

# MULTIPLE PERSPECTIVES TECHNOLOGY APPROPRIATION: ANALYSIS OF OPEN SOURCE SOFTWARE IMPLEMENTATION FAILURE

Nor Zairah Ab. Rahim, Faculty of Computer Science and Information Systems, Universiti  
Teknologi Malaysia, Skudai, Johor, Malaysia, [nzairah@utm.my](mailto:nzairah@utm.my)

Rose Alinda Alias, Faculty of Computer Science and Information Systems, Universiti  
Teknologi Malaysia, Skudai, Johor, Malaysia, [alinda@utm.my](mailto:alinda@utm.my)

Jennie Carroll, School of Property, Construction and Project Management, RMIT University  
Melbourne VIC, Australia. [jennie.carroll@rmit.edu.au](mailto:jennie.carroll@rmit.edu.au)

## Abstract

*Adoption of new technology such as Open Source Software (OSS) is one of the important issues in organizations. Despite being considered as cost effective by many organizations, OSS implementation still encounters many challenges. This paper describes a case study conducted at one of Malaysia's public universities which initially adopted Open Source based applications but then later rejected them. An integrated framework that combines a multiple perspectives approach and the Model of Technology Appropriation is proposed in this study. This framework facilitates the understanding of why and how organizations adopt and use OSS. The study identified various criteria influencing the OSS appropriation process from multiple perspectives in the organization as well as its status of OSS appropriation. This understanding assists in effective implementation decisions which could lead to more effective use of the OSS technology.*

*Keywords: Multiple Perspectives, Open Source Software, Technology Appropriation.*

# 1 INTRODUCTION

Open Source Software (OSS) is defined as computer programs with licenses that conform to the Open Source Definition (OSD) as outlined in the Open Source Initiative (OSI, 2005). It is free software that is built, modified and enhanced through public collaboration and gives the user unrestricted access to the source code. Great media coverage of the technology for the past few years has increased interest in organizations to adopt OSS for running their businesses. Organizations are evaluating this technology as an alternative to the costly proprietary systems, particularly in regard to controlling their IT spending. The interest shown by organizations towards OSS makes it crucial to investigate how this software is being appropriated in organizations.

Technology appropriation research can be one of the lenses for looking at the issue of OSS adoption and use in organizations. It relates to how individuals or organizations adopt, understand and use the technology to achieve personal or organizational benefits. It complements existing technology adoption, use and implementation research as it studies the whole cycle of the usage after the initial adoption (Carroll *et al.*, 2002b). Further, there are multiple perspectives on appropriation: organizational, technical and personal. Therefore, the paper addresses the question: *'What criteria, from what perspectives, influence the appropriation process of OSS in organisations?'*

The paper presents part of a research program on the multiple perspectives of OSS appropriation in Malaysian public organizations. It begins with the background of the research followed by the description of research framework used in the study. The following sections describe methodology used. Findings from the case study are presented and then discussed. The paper concludes by outlining the contribution of the research.

# 2 BACKGROUND OF THE RESEARCH

OSS is a relatively new phenomenon with growing interest around the world especially in developing countries including Malaysia. This is shown by the establishment of Open Source Competency Center (OSCC) by the Malaysian Administrative and Management Planning Unit (MAMPU) in 2004. The OSCC is the center of reference for OSS implementation in Malaysia especially for the government sector. The agency has been given the responsibility to lead the OSS initiative for the Malaysian public sectors. From this initiative, public sectors in Malaysia began adoption of OSS to support their operation. However, it is not clear to what extent these organizations have adopted and used OSS in their operation.

Many previous studies focused on how OSS provides potential benefits and opportunities for reducing organizational costs but placed much less consideration on the software's capacity to fully meet the needs of today's organizations (Bergquist & Ljungberg, 2001; Gacek & Arief, 2004). Many of the surveys in the studies also focused much on the technical aspects of the OSS while neglecting the social aspect of the OSS especially the perception of the stakeholders other than the developers. This study fills this gap by studying OSS appropriation criteria not only to understand the capacity of the technology, but also the perception of the stakeholders towards this technology and how they actually implement and use it in organization.

Many models and frameworks have been developed from IS studies for investigating the implementation, adoption and use of certain technologies in organizations (Cooper & Zmud, 1990; Davis, 1993; Rogers, 2003; Sykes *et al.*, 2009). However, these models had less focus on the later stages after the initial introduction of the technology. The continuity of technologies utilization is usually unknown. Whereas, it is important for organizations to effectively use the technologies in order to enhance their performance and for that, the understanding of continued use of technology beyond its initial adoption is including its non-appropriation or disappropriation is critical (Delaney *et al.*, 2008). This is where technology appropriation studies, namely studies that incorporate technology adoption, implementation and use could fill the gap.

