, 2003). The OSS adoption helps strengthen the local software industry by increasing and enhancing local IT competencies. The OSS has the potential to be the driver of economic growth for developing countries through software export. OSS has provided some governments an opportunity to promote local markets which were heavily dominated by monopolistic proprietary software companies (Kesan and Shah, 2008). The European IT industry has seen OSS as a way to reduce dependence on international IT foreign monopolies.

Promoting Competition
Chopra and Dexter (2009) point out that the support of open source by government reduces the entry barrier by new entrants in the software industry dominated by foreign countries. They add that the existence of OSS means that there is no need for new entrants in the software industry to spend money in reinventing existing software. They write that OSS may help break traditional monopolies in the software industry bringing in much needed competition. Haider et al. (2009) claim that the market for government software procurement is crucial to software companies. The government is usually the largest consumer of software products in a country and it is plausible that a government's use of specific software may encourage businesses dealing with the government to follow suit.

2.3 Social Benefits

Chopra et al. (2009) note that in the process of considering benefits of OSS it is best to keep in mind that the social benefits are often ignored. The social benefits from OSS adoption include reducing the digital divide, creating employment and developing local skills. Wong (2003) points out that OSS has social value which makes it necessary to get public and private sector recognition in today's knowledge society. Most governments' OSS adoption decisions are made in the interest of the society at large (Fitzgerald, 2006).

Reducing the Digital Divide
Nagy et al. (2010) point out that OSS helps to bridge the digital divide between developed and developing countries by lowering IT cost. OSS helps to bridge the social and technological gap between the rich and the poor at minimal cost. Many governments have realized the potential cost benefits of OSS in making IT accessible to its citizens (Wong, 2003). Fitzgerald (2006) urges governments to take an active role in OSS adoption as its intervention in the free market brings benefits to vulnerable citizens. OSS is a useful alternative to proprietary software for developing countries to embrace the information age (McNaughton, 2010). Haider et al. (2009) point out that OSS adoption by governments is likely to change the IT industry rules which can benefit different communities.

Creating Employment
The adoption of OSS by public organizations provides an opportunity to create employment in the local software industry. Wong (2003) notes that developing countries consider OSS as an opportunity to develop their local software industry which is dominated by foreign companies. Most developing countries' technology expenditures are benefiting foreign software companies at the expense of the local software companies. Government support of OSS in developing countries helps create employment, thereby allowing full participation in the global information society (McNaughton, 2010). Wong (2003) adds that governments have a social responsibility for promoting OSS as a means of creating employment through support of the local industry.

Developing Local Skills
Government support of OSS in developing countries helps develop local skills thereby allowing full participation in the global information society using local talent (McNaughton, 2010). The adoption of OSS provides a platform to foster local IT skills which also helps to boost the national economy (McNaughton, 2010). The adoption of OSS by public organizations provides an opportunity to develop local skills in the software industry. Wong (2003) points out that developing countries regard OSS as an opportunity to develop local software skills. The availability of source code makes it possible for developers to customize the software to meet their local requirements, also contributing in the development of their software skills, which is not possible with proprietary software which is sold without source code (McNaughton, 2010).

2.4 Technical Benefits

Wong (2004) points out that most government departments are considering OSS adoption owing to its technical benefits compared to the proprietary software. OSS products such as Apache Web Server have more market share than its proprietary counterpart because of technical benefits. Most technical benefits of OSS adoption cited in the literature include interoperability, support of open standard, security and open source code (Dedrick et al., 2004). The technical benefits are encouraging many governments to switch to OSS solutions (Gosh et al., 2006).

Improving Interoperability
Besides the low cost benefit, OSS has many technical benefits such as interoperability due to its open standards compliance (Haider et al., 2009). The interoperability technical benefit is important for e-government infrastructure which requires data integration and support of multiplatform IT infrastructure. OSS interoperability enables the use of legacy systems and the customization of interfaces. Wong (2003) points out that organizations have come to realize that some OSS products are actually superior to proprietary software and improves interoperability while reducing switching cost in the long term. Haider et al. (2009) point out that interoperability is important to organizations since it allows data sharing between organizations. Morgan and Finnegan (2007) add that most OSS adoption decisions are motivated by the need for interoperability of new and old software.

