Against All Odds: How A Government's Open Source Software (OSS) Implementation Survived

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Abstract

In this study, we suggest that actors and their relationship in an information systems (IS) implementation influence the survival of a government's open source software (OSS) project. Specifically, we investigated the OSS implementation by the Malaysian government since 2002. Due to the numerous and enormous challenges faced by such implementation such as inertia and concern about the quality of the software, the odds are often stacked against such project to survive. The theoretical lens of this study was the Actor-Network Theory (ANT) while the case study research method was employed to identify the actors and their relationships in ensuring the survivability of the project. Our findings suggest that the survival of the project was strongly influenced by the network built by its human and non-human actors that led to the successful enrolment and translation of the implementation. Furthermore, the actors can be divided into main and supporting with each contributing uniquely to the government's OSS implementation.

Keywords

Open source software (OSS), government, implementation, actor-network theory (ANT), case study research.

INTRODUCTION

OSS is a type of software that directly competes with proprietary software such as the office productivity suite produced by Microsoft. Whilst proprietary software licenses disallow people from viewing and modifying its code, OSS licenses allow the people to do so. In addition, a number of rules follow the use of OSS. The license holder shall not require a royalty or other fee if the person's software has been redistributed in parts or as a whole. The software license shall not restrict its usage to a specific field of endeavor only, nor place restrictions on which software could be distributed along with the licensed software (Open Source Distribution at www.opensource.org/osd). In terms of OSS types, a study conducted by Shaik Ismail (2013) found that about 80% of the respondents implemented OSS for their operating system and database. Another highly implemented system is in enterprise portals where the percentage of implementation is about 38.7%. Implementation of OSS in accounting/financial and human resource recorded about 11.3% and 14.5% respectively.

The freedom afforded by OSS has attracted the attention of many governments. The governments, especially from developing countries, want to embrace open standards and release themselves from the shackles of large and powerful software companies such as Microsoft and Oracle (Simon, 2005). Furthermore, these governments are attracted to the economic and technical benefits of OSS. Economically, the adoption of the software will reduce information and communication technology (ICT) costs and enable the transfer of modified software to other government bodies. Technically, the software will provide better security, interoperability and technological continuity (Muffatto, 2006).

One of the countries that have implemented OSS is Malaysia. Since 2002, the Malaysian government has implemented OSS in its many ministries, departments and agencies. Among the implementation's objectives are reducing the total cost of ownership and providing more freedom of choice in selecting the software for use. The project is divided into three phases. In the first phase (0 – 2 years), the government intends to lay the foundation for the implementation and get some departments and agencies to be early adopters of the software. In the second phase (2 – 5 years), the government wants to accelerate the software adoption by getting as many departments and agencies to embrace OSS. In the third phase (beyond 5 years), the government hopes that the software adopters will be able to rely on themselves to implement OSS. As a guidance, the OSS implementation in the public sector must be fit for its purpose, least disruptive to operations, can co-exist with other legacy proprietary system, must leverage on existing facilities, hardware, software and expertise and lastly, it must not be driven or controlled by hardware and software vendors. These initiatives are then transcended to the private

sector by increasing the Information Communication Technology (ICT) industry growth (Open Source Competency Centre (OSCC), 2010).

This year marks the 12th anniversary of the implementation. The fact that the Malaysian government OSS project last this long has surprised many because such implementation is often saddled with enormous challenges. The challenges include inertia, concern about the possible lack of quality assurance, concern about commercial support and warranties, issue of standards and inter-operability, concern about certification and accreditation and procurement policies and implementation (Wheeler and Dunn, 2014). In the case of Malaysia, the implementation was hit by the resignation of Dr Mahathir as the Prime Minister of Malaysia. He was the OSS project champion and single-mindedly ensured that the implementation took off.