The term appropriation is used by DeSanctis and Poole (1994) to address how people incorporate IT in their work practice. Although there have been several studies on technology appropriation in various context (Carroll *et al.*, 2002a; Degele, 1997; DeSanctis & Poole, 1994; Mendoza *et al.*, 2008), the relevancy or suitability of the frameworks/models for investigating OSS were not studied. The nature of OSS which seems to have quite a different cycle of development (Osterloh & Rota, 2007) from proprietary software and its support by special communities makes it interesting to study appropriation of the OSS especially in organizational context.

### 3 RESEARCH FRAMEWORK

This study proposed an integrated framework named Multiple Perspectives Open Source Software Appropriation (MPOSSA) (Figure 1), which combines and extends the Multiple Perspectives approach described by Mitroff and Linstone (1993) and the Model of Technology Appropriation (MTA) (Carroll *et al.*, 2002a). The Model of Technology Appropriation (MTA) (Carroll *et al.*, 2002a) resulted from studies on technology appropriation by young people in Australia. The work looks at the concept of appropriation from individual user perspective which studied how young people choose, evaluate and adapt various features and aspects of mobile technology to fit their needs. The model represents three levels: level 1 – users’ first encounter with the technology. At this level it can be either the user will be uninterested with the technology which results to non-appropriation, or they are attracted to the technology and lead to the decision to adopt which initiates the process of appropriation; level 2 – involve users’ deeper evaluation of the technologies through use. If users are attracted to the technology they will explore it through appropriation process. Criteria encourage continuing evaluation or rejection of the technology; level 3 – captures the *reinforcers* or users’ persistent act to maintain use where the technology is considered stabilized. The model is adapted to study the cycle of the OSS appropriation (Table 1):

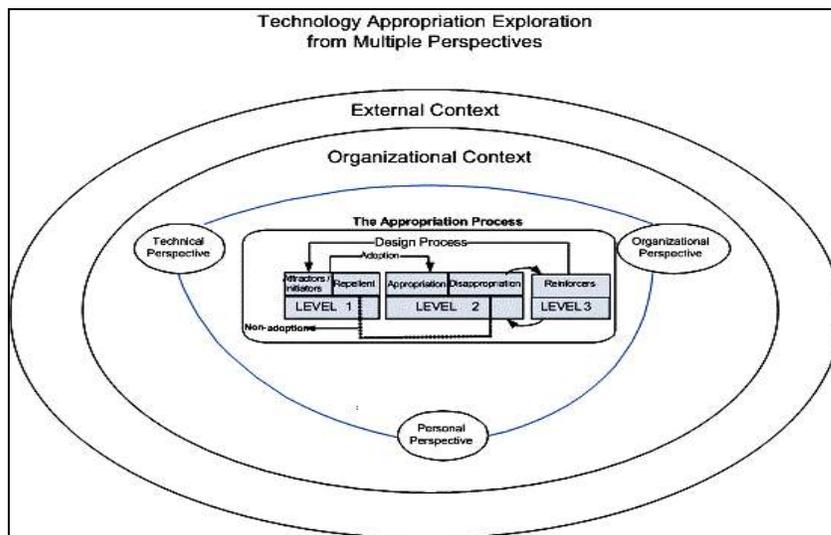


Figure 1. Multiple Perspectives of OSS Appropriation (MPOSSA).

<b>Level 1</b>	The organization is still in the stage of getting to know OSS and exploring the possibilities whether or not to adopt OSS in the organization.
<b>Level 2</b>	The organization has already adopted the OSS but is still exploring and evaluating its usage while trying to adapt its applications to the business operation.
<b>Level 3</b>	The usage of OSS is stabilised and had became an integral part of the organization activities.
<b>Non-adoption</b>	The organization may be not interested or no longer appropriating the OSS .

Table 1. Levels of OSS Appropriation (Nor Zairah & Rose Alinda, 2007).

The multiple perspectives in the framework consist of three perspectives; technical perspective (T), organizational (or societal) perspective (O), and personal (or individual) perspective (P). Linstone (1989) comments that “each perspective yields insights not obtainable from the others” and that “O and P perspectives are essential in bridging the gap between analysis and action” (p. 314). These different perspectives allow us to see the problems from various different angles (Avison *et al.*, 1998).

Applying a multiple perspective approach extends the MTA from the viewpoint of an individual user to organisation (Nor Zairah & Rose Alinda, 2007). Thus, based on the above understanding of the multiple perspectives, the main construct of T, O and P in the context of OSS appropriation is described as below (Table 2). The key concept of appropriation is mutuality. It is a 2-way process of how the technology affects and is affected by users. Thus, this framework applies the concept by looking at the three different contexts and how they iteratively influence and are influenced by the appropriation process.