Promoting Open Standards
Gosh et al. (2006) urge government organizations to consider open standards in order to reduce future problems associated with compatibility. The benefit for organizations from open standards is the ability to integrate different vendor software and hardware to achieve the best performance (Hwang, 2005). Hwang (2005) points out that OSS is more aligned to open

standards than proprietary software which increases information sharing and compatibility of various technologies to the benefit of organizations. Open standards allow documents to be readable in perpetuity which is a legal requirement for certain types of documents to be kept for certain duration (Hwang, 2005). Open standards also help to remove natural monopolies, leveling the playfield in the software industry and ensuring competition among software vendors (Ghosh et al., 2006). The European Union has mandated the use of open standards as part of e-government initiatives through policies to ensure easier access to government applications (ibid.). Most proprietary software companies have not been willing to comply with open standards as a way to protect their proprietary software from competitors (McNaughton, 2010).

Improving Security

Haider et al. (2009) point out that most governments are adopting OSS to address security concerns of proprietary software. Wong (2003) adds that the security concerns have motivated the governments of France, China, Japan and South Korea to switch to OSS. Most organizations have cited Windows operating system security flaws as a major reason to consider OSS (Wong, 2003). Since most government organizations store confidential data it needs protection from unauthorized access. Wong (2003) points out that the mistrust of 'unauditable' proprietary software is a major reason why organizations are considering OSS adoption. Ghosh et al. (2006) point out that, in OSS, the availability of source code allows organizations to assess security risk sooner and to find its remedy. OSS provides a framework for a collaborative evaluation of security architecture in software (McNaughton, 2010).

3. SYSTEMS APPROACHES

The success of the systems approach in Information Systems research has been attributed to its interdisciplinary nature and its viewing of problem situations in terms of wholeness (Jackson, 2010). Jokonya and Hardman (2011) point out that a systems approach allows collective decision making in complex organization problem situations. The system of systems methodologies (SOSM) (see Figure 2) is based on the assumption that there is a fit between system approaches and problem contexts (Reynolds and Holwell, 2010). The SOSM logic is that any single type of problem context can be assigned meaningfully to a conforming (dominant) systems approach. The SOSM classifies systems approaches in two dimensions which are the level of complexity and diversity of views. The classification results in a six-celled matrix where a problem situation defined in a cell invites a suitable systems approach.

Based on Figure 2 the hard systems approaches are considered unitary (simple or complex), soft systems approaches are considered pluralist (simple or complex) and critical systems approaches are considered as coercive relationships. The simple/complex dimension in Figure 2 relates to the levels of interrelatedness and interdependencies; and the unitary, pluralist and coercive dimensions in Figure 2 relate to the levels of engagement with multiple perspectives (Reynolds et al., 2010). The systems approaches shown in Figure 2 are not mutually exclusive possibilities, but offer a reasonable guideline as to where the approach's main emphasis lies, as well as to which managerial end it most easily lends itself.

Participants dimension of contexts (increasing diversity of values)

	Unitary Hard Systems Approaches	Pluralist Soft Systems Approaches	Coercive Emancipatory Systems Approaches
Simple	Simple–unitary problem contexts •Operations research (OR) •Systems engineering (SE) •Systems analysis (SA)	Simple-pluralist problem contexts •Strategic assumption surfacing and testing (SAST)	Simple-coercive problem contexts •Critical systems heuristics
Complex	Complex–unitary problem contexts •System dynamics •Organizational cybernetics •Complexity theory	Complex-pluralist problem contexts •Interactive planning •Soft system methodology	Complex-coercive problem contexts •Critical systems approaches •Total system intervention