Despite the odds against the OSS project, it survived. A survey conducted by the Open Source Competency Center Malaysia in July, 2009 shows that more than 70% of Malaysian government offices were running on open source software ("OSS Adoption Statistics Malaysian Public Sector Open Source Software Programme," 2010). This number increased in the year 2010 where 97% of the adoption rate was reported in the public sector ("Open Source Competency Center (OSCC) Laporan Adoption Chart Tahun 2011," 2012). These statistics suggest that there is an increase in the OSS implementation in Malaysia. However, there is a lack of study to explain why and how such implementation survived. We assert that the reason for its survival lies in the human and non-human actors that were involved in the project. More importantly, these actors formed a network to translate the implementation successfully. Thus, to better understand the survival of the OSS project, we use the Actor-Network Theory (ANT) (Latour, 2005; Law, 2003) as our theoretical lens. Meanwhile, the case study research method was employed to collect and analyze the data. Eventually, we will present who are the actors that have influenced the survival of the project and how they are related to each other in the implementation.

Theoretically, this study will add to the existing literature on the relationship between governments and OSS. Currently, these studies are limited in scope because they are more focused on government's OSS policies while lacking in the actual government's implementation of the software. More importantly, this study adds to the existing knowledge on government's implementation of OSS by viewing the phenomenon using the ANT as the theoretical lens. Practically, this study will inform governments that are pondering to use the software. They will be able to use the findings from this study to guide them in their own implementation of OSS. Hopefully, it will increase the chances of their projects surviving in the long run.

LITERATURE REVIEW

Aksulu and Wade (2010) review and synthesize research on open source. They collected 618 peer-reviewed papers on the topic and categorized them into taxonomy. They found that most papers fall under two generic categories: OSS production and OSS applications. Meanwhile, a smaller number of papers were found in OSS diffusion category that includes the software adoption factors, adoption barriers and implementation. The implementation sub-category includes OSS implementation by governments/nations.

Governments OSS Implementation

Some papers address the reasons governments adopt OSS. Although reducing costs has often been cited as the most important reason for its adoption, political reason is equally important, if not more (St. Amant and Still, 2007). Among the political reasons are democratizing e-government (Berry and Moss, 2006) and achieving independence and self-determination (Cassell, 2008). Berry and Moss (2006) argue that OSS democratizes e-government by protecting and extending transparency and accountability. They further argue that the software enables citizens, associations, administrators, and private interests to shape how the technology is adopted. Meanwhile, from a comparative case study of four cities in Europe, Cassell (2008) found that the desire to reduce costs was not the main impetus for them to adopt OSS. Instead, the author found that democratic values such as independence and self-determination to be the more important reason for the adoption.

On the other hand, some papers demonstrate how governments formed policies to support OSS (Applewhite, 2003; Comino and Manenti, 2005; Hahn and AEI-Brookings Joint Centre for Regulatory Studies, 2002; Kshetri and Schiopu, 2007; Simon, 2005;). Government's policy on OSS falls under three categories: (1) mandated adoption – government forces public agencies, schools and universities to adopt the software, (2) information provision – government informs the uninformed users about the existence and the characteristics of the software, and (3) subsidy – government makes a payment to consumers if they adopt the software (Comino and Manenti, 2005). Governments of countries such as Germany and Brazil encouraged the use OSS by subsidizing its production and usage (Hahn and AEI-Brookings Joint Centre for Regulatory Studies, 2002). On the other hand, the governments of China, Japan, and South Korea provide vision and information to their OSS industry, leading to continental collaborations in the software project (Kshetri and Schiopu, 2007). Meanwhile, the United States

federal government was seen to be lagging behind other countries in promoting OSS. Efforts to promote the software were happening mostly at the state governments such as Oregon, Texas, and Oklahoma (Applewhite, 2003).

Although Waring and Maddocks in 2005 argue that studies on actual OSS implementation, especially by government is lacking (Waring and Maddocks, 2005), the situation has not changed much since. We found only one other paper (Maldonado, 2010) on actual government's implementation. Whilst Waring and Maddocks studied the software implementation by the UK public sector, Maldonado studied the implementation by the Venezuela's public administration. The motivation behind the OSS implementation in the UK was to reduce wastage and underperforming information systems while in Venezuela was to achieve the agendas of social inclusion, sovereignty, and freedom. Both studies, however, describe the how government characteristics influence the way OSS is implemented in both cases.