<b>(T)</b> <b>Technological Perspectives</b>	Look at the competency of the OSS for the organization. The criteria can be seen from two different perspectives: the technology that being appropriated itself, and the other technology that will be affected by the appropriation process.
<b>(O)</b> <b>Organizational Perspectives</b>	Concern with the capacity of the organization to adopt and use the technology (OSS). It also looks at the management side of the perspectives towards the technology.
<b>(P)</b> <b>Personal Perspectives</b>	Rely on the individual perception of the stakeholders towards the OSS. It may be based on their personal experience and how the usage and encounter with the OSS shape their interest and understanding towards the technology.

Table 2. *OSS Appropriation Multiple Perspectives (Nor Zairah & Rose Alinda, 2007).*

The framework also refer to the *technical* and *organizational* elements of the Technology-organization-environment (TOE) model by DePietro *et al.* (1990) and integrates the *environment* element and named it as *external context* in the research framework to understand the external influences apart from the three perspectives within the organization which would influence the appropriation process of the OSS applications. This framework suits the context of the study as it involves different level of processes, multiple actors, various technical disciplines, organizations and diverse individuals (Mitroff & Linstone, 1993).

It is also interesting to note that technology appropriation is also relevant to theories of technology assimilation. Zhu *et al.* (2006) formulated an integrative model that identified three stages of technology assimilation, namely initiation, adoption and routinization with three antecedents comprising technological, organizational and environmental contexts. Thus, the criteria influencing technology appropriation within this MPOSSA framework can also be compared with the factors influencing technology assimilation within the integrative model of Zhu *et al.* (2006).

## 4 METHODOLOGY

Case study approach was chosen to study OSS appropriation in depth. The Engineering and Technology University (ETU) was chosen because based on the preliminary data gathered from the OSCC, it was found that ETU used to have a very successful OSS implementation. Therefore, it would be a revelatory case study to understand what took place in the organization’s OSS implementation. The ETU is one of the university colleges in Malaysia with the status of technical institution. The focus of ETU is on technical education where it only offers courses on technology, engineering and computer science. The ETU felt that they should become one of the pioneers from the Malaysian Institute of Higher Learning to adopt and implement the OSS. Thus, towards the end of 2003, ETU decided to start implementing the OSS. This implementation was the directive of the first Rector of the ETU who got the idea of the implementation through series of OSS promotion events

organized by the OSS community that he had attended. The Rector then instructed the IT Manager to be responsible with the OSS implementation in the organization. ETU took a top-down approach in directing the OSS implementation. With this directive is the policy of mandatory implementation of the OSS desktop application to all the workstations in ETU.

Interviews, observation, and document analysis were conducted during this case study. Nine interviews respondents were selected from various levels and who were key stakeholders within the studied organizations: 1) Technical personnel, 2) Management level and 3) Individual end user in order to capture the T, O and P perspectives. They consist of the current IT Director and three other ex-IT Directors, a System Analyst, two academic staff and two administrative staff

Open-ended interviews were then conducted with the selected respondents to gain in-depth information on the appropriation of the OSS. An interview protocol outlining the questions was used to guide the interviewer but the respondents were given sufficient time to reflect and steer the interviews. Each of the interviews lasted between twenty to ninety minutes. At times, the interviewer prompted respondents based on the initial answers given by the respondent or summarized their response to seek clarification or probe deeper. The interviews were all tape-recorded and transcribed.

General observations during and in-between the interviews also noted the overall infrastructure where the OSS is being used in the organizations. The observations include the usage of all types of OSS and how the personnel handled the application. Organizational documents relevant to the adoption and implementation of the OSS were also reviewed. Transcripts of interviews and notes from the observation and document analysis were collected, organized and analyzed. The data were analyzed according to a *a priori theme* where the categorizations were developed during the literature review process based on the conceptual framework (Bazeley, 2003). With the help of a qualitative software, all the collected data were then systematically identified and grouped together or coded according to the predetermined categories (Silverman, 2004). Throughout the analysis, new categories or themes (Bazeley, 2003) were also generated.

## 5 FINDINGS

This section reports the findings of the study on the criteria of OSS appropriation within the organization.

### 5.1 External Context

The ETU initiative commenced shortly before the *Malaysian Government's OSS Initiative*. Apart from the Rector's encouragement, the ETU's OSS initiative was also much influenced by the promotion of the existing *OSS community* in Malaysia including some *vendors* known by the university which dealt with OSS solutions. Thus ETU worked with MAMPU and OSCC to promote their OSS initiative and became the spokesperson for all Malaysian Institute of Higher Learning on OSS. ETU also participated in many of the OSS programs and road shows organized by MAMPU and OSCC. At that point of time, ETU managed to achieve part of its vision to become the OSS leader among the institute of higher learning and also to become source of reference and support center for other organizations. Apart from creating the OSS culture within the university community, ETU also tried to inculcate the culture to the community around the university. This was being done by conducting various awareness programs such as OSS talks and exhibition in schools and community centers. ETU was also promoting their status as the OSS center in the state and welcome any queries or discussion related to OSS from these external communities.