(Left axis: Systems dimension of contexts (increasing complexity))

Figure 2: SOSM System Approaches (Adopted from Reynolds et al., 2010)

3.1 Hard Systems Approaches

Hard systems approaches, which are based on reductionism, are useful in problem contexts that are simple-unitary or complex-unitary in nature, as shown in Figure 2. In both cases there is an agreement on the objectives of the problem situation. Jackson (2010) points out that hard system approaches have an emphasis on prediction and control to achieve desired objectives which are outside human observation. Hard systems approaches are premised on the fact that participants have agreed objectives to problem situations. However, the realities facing organizations today are too complex and subject to change which makes it hard to reduce problem situations amenable to scientific modeling. Most organizational problems are too complex with no agreed objective, which forms part of the problem to be addressed (Reynolds et al., 2010). This shows that hard system approaches appear incapable of dealing with some of the complexity associated with organizational problem situations (Jackson, 2010).

3.2 Soft Systems Approaches

Soft systems approaches are suitable for analyzing complex problem situations with divergent views to the problem situation (Reynolds et al., 2010). According to Jackson (2010), soft systems approaches are based on the assumption that knowledge can be obtained from interpreting human thoughts and feelings of stakeholders through debate and discussion of the problem situation. Soft systems approaches accept humans as having different perspectives in a problem situation. Reynolds et al. (2010) point out that soft systems approaches help address cultural issues and situations dominated by observer worldviews. They are suitable for addressing problem situations with human (but not technical) complexity. Jackson (2010) notes that soft system approaches have weaknesses in addressing problem situations that are based on conflict and are coercive.

3.3 Emancipatory Systems Approaches

Reynolds et al. (2010) point out that the emancipatory systems approaches are focused on improving real-world problem situations by revealing all forms of alienation and oppression in a particular setting. The assumption is that there is alienation of individuals and oppression of particular social groups in organizations (Jackson, 2010). The emancipatory systems approaches help the alienated and oppressed to take responsibility for their liberation, and its success is evaluated in terms of empowerment and emancipation (Reynolds et al., 2010). Human well-being and emancipation can be achieved by systems with a perspective to support the achievement of that emancipation objective. The emancipatory systems approaches are assigned to coercive problem contexts based on the emancipatory paradigm (Reynolds et al., 2010).

3.4 Critical Systems Approaches

Jackson (2010) highlights that some problem contexts are deemed to be extremely complex, that they are very hard to understand using one approach. The critical systems approaches perspective of organizations disagrees about claims of guaranteed solutions to problem situations. The critical systems approaches support pluralism of method as a way of complementing each other's weaknesses. According to Jackson (2010) the critical systems approaches are centered on themes of critical awareness, emancipation and pluralism of approaches. The critical systems approaches challenge the hard systems and soft systems approaches for failing to challenge the power relation of problem contexts. The critical system approaches' intervention helps to resolve conflict and encourages diversity of worldviews. Critical systems approaches support pluralism of worldviews and allow marginalized voices to be heard.

4. PROPOSED FRAMEWORK

This section presents our proposed framework for evaluating OSS adoption in public sector organizations. Figure 3 illustrates the components of the framework and their relationship with the OSS benefits to public sector organizations. The proposed framework is made up of six components. These are simple-unitary (technical benefits), complex-unitary (economic benefits), simple-pluralistic (social benefits), complex-pluralistic (social benefits), simple-coercive (political benefits) and complex-coercive (political benefits). The framework assumes that there is no one-size-fits-all approach with regard to OSS adoption benefits to organizations. It is, therefore, important to evaluate the OSS adoption benefits using the most suitable systems approaches for any given situation.

It is anticipated that the proposed framework will assist organizations to analyze possible OSS adoption benefits, as it provides a holistic approach based on systems approaches. The proposed framework based on the systems approaches supports a holistic approach to complex problem situations as opposed to the traditional deterministic approaches. The framework ought to help decision makers understand the OSS adoption benefits from different stakeholders' perspectives. The next sections briefly discuss the framework components.