The Actor-Network Theory (ANT)

The actor-network theory is an approach that "describes sociotechnical ensembles as heterogeneous networks of human and non-human actors" (Bijker, 1995). The main purpose of the theory is to provide better definition of social, and eventually, society. According to Latour (2005), social is not "glue that fix everything including what the other glues do not fix". Instead, it is "glued together by many other types of connectors". He added further that sociology – a study of society – is thus an effort to trace associations (Latour, 2005).

The theory presents three important concepts: actors, network and translation. Actors, also known as agents (Law, 2003), are any material, be it or human and non-human that interact and cooperate to pursue a certain goal (Cho et al., 2008). The network maps "how actors define and distribute roles, and mobilize or invent others to play these roles" (Elbanna, 2012). Distributing roles among actors is an example of translation. It describes how "an ordering of society is brought about by reshuffling and transforming machines, institutions, and actors" (Law, 2003; Bijker, 1995).

As suggested by Callon (1986) translation occurs in four interrelated moments: problematization, interessment, enrolment and mobilization (Elbanna, 2012). Problematization is a process whereby an actor makes his initiative indispensible to other actors. Interessment involves making one appealing to an entity by being the middle actor between that entity and a third one. Enrolment is the process of forming alliances with other actors in order to get them into the network. Lastly, mobilization refers to a "successful alignment of actors into the network builder's network" (Elbanna, 2012).

RESEARCH METHOD

In this study, the case study approach was chosen due to the real-life situations where we did not have control of the situation and everything might have happened all at once (Myers, 2009). We have employed the case study research approach for several reasons. First, the approach allows us to examine the phenomenon of government's OSS implementation in-depth. Second, the approach enables us to examine the phenomenon through those who live it, that is, those who were involved, either directly or indirectly, with the software implementation. Third, the approach allows us to develop the boundary for the study, thus allowing more relevant and useful findings to emerge.

Interview, either in the form of individual or focus group, was our main technique for data collection. The technique enabled us to gather in-depth data from the informants. It also enabled us to develop good and strong rapport with the informants, thus enabling us to gather insights from the implementation that is not possible with other data collection techniques. In addition to interviews, we also collected data through analysis of relevant documents. Fortunately for us, the governments OSS project produces a number of reports such adoption charts and guidelines. Additionally, rich information about the project are stored and displayed at the project's website, thus providing us with more detailed data for analysis.

We have carefully selected the informants to represent the Malaysian government at all levels (Table 1). The informants represented the federal, state and local government. Other informants represented the education sector at school and university levels. The departments of these informants are active users of OSS and are recipients of many awards at national level for their usage of the software. Therefore, the informants have the authority to talk on the topic of OSS. The interviews were conducted at the informants' workplace to allow them to be at ease during the sessions, thus enabling them to talk freely about their departments' involvement in the implementation. During the interviews, the respondents were asked to describe their experience in implementing OSS in their respective departments. Because OSS is specialized software that many found hard to use, the respondents were also asked to explain who assisted them in using the software. In other words, we were probing the informants to identify how they implemented OSS successfully and who else were involved in

making it a success. The interviews lasted between one and two hours. They were recorded and transcribed verbatim for analysis.

Table 1: List of Respondents

Type of Office	Informants	Number of interviewees
Federal government	Malaysia OSS Competency Centre (MyOSSC)	4
State government	Selangor's Islamic Religion Council (MAIS)	4
	Terengganu's Information Management Unit (UPMNT)	2
Higher education	University of Malaya's IT Centre	3
School education	Sena Primary School, Perlis (SKS)	5
Local council	Kajang Township Council, Selangor	1
	Malacca City Council	1
IT vendor	Skali	1

The analysis of the interviews and documents followed closely the ANT. The theory was used to identify who are the actors, how they are linked to each other, how the project was translated into a success, and how was support mobilized to translate the OSS project into a success (the full definition of the key concepts are presented in Table 2). We identified the key concepts by reading the interview transcripts and the relevant documents line-by-line. The relevant quotes from the transcripts were marked and coded accordingly. The marked quotes were then compared to develop higher abstraction of actors. We also identified quotes that contrasted the initial quotes to provide a balance view of the contribution of each actor. This process went through several iterations until we conclude that there is no more significant insight to be gained from the analysis. Eventually, we were able to identify the main actors, the supporting actors and their contributions to the survivability of the project. A main actor is the one who is crucial in ensuring the survivability of the project while a supporting actor is the one who contributes significantly to the project but is not as crucial in ensuring its survivability.