At some point of time, ETU also obtained external support from several Koreans who had a collaborative research with them. With this collaboration they have developed with their own OSS operating systems. The ETU OSS operating systems were recognized by the Malaysian Government and formally accepted by MAMPU in December 2004. This operating system has become the highlight of the whole OSS implementation in ETU. The ETU OSS operating systems was then installed in all computers in ETU replacing the existing OSS operating systems that they were using.

Some other external factors that influenced ETU's OSS Initiative and implementation were the competition of the proprietary corporation. A large *proprietary corporation* has a powerful influence on the software market all over the world and also in Malaysia. Most of the users perceived the proprietary applications to be more user-friendly and having more functions that they needed. It is known that the proprietary corporation is able to provide good technical support. The corporation also had a big influence especially to universities in Malaysia when they started establishing various programs specifically focused for the community. These were strengthened with several Memorandum of Understanding (MoU) signed with the Higher Learning Ministry to get their programs to be run in the universities. The campaigns made by this corporation have impacted OSS efforts in universities including the ETU. Table 3 summarizes the *External Context* which influences the OSS appropriation in the ETU.

External Context
Marketing by vendors Participation/support of the OSS Community Government encouragement Competition of the proprietary corporation

Table 3. ETU Appropriation Criteria from External Context

## 5.2 Multiple Perspectives of OSS Appropriation

### 5.2.1 Level 1 of ETU OSS Appropriation

**Technological.** Many criteria from the technological perspectives came from the technical personnel as they had more understanding on the technical aspect of the OSS. However, some comments on the technical perspectives came from the administrative end user with minimal IT background mainly on their experience on using the tools and functions of OSS. One of the attractor criteria of the OSS adoption in ETU was their *expectation* that the OSS applications will be *compatible* with the existing skills in the organization as several of the academic and technical staff at that time has prior knowledge on OSS. Therefore, these people should have no problem in assisting the implementation. In addition, OSS is *trialable* as it can be freely and easily installed and tested before actually adopting it. Another most mentioned criteria which made OSS an attractive technology was its *relative advantage* over the existing proprietary applications that they were using. One of them was in terms of its *security*. OSS application was *expected* to have a *better security* compared to the existing proprietary software being used. Others *expected* that the *functionality* of the OSS applications was also competitive if not better than the existing proprietary applications in the market. Apart from that, the *cost*, and *lack of flexibility* of the existing technology made them turned to the OSS applications. The IT Department did reject several of the OSS applications that they tested before the implementation due to its *lack of functionality*. Some of the functionality problems were caused by the *lack of maturity* of the OSS application at that time.

**Organizational.** *IT innovativeness* and *top management directives* are the two most popular attractor criteria from the *Organizational Perspectives* cited during the case study. The two criteria actually relates to one another as part of the IT innovativeness of the Rector with the support of the IT Director and the IT Department at that time that actually lead to the directive of the implementation. At that point of time, ETU managed to achieve part of its vision to create its *image* in becoming the OSS leader among the institute of higher learning and also to become source of reference and support center for other organizations. By adopting the OSS the ETU were also expecting the *low cost* in the implementation with the reduction of licensing cost. This also influenced the organization perspectives as the organization *expected* that the OSS implementation would be *cost-effective* as they would be able to achieve a large reduction of IT implementation cost with the OSS. The organization also believed that by implementing OSS, they would have more *control* on their applications choices and updates. This fitted ETU's mission and vision, to be creative and dynamic and also less

dependent to the proprietary application. An OSS center was also established in the IT Department to handle all matters related to the OSS implementation. This *centralization* and the small *firm size* of about only 100 staff at that time made the OSS implementation more manageable. Most of the outcomes outlined in the ETU OSS Roadmap were also successfully achieved. The *mandatory usage* policy of the organization to use the OSS desktop application is considered as the main criteria which initiates its usage from personal perspectives in the ETU. This applies especially for the end users with no technical background. For the IT Director in charge at the time of the implementation, apart from the instruction from the top management, her attraction towards the technology was also influenced by her *personal contact network*. The OSS was being introduced to IT Director by the vendors of ETU which also had indirectly played some roles in assisting her with the implementation. Those with technical background especially the academic staff had known and started using the OSS even before the implementation and were influenced by their *personal motivation*.