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Participants dimension of contexts (increasing diversity of values)
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	Unitary Hard Systems Approaches	**Pluralist** Soft Systems Approaches	**Coercive** Emancipatory Systems Approaches
Simple	Simple-unitary problem contexts •Operations research (OR) •Systems engineering (SE) •Systems analysis (SA) •*Suitable for analyzing OSS technical benefits with agreed objectives*	Simple-pluralist problem contexts •Strategic assumption surfacing and testing (SAST) •*Suitable for analyzing OSS economic benefits with no agreed objectives*	Simple-coercive problem contexts •Critical systems heuristics •*Suitable for analyzing OSS social and political benefits with coercive relationships*
Complex	Complex-unitary problem contexts •System dynamics •Organizational cybernetics •Complexity theory •*Suitable for analyzing OSS economic benefits with agreed objectives*	Complex-pluralist problem contexts •Interactive planning •Soft system methodology •*Suitable for analyzing OSS social benefits with no coercive relationships*	Complex-coercive problem contexts •Critical systems approaches •Total system intervention •*Suitable for analyzing OSS benefits with technical, practical and emancipatory interests*

(Left axis label: Systems dimension of contexts (increasing complexity))

Figure 3: Relationship between Systems Approaches and OSS Benefits

4.1 Hard Systems Approaches - Technical and Economic Benefits

Based on Figure 3, hard systems approaches are more appropriate for analyzing technical and quantitative economic benefits of OSS adoption in public sector organizations. Hard system approaches allow the OSS adoption's technical and quantitative economic benefits to be placed at center stage. Most of the technical and quantitative economic issues have clear objectives with the main aim being how to achieve those objectives. Hard system approaches rely on the use of mathematical models for their success to solve problem situations. The hard systems approaches' measures of success are based on efficiency and effectiveness of the system of concern. The hard systems approaches have more emphasis on planning and control as a means of realizing the OSS adoption benefits. It is plausible that hard systems approaches are not good at handling complex socio-technical problems as they distort the reality of a social perspective (Jackson, 2010).

4.2 Soft Systems Approaches - Economic and Social Benefits

Based on Figure 3, soft systems approaches are more appropriate for analyzing social and qualitative economic benefits of OSS adoption in public sector organizations. Soft systems approaches allow social and qualitative economic OSS adoption benefits to be placed at centre stage. Soft systems approaches are appropriate for addressing social and economic OSS benefits where stakeholders have different worldviews about the nature of the benefits to the public organization. Soft systems approaches help to bring consensus on social and qualitative economic benefits of OSS adoption in public sector organizations. The qualitative economic and social benefits of OSS adoption are not always simple to analyze using the cause and effect relationship of hard systems approaches. Soft systems approaches are more suitable for understanding multiple stakeholder perspectives with regard to qualitative economic and social benefits of OSS adoption (Reynolds, 2012). Soft systems approaches encourage constructive debate and accommodate social factors such as values, beliefs and feelings about the nature of improvement of OSS adoption in organizations (Reynolds, 2012). However, a weakness of soft systems approaches is their failure to address situations with conflicts and coercive relationships.

4.3 Emancipatory Systems Approaches – Social and Political Benefits

Based on Figure 3, the emancipatory systems approaches are more appropriate for analyzing the social and political benefits of OSS adoption in public sector organizations having conflicts and coercive relationships. Emancipatory systems approaches allow social and political OSS adoption benefits to be placed at centre stage. The emancipatory systems approaches are useful for addressing conflict in an OSS problem situation with some form of alienation and oppression to some stakeholders. The emancipatory systems approaches are based on the assumption of the existence of different forms of oppression in society. The emancipatory systems approach allows questions to be asked about those who are affected by the OSS adoption decisions (Reynolds, 2012). The emancipatory systems approaches allow for democratic debate on OSS benefits (Jackson,

2010). OSS adoption empowers the marginalized members of the society and narrows the digital divide. The adoption of OSS may allow most members of the society to participate in the information age.