Table 2: Definition of Key ANT Concepts

ANT Concepts	Definition of Concepts
Actor (or actant)	Human beings or non-human actors
Network	Connected actors in a heterogeneous network of aligned interest
Translation	How actors generate ordering effects by negotiating or directing others' interests to one's own
Enrolment	Mobilize support by creating a body of allies through translation

THE FINDINGS

The Main Actors

One of the main actors in the OSS project was Dr Mahathir, Malaysia's 4th Prime Minister. He was the "founding father" of the project because he came up with the idea for the implementation. He pushed the OSS agenda through the Malaysian government's cabinet to enable the Malaysian Administration and Modernization Planning Unit (MAMPU) to receive a mandate to implement the project. To lead the OSS project, MAMPU established a unit called "The OSS Competency Centre" (MyOSSCC) under the ICT Policy and Planning department.

MyOSSCC is the most influential actor in the implementation, especially after Dr Mahathir stepped down as the country's Prime Minister. It is the heart of the Malaysian government's OSS initiative. It acts as a platform/hub to bridge the different OSS communities either within or outside the public sector. The centre's main task is to

create an eco-system for the software to thrive among the various agencies and departments under the Malaysian government. According to the centre's director:

"We cannot do it alone, (so) we leverage whatever expertise whether they are inside or outside the public sector"

One of the first activities of the centre was to provide training. It was the result of the collaboration between human actors (the training providers and participants) and the non-human actors (the course content and the OSS). At the early stage of the implementation, the training was aimed at creating awareness among the decision makers and the users on the benefits of adopting OSS. Later on, the training was aimed at preparing the users to use the technology with training on Linux and PHP. It was also aimed at persuading the decision makers to apply the software in their respective departments and agencies. The trainings are provided by a number of parties. Among the parties are certified training providers (CTPs) and the National Public Administration Institute (INTAN). However, some departments do not send participants to the trainings. According to the IT officer of a local council:

"The training of trainers did not help much."

One of the most important tools provided by the mandate is the centre's ability to monitor the Malaysian government's departments and agencies adoption of OSS. From time to time, the centre will ask the respective departments and agencies to provide a report on their status adoption. The centre will collect the individual report and generated an overall report. The report provides a detailed breakdown of OSS adoption by federal and state departments. For example, it shows the kind of OSS these departments use and the number of computers where the software is installed. This report provides an impetus for the various departments and agencies to use OSS as quickly as possible because they do not want to be seen as the laggard in OSS adoption. According to the head of MyOSSCC:

"The mandate gave us the power to get them (the departments and agencies) to report to us. What we do we get back to the (Malaysian) cabinet (ministers) to report on the progress"

However, there are some criticisms levelled at the MyOSSCC. Some departments claimed that the centre failed to provide adequate leadership on the project. These departments also claimed that the centre has not done enough to enrol universities to implement OSS totally in their organizations. They asserted that they would only put more effort in the project if MyOSSCC could prove that an organization can survive only on OSS. An IT officer with a city council argued:

"MAMPU still do presentation using Microsoft Office. They should show more leadership (in this matter) … If a university, say University of Malaya can implement (OSS) hundred percent, then only will the top officers are willing (to follow suit)"

The IT artifacts of the OSS and proprietary software are two very important non-human actors in the project. Their current form makes it easier to translate the project successfully. OSS has followed proprietary software by making its user interface much friendlier than before. Although OSS still has the console feature where users can type their command directly, users now have more buttons and windows to operate the software. As a result, it is easier to persuade users who are used to the graphical user interface to switch from proprietary software to OSS. Furthermore, there are thousands of volunteers around the world who are developing drivers for the software. As a result, more machines and their devices such as printers, monitors and speakers can use OSS. A teacher in Sekolah Kebangsaan Sena clarified:

"Most of the instructions are in graphical form. If they did not understand, they can follow the steps in the video"

The Supporting Actors

There are a number of human and non-human actors under the centre. Human actors include the steering, the strategic thrust and the pilot thrust project committees. These committees comprise representatives from various government departments and agencies. They provided input to the OSS project especially at the initial stage of the implementation. Their participation was also meant to indirectly expose them to the software and get their commitment to implement it at their own departments and agencies. The centre's director stressed this point:

"We must also involve others because we want OSS to be in all government agencies, in the schools (and) in the hospitals. If we did it on our own, pushing (it) down, it won't work"

Meanwhile, non-human actors include the OSS master plan and the OSS competency centre web page. The project's OSS web page (http://www.oscc.org.my/index.php/en/) is the repository of all the information about the project. Among the information stored on the web page is the history of the project, its committees, its products, adoption charts and newsletters. As a result, it becomes a one-stop centre for departments and agencies that are or intending to adopt OSS. The web page also contains the government's OSS master plan. The master plan describes in detail what the government intends to achieve at each of the three-stage implementation. The plan becomes the reference document when the steering committees, the strategic thrust committee and the pilot thrust project committee convene.

Another non-human actor under the competency centre is guidance to the various departments and agencies in selecting the most appropriate software. Three of the most important principles in choosing a particular OSS are fit for purpose, least disruptive to operations and able to co-exist with other proprietary legacy systems. These principles reduce the pressure on the government departments and agencies to adopt OSS. It means that they can choose the right software at the right time to deploy the software. This flexibility is important because OSS is currently used mostly for servers (web and mail) and compilers. The use of OSS for productivity software such as word processing is still limited. According to a local council:

"The users found them (Open Office suite) hard to accept. They are used to MS Words"

Another supporting non-human actor is the Malaysian Government Open Source Software Conference (MYGOSSCON). Up until 2012, the annual conference has been conducted six times. There are a number of human actors in the conference such as the organizers, the speakers, the conference participants, the exhibitors and the award recipients. On the other hand, there are non-human actors such as the awards and the exhibits. The network built by the human and non-human actors serve several purposes. For the participants who have adopted OSS, the conference enables them to get the latest information about the software. For those who have not adopted OSS, the conference provides an opportunity to the MyOSSC to persuade them to use the software in their respective departments and agencies. Meanwhile, the awards serve as rewards to those who have made strong efforts towards realizing the use of OSS in the Malaysian public sector. It often becomes the catalyst towards enhancing the daily use of the software. According to a state level agency:

"We won the award in 2010 from the Malaysian government because our web pages were developed totally using OSS. A year after, we won an award from the government for our cloud-based e-mail system that was also developed using OSS"

The supporting actors that fall outside of the MyOSSCC's jurisdiction are those that have already used OSS before the competency centre was established. The existence of these actors helped accelerate the adoption of the software because they become the OSS exemplars in the public sector. Some of them received assistance from other actors who have used the software earlier. An example of this actor is the Sena Primary School in the state of Perlis, Malaysia. It is a primary school (7 – 12 year olds) that has been using OSS for nearly ten years. An academic from a nearby public university exposed the school to the software. Since then, through strong support from its principal and guidance of a teacher, the school has excelled in the use of OSS. It is now able to conduct courses for people in the state and has received national awards for its innovative use of the software. On the other hand, some human actors in the public sector have used OSS on their own initiative. The Information Technology (IT) Centre of University of Malaya is one such example. As an IT centre in a university, the centre was exposed to the possibility of using OSS in the early 2000s and decided to explore the software. According to one of the centre's officers:

"Our director at the time was from the Computer Science Faculty. He led us to explore the open source technology because we can find it on our own and it does not have license (like the proprietary ones)"

DISCUSSION OF FINDINGS

In this study, we separate the human and non-human actors into two categories: main and supporting. The main actors are those who are important and crucial to the survivability of the project. Among the main actors are the 4th Prime Minister of Malaysia, the MyOSSCC and the OSS itself. These actors are crucial in starting up the OSS project and ensure that the departments and agencies under the Malaysian government are enrolled into the translation process. On the other hand, the supporting actors are those who are important to the project but are not crucial in influencing its survivability. Among the supporting actors are the committees under the MyOSSC, the OSS master plan, the competency centre's web page, and the actors that have used the software even before the establishment of the competency centre. These actors ensure that the OSS project moves forward despite the scepticism of some parties in the public sector and other challenges that it faced. Table 3 summarizes the roles of each actor in the project.