**Personal.** From personal perspectives, several respondents perceived that it would be an *easy technology to use* despite OSS being a new technology to them. These views were shared by both those who have IT or non-IT background. They saw OSS as something interesting and *useful* for them who are working in an engineering and technology institution. The academic staff needs to teach the students various IT applications including the OSS and sometimes use the technology in their research. The IT personnel need to explore the OSS to find alternative solutions of applications to be used by the IT Department. Some of the academic staff at that time had prior knowledge on OSS. Therefore, they were *familiar with the technology* and had no problem in assisting the implementation. Furthermore, some of the OSS applications such as the desktop applications had quite similar features to the proprietary software that they had used.

Although from the organizational perspectives there were no obvious repellent towards the implementation, there were several repellent criteria cited from the personal perspectives from those who were not really keen on the implementation. Among the reasons for this rejection was *personal rejection* as they do not believe or understand the philosophy and benefits of OSS. An ex-IT Director reported that there were cases where people simply rejected it just because they did not like using it. However, another ex-IT Director had a different opinion on this where he believed that some of them were reluctant to use the OSS because they were restricted with *other commitments*. They felt that learning a new thing such as OSS would take up much of their time while they were busy with other tasks. Thus, they preferred to stick to the applications that they are familiar with and avoided attending the OSS trainings organized by the IT Department. The current ETU IT director and system analyst reported that, during the implementation, many staff were initially reluctant to use the OSS because they were *not familiar* with it and more comfortable with the proprietary applications.

The Level 1 (attractors and repellents criteria) of the ETU showed there were no significant repellents to the OSS adoption especially from the organization perspectives. Thus, ETU had managed to adopt and considered successfully implemented the OSS in the organization. The next section will look at the influencing criteria once the OSS has been adopted in the organization.

### 5.2.2 Level 2 of ETU OSS Appropriation

**Technological.** After adoption, and the IT Department had successfully migrated from the proprietary applications to OSS, no major problems were reported. From the technological perspectives, this shows that OSS applications were quite *stable* at that time. As the OSS was continuously being used in ETU, the attractor criteria in terms of its *relative advantage* mentioned in Level 1 of the Technological Perspectives; *functionality*, *security*, *lower cost* and *flexibility* continued have an influence at this level. An academic staff who teaches computing subjects said that OSS has *good functionality*, while, one administrative staff who had never used OSS before, realised that the *security* level of her workstation had improved since she used the OSS. This also led to *lower maintenance cost* experienced by the IT Department especially for their back-end servers and email applications. Another academic staff mentioned that the *trialability* of OSS had allowed him to do trial and error for some part of the applications when finding solutions to his computer problems. This was also influenced by the *flexibility* of the OSS where it allowed the source code to be accessed and

manipulated by the user if they had the skills. For many academic staff, since the mandatory policy was imposed, they have started to find OSS *alternative* applications which are similar in functions or compatible to the proprietary applications that they previously used. The *frequent updates* of the OSS helped them to always find the latest solution. Although OSS uses different format or standards from the usual proprietary applications that ETU have used, some of problems were overcome as OSS allows *interoperability* with the proprietary application.

However, not all of the problems were solved as *compatibility problems* were still reported as among the main problems of the OSS applications which lead to its disappropriation. One of the criteria which led to OSS disappropriation mentioned earlier was the compatibility problem of OSS applications. This also relates to the *legacy system incompatibility*. Not only some of the proprietary applications failed to run in the OSS platforms, but some of OSS applications also had problems with the systems that were developed using proprietary applications. Thus, the IT Department failed to integrate the legacy systems with the OSS applications being used. The system analyst mentioned that the OSS, was also disappropriated because of *failure of the technology*. The same problem reported with the ETU OSS operating systems which were co-developed with the Korean collaborator.

**Organizational.** The *OSS policy enforcement* is one of the main influences for the OSS to be continuously being appropriated in ETU. Since a majority of the computers in the ETU had already been installed with the OSS, any of the computers found with unauthorized proprietary application installation were penalized. At the same time there was also *support from a technical team* in ETU to deal with any emerging problems related to OSS. The OSS roadmap outlined by the first IT Director had promoted *continuous development* of the OSS. The initiative started from desktop OSS implementation and later expanded to developing the OSS application themselves. This was done to inculcate the culture in the organization not only as the end-user of the OSS but also to be more innovative by developing ETU's own OSS applications. Training was also conducted for all the staff and the OSS usage were also promoted to the students. All of these had encouraged the OSS to be appropriated in the ETU community at that time. *Cost-effectiveness* was another influence of the OSS continuously being appropriated after its initial adoption. In fact, despite the major disappropriation of the OSS desktop application in the organization (will be described further later), the back-end OSS applications managed by the IT Department are still being appropriated in ETU due to its *cost-effectiveness*.