4.4   Critical Systems Approaches – Political, Economic, Social and Technical Benefits

Based on Figure 3, the critical systems approaches are more appropriate for analyzing complex OSS adoption problem situations with elements of political, economic, social and technical benefits in public sector organizations. Critical systems approaches allow all OSS adoption benefits to be placed at centre stage. Critical systems approaches are useful for addressing OSS problem situations which have technical, social and emancipatory interests for the society. Technical interests are useful for predicting and controlling OSS adoption benefits in the public sector organizations. Technical management competencies are, therefore, important to achieve the technical benefits. The social interest is based on the subjective nature of the social world where OSS adoption benefits need to be agreed upon by those affected and involved. The emancipatory interest seeks insight into power structures and hidden sources of oppression. Critical systems approaches criticize all forms of OSS adoption oppression in organizations. OSS adoption benefits include empowering the marginalized members of the society by participating in the information age and reducing the digital divide.

5   DISCUSSION

Our framework challenges the one-size-fits-all approach to complex phenomena such as evaluating OSS adoption benefits to public sector organizations. The proposed framework acknowledges that understanding OSS adoption benefits in public sector organizations is complex and subjective. In order for public sector decision makers to understand the benefits of OSS adoption they need to view the problem context from different perspectives. The proposed framework can assist public sector organizations to analyze the different OSS adoption benefits based on multiple stakeholder perspectives. Hard systems approaches are seen not to be suitable for analyzing OSS adoption benefits where there are no agreements on the nature of benefits. The problem contexts which fit hard systems approaches require stakeholders to agree on the expected benefits of the OSS adoption.

Whilst soft systems approaches are suitable for analyzing OSS adoption where stakeholders have a divergence of worldviews, it has been found unsuitable to address conflicting environments. However, the problem contexts, which are of a coercive nature, may require emancipatory systems approaches that are suitable for emancipating the oppressed stakeholders. In some cases the problem context may be so complex as to require the analysis to use more than one approach. Critical systems approaches support the use of more than one approach as a way of complementing each other's weaknesses. In order to select the appropriate systems approaches it is, therefore, important to understand the problem context.

As part of future work, the proposed framework will be validated in public sector organizations that are migrating to OSS in South Africa. The validation will involve interviews with managers involved in OSS adoption in public sector organizations. Generalizability of the suggested framework could be confirmed by conducting follow-up research in other organizations. Interviews with managers may help to get their perceptions on OSS adoption benefits in their organizations.

6.   CONCLUSION

The proposed framework provides a way of analyzing OSS adoption benefits in public sector organizations from political and legal, economic, social and technical perspectives. The main idea behind the proposed framework is that OSS adoption benefits are complex socio-technical phenomena as they are both objective and subjective in nature. The proposed framework has the potential to address both objective and subjective issues common to OSS adoption benefits. The proposed framework provides a structured way of analyzing OSS adoption benefits in public sector organizations from multiple perspectives. We believe that the proposed framework will enhance a deeper understanding of OSS benefits before taking adoption decisions in public sector organizations.

The proposed framework may assist organizations in analyzing OSS benefits in the public sector. For instance, the proposed framework will enable technical benefits of OSS adoption to be analyzed from the perspective of hard systems approaches. Secondly, in cases where the OSS benefits are more than one, a combination of approaches may be necessary to understand the nature of the adoption benefits. Thirdly, the proposed framework can be used as a governance framework for OSS adoption in public sector organizations. In order to accommodate different perspectives of OSS adoption benefits by different stakeholders, there is a need for a systems approach to consider the holistic nature of a problem situation. Although by no means exhaustive, this paper proposes a framework for analyzing OSS adoption benefits in public sector organizations. In addition, we hope that this research will act as a stimulus for further research on this complex socio-technical phenomenon. We also look forward to refining the proposed framework as part of future work.

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