Table 3: Main and Supporting Actors in the OSS Implementation

The Actors	Category	Contribution to the OSS Implementation
MyOSSCC	Human actor (main)	The unit in-charged of accelerating the adoption of OSS in the departments and agencies of the Malaysian government
The 4th PM of Malaysia	Human actor (main)	Came up with the idea of using OSS in the government and ensured the implementation started
The OSS itself	Non-human actor (main)	Provide a similar computing environment to proprietary software such as Microsoft's Windows and Office
Mandate	Non-human actor (main)	Opens the path to the establishment of the MyOSSCC. Gives the competency centre the authority to monitor the adoption of OSS by the government agencies and departments
The OSS Project Committees	Human actor (supporting)	Provides input to the implementation, especially at the initial phase of the project. The participants then became active users of the software.
The OSS master plan and web-page	Non-human actor (supporting)	Show the path that will be taken in deploying the software in various departments and agencies. The web-page becomes the one-stop centre for all information regarding the OSS project
MYGOSSCON	Non-human actor (supporting)	Creates an avenue where the latest advancement in OSS will be showcased to the various agencies and departments.
Existing users of OSS	Human actor (supporting)	Ensures that the project does not have to start from square one. These users gave the project inertia to build on, thus accelerating the adoption of the software.

In the process network building, the actors went through the process of translation and enrolment. The MyOSSC led the enrolment process. Through the mandate given by the Malaysian Cabinet Ministers, the centre formed alliances with other actors in the network. For example, the centre worked with INTAN and OSS certified training providers to give training to government departments and agencies that were interested to adopt the software. In other example, the centre, through MYGOSSCON, gathered the key IT personnel from various government departments and agencies to expose them to OSS. Meanwhile, the translation process was carried out by a number of actors. For example, a professor in University Malaysia Perlis influenced the SKS to adopt OSS, while the school influenced other schools in its vicinity to use the software as well.

This study differs in some aspects with the study conducted in Venezuela (Maldonado, 2010). The differences are caused by the contextual differences of these two studies. In Maldonado's study, the OSS implementation was mandated on all government departments while in this study, it was not compulsory for the departments to adopt the software. In addition, the aim of the implementation in Venezuela was more ideological while the aim was more economic in Malaysia. Despite those differences and in the theoretical lens used by the two studies, the findings of the study show many similarities. First, strong mandate from the government is required to ensure the survival of the OSS project. In Venezuela, it was the Decree 3,390 while it was the Cabinet Ministers Mandate in Malaysia. Second, the current nature of OSS makes it feasible for the public and the private sectors to use it. Third, the barriers to more extensive adoption of OSS beyond servers are pretty similar. One of the strongest barriers was the reliance of the users on proprietary productivity software such as Microsoft Word and Excel.

CONCLUSION

This study aims to identify the factors that influenced the survival of the Malaysian government's OSS project. To achieve this aim, we have used the ANT as the study's theoretical lens and employed the case study research as its investigation method. We found that non-human actors play important roles along with the human actors in ensuring the survival of the project. Some of the actors enrol other actors into the OSS implementation network, which led to the successful translation of the software project. We also suggest that not all actors have the same standing in the implementation. Some actors are more crucial than other in ensuring the OSS project's survivability.

These findings have profound implications towards theory and practice in the information systems field. Theoretically, the findings add the existing literature on the relationship between government and OSS. It also extends the ANT by including the concept of main and supporting actors. Practically, this finding may guide governments that are pondering to use the software. They must be aware that non-human actors such as the IT artefact plays an important role towards successful implementation of an IS.

ACKNOWLEDGEMENT

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