The successful introduction of the OSS in ETU did not last long. Many people in ETU started to disappropriate the OSS desktop application. One of the main influences of the disappropriation was the *change of management* in ETU. The term of ETU Rector during the introduction of the OSS initiative ended in November 2004 and a new Rector took over the ETU management. Not long after that, the term of the IT Director were also ended. Despite the initial success, the OSS initiative was not seen as a priority by the new management. The IT vision and mission had changed. Moreover, the previously endorsed OSS policy was *weakly enforced* in the university. With the change of the ETU management, the ETU OSS initiatives also *lost the technology champion* to vanguard the whole OSS implementation. There was nobody in the new management to hold that position. The OSS initiative mission and vision seemed to wither away.

The departure of the IT Director who was also the technology champion also raised the issue of *lack of records and documentation* for the whole OSS implementation. Nobody seemed to know if there were actually any written records kept during the implementation because none of the successors to the position has ever seen any record related to the OSS implementation. There was also *no transfer of technology (TOT)* taking place between the Korean collaborator and the ETU technical team during or after the development of the ETU OS. There were many comments made by the respondents on the *lack of technical support* on the OSS which also led to its disappropriation. This happened especially after the Korean collaborators who developed the ETU OSS operating systems completed their tasks and left. Since then, many of the arising technical issues related to the developed ETU OSS operating systems were unresolved because there were no experts handling the matters. Despite the existence of the OSS center in ETU, there was actually no formal OSS team established. Apart from the IT Director herself and a few IT staff who were assisted her, many of the people were involved in the

implementation were the academic staff who joined the team on voluntary basis who later left to further their studies. The existing team members were not capable of handling all the unresolved issues and at the same time having other tasks to focus on.

The *increasing numbers of staff* worsened the situation. From the year 2004 to 2007 the number of staff had increased from about 100 to 500 staff. There were more and more problems kept on recurring not only on OSS but also on other systems with ETU while it was only handled by a few members of the IT Department and academic staff. Technical problems were mounting as there was a lack of manpower to handle all the problems. More new people were coming in and there were *lack of awareness* on the OSS.

The failure was also due to the *Big Bang* approach to the OSS implementation taken by the top management and the IT Department. It was too drastic for a new institution such as ETU at that time. All of the mentioned criteria were also greatly influenced by the *political motives* of different stakeholders in ETU at that time. The big bang approach was taken because the vision and mission of the ETU management at that time wanted ETU to become the pioneer of the OSS initiative among the Malaysian higher learning institute. However, there were not many experts in ETU itself resulting the IT Director to take a shortcut approach of engaging collaboration with external parties. Due to lack of knowledge and interest on OSS, there was also a lack of internal supports from the ETU thus only a few people who were really interested with the OSS took part in the team. *Political motives* also played its role in the new management. As the management of ETU changed, the motives also changed. The new management saw that they could come out with other initiatives thus making the OSS initiative by the previous management became less important. At the same time there were also a few people within the organization who had been disagreeing with the OSS implementation since the start, therefore once the management changed, they took the opportunity to highlight their dissatisfaction and influence the top management to revert back to the proprietary applications.

**Personal.** Many of the OSS desktop users commented that although they initially had problems using the OSS applications, after a while, they felt that the application is *easy to use*. In fact, they felt more *comfortable* using it as they were getting *familiar* with most of the functions. The OSS application usages were also encouraged with the existence of *support* from the ETU OSS *technical team* at that time. The users also believe that the prolonged usage will *increase their skills* and they felt proud of it as not only they were skilled with the proprietary applications, but also with the current OSS applications. Several of the staff chose to continue using the OSS because of their *work requirement*.

However, after a while, many of the users in the ETU disappropriated the OSS applications and reverted to the proprietary application. *Poor usability* was one of the influences to the disappropriation of the technology. Many in the ETU feel that the OSS applications were not user-friendly enough. This made them felt uncomfortable to continue using the OSS applications despite the mandatory requirement by the top management. The users also felt that after a while, there was a *lack of support* for them in using the applications. Being individual users, it was hard for them to continue using the OSS if there were no one to turn to each time they were having problems with it especially with the *lack of training*. Although the users were aware that there are ample of resources from the internet for solutions to the OSS problems, however they felt that they do not have adequate time to search for the solutions or to learn new things related to the technology as they have other more important commitments. The disappropriation was more obvious when the management of ETU changed and the mandatory policy imposed earlier was no more in place. So, most of the users were *influenced by their peers* to revert to proprietary applications. Moreover, when this transition happened, it gave problems to a few staff who were still using the OSS especially due to different file standards. This also influenced the minority to join their friends reverting to proprietary applications.

Due to the major disappropriation of the OSS, especially on its desktop applications in ETU, there were no obvious reinforcers criteria identified in terms of the technological perspectives. Since its initial implementation, only the back-end OSS applications were still being used up till now mainly because of its *relative advantage* in terms of its *cost-effectiveness* and *security*. Similarly in organizational perspectives, OSS is not on their agenda anymore. Thus, after the major disappropriation on the OSS desktop application took place, the organization paid no attention

whether OSS was being used or not. However, the IT Department were free to implement any OSS applications where necessary such as for the back-end servers' applications. Therefore, there are no apparent reinforcers criteria from organizational perspectives. The reinforcers criteria could only be seen from personal perspectives where those who are the firm believers in the OSS and still using it due to their *continuous motivation* and *sense of belonging* to the OSS community. It should be noted that repellent and disappropriation criteria are related to factors that contribute to the rejection of OSS.

Perspectives	LEVEL 1		LEVEL 2		LEVEL 3
	Attractors/Initiators	Repellent	Appropriation	Dissappropriation	Reinforcers
<i>Technological Perspectives</i>	Trialability Expected compatibility: (with existing skills) Relative advantage: (Expected better functionality Expected better security Lower cost Flexibility)	Lack of functionality Lack of maturity	Stability Relative advantage: (Functionality Security Lower cost Flexibility) Frequent updates Interoperability Alternative options Trialability	Lack of functionality Compatibility Problem	Relative advantage: (Security Cost effectiveness)
<i>Organizational Perspectives</i>	<b>Top management support/directives</b> <b>Expected cost-effectiveness</b> IT Innovativeness Firm size Control Centralization <b>Image</b>	<b>None</b>	Policy enforcement Cost-effectiveness Continuous development Support from the internal team	<b>Change of top management</b> <b>Lack of strong enforcement or policy</b> <b>Loss of champion</b> Lack of implementation records and documentation No TOT Lack of technical support Increasing staff number or firm size Lack of awareness Big Bang approach Political motives	<b>None</b>
<i>Personal Perspectives</i>	Personal contact network Mandatory usage Personal innovativeness Familiarity Expected ease of use Expected usefulness	Personal rejection, resistance or fear Unfamiliar Having other commitments	Usability Familiar and Comfortable Availability of support Increase skills Work requirement	Poor usability Lack of support Lack of training Having other commitments Social influence	Continuous motivation Identity and sense of belonging

Table 4. Multiple Perspectives OSS Appropriation Criteria of the ETU

## 6 DISCUSSION

The implementation of the OSS applications in ETU could be considered as both a success and a failure. It was a successful implementation during the headship of the first Rector. Later, however, the OSS initiative was abandoned so that the OSS technology was disappropriated except for a few

individual users who persisted with the OSS despite its abandonment at the organizational level. The findings also showed that many of the disappropriation criteria are from the organizational perspectives which show that the failure of the OSS implementation is greatly influenced by organizational factors. This is shown in Table 4, where the dominant influence on the longer-term appropriation of OSS is the organizational perspective (shaded) with the main influences for appropriation and disappropriation in bold. It illustrates how, in the ETU case, the balance of dominant organizational influences over time shifted from positive (Level 1) to negative (Level 2). Thus, based on the criteria extracted from the analysis of the case study can be used to answer the question addressed in the earlier part of this paper; *'What criteria, from what perspectives, influence the appropriation process of OSS in Malaysian public organisations?'* The case also illustrates that there are various interactions and relationships between the stakeholders within the ETU and also between the ETU and other external parties. These interactions and relationships developed and changed throughout the implementation which also leads to the constantly changing or emergent influences to the appropriation of the OSS applications. The findings could become a lesson learned for the ETU and also other organizations which are planning or currently implementing the OSS applications in their organization. Appropriate guidelines and corrective actions could be outlined based on the identified criteria from the multiple perspectives in order to have a more successful and effective information technology in this case the OSS implementation in the organizations. The finding enriches the understanding on organizational OSS and technology appropriation in general.

The top management, IT personnel, the OSS community and the government may use the MPOSSA framework to explore, assess, and evaluate all of these different and changing perspectives that will assist in their decision making and also in anticipating the possible influences that will lead to the success or failure of the OSS implementation. This understanding will allow them may it be to tackle issues related to the implementation and other related IT concerns. It will also assist in minimizing the expectation gaps or mismatch between different stakeholders on the technology.

By applying the MPOSSA framework, the organizations would also be able to know the extent of their technology appropriations. This can be achieved through the understanding of the identified criteria throughout the appropriation process of OSS. The top management of the organizations could decide on appropriate action to be taken for each of the identified criteria. The understanding will also provide insights for the organization on how to improve the overall implementation and management practices related to the systems implementation. This may lead to better planning and more informed decision making for future or current OSS development, adoption, implementation and investment.

## 7 CONCLUSION

The in-depth case reports the multiple perspectives criteria of OSS appropriations in a Malaysia public university. The study contributes to the understanding of the role played by various stakeholders within the organization and how it influences the successful or failure implementation of a new technology. Understanding the processes that shape technology may help in creating better technologies (Bijker & Law, 1992) and also lead to better utilization of the technology. Mandatory adoption will not ensure a technology will be successfully implemented and fully utilized. Thus the argument of this paper is that the criteria which influence each level at the different time periods of the appropriation process need to be identified and understood in order to have an effective implementation and prolong use of the technology.

## References

- Avison, D. E., Wood-Harper, A. T., R.T., V., & Wood, J. R. G. (1998). A further exploration into information systems development: the evolution of Multiview2. *Information Technology & People*, 11(2), 124-139.

- Bazeley, P. (2003). Computerized Data Analysis for Mixed Method Research. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of Mixed Methods in Social and Behavioral Research*. Thousand Oaks: Sage Publication.
- Bergquist, M., & Ljungberg, J. (2001). The power of gifts: organizing social relationships in open source communities. *Information Systems Journal*, 11, 305-320.
- Bijker, W. E., & Law, J. (1992). General introduction. In *Shaping technology/building society: studies in sociotechnical change* (pp. 3). Cambridge, MA.: The MIT Press.
- Carroll, J., Howard, S., Peck, J., & Murphy, J. (2002a). A field study of perceptions and use of mobile telephones by 16 to 22 years old. *Journal of Information Technology Theory and Application (JITTA)*, 4(2), 49-62.
- Carroll, J., Howard, S., Vetere, F., Peck, J., & Murphy, J. (2002b). *Just what do the youth of today want? Technology appropriation by young people*. Paper presented at the Proceedings of the 35th Hawaii International Conference on System Sciences - 2002.
- Cooper, R. B., & Zmud, R. W. (1990). Information Technology Implementation Research: A Technological Diffusion Approach. *Management Science*, 36(2), 123-138.
- Davis, F. D. (1993). User Acceptance of Information Technology: System Characteristics, User Perception and Behavioral Impacts. *International Journal Man-Machine Studies*, 38, 475-487.
- Degele, N. (1997). Appropriation of Technology as a Creative Process. *Creativity and Innovation Management*, 6(2), 89-93.
- Delaney, P., Timbrell, G., & Chan, T. (2008). *A Marxian Model of Technology Appropriation*. Paper presented at the JAIS Theory Development Workshop, Working Papers on Information Systems, 8(28).
- DePietro, R., Wiarda, E., & Fleischer, M. (1990). The Context for Change: Organization, Technology, and Environment. In L. G. Tornatzky & M. Fleischer (Eds.), *The Processes of Technological Innovation*. Massachusetts: Lexington Book.
- DeSanctis, G., & Poole, M. S. (1994). Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory. *Organization Science*, 5(2), 121-147.
- Gacek, C., & Arief, B. (2004). The Many Meanings of Open Source. *IEEE Software*, 21(1), 34- 40.
- Linstone, H. A. (1989). Multiple Perspectives: Concept, Applications, and User Guidelines. *Systems Practice*, 2(3).
- Mendoza, A., Carroll, J., & Stern, L. (2008). *Influences on continued use of an information system: a longitudinal study*. Paper presented at the 6th European Conference on Information Systems (ECIS).
- Mitroff, I., & Linstone, H. (1993). *The Unbounded Mind, Breaking the Chains of Traditional Business Thinking*. New York.: Oxford University Press.
- Nor Zairah, A. R., & Rose Alinda, A. (2007). *Open Source Software Appropriation: Attractor and Repellent Criteria of a City Council*. Paper presented at the MMU International Symposium on Information and Communications Technologies (M2USIC 2007).
- OSI. (2005). Open Source Initiative: Open Source Definition. Retrieved May 2005, 2005, from <http://opensource.org/docs/osd>
- Osterloh, M., & Rota, S. G. (2007). Open-source Software Development - Just Another Case of Collective Invention? *Research Policy*, 36(2), 157-171.
- Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). New York: Free Press.
- Silverman, D. (2004). *Qualitative Research: Theory, Method and Practice* (2nd ed.). London: Sage Publication.
- Sykes, T. A., Venkatesh, V., & Gosain, S. (2009). Model of Acceptance with Peer Support: A Social Network Perspective to Understand Employees' System Use. *MIS Quarterly*, 33(2), 371-393.
- Zhu, K., Kraemer, K. L., & Zu, S. (2006). The Process of Innovation Assimilation by Firms in Different Countries: A Technology Diffusion Perspective on E-Business. *Management Science*, 52(10), 1557 – 1576.