Open Source Software in Local Authorities

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Declaration

I declare that the work described in this dissertation is, except where otherwise stated, entirely my own work, and has not been submitted as an exercise for a degree at this or any other university. I further declare that this research has been carried out in full compliance with the ethical research requirements of the School of Computer Science and Statistics.

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Abstract

Open Source Software (OSS) is software whose source code is available free or under a license. OSS adheres to open standards and provides vendor independence, which will be highly beneficial in delivering public services. Irish local authorities appear to be slow in adopting the OSS. The main objective of this study is to identify what factors influencing or inhibiting OSS adoption in the Irish local authorities. In order to attempt to provide an answer to this question, this study investigates what information and technology managers of the local authorities perceive to be the influencing factors and inhibitors to open source adoption in local authorities.

The primary research used is effectively a qualitative pragmatic study exploring factors influencing and inhibiting the adoption of Open Source Software in local authorities. The factor that found to be not consistent with the literature is the Total Cost of Ownership (TCO), the local authorities consider the TCO of OSS to be an inhibitor and this finding contradicts the literature findings. The TCO constitutes switching costs, training, support and maintenance and upgrade costs. This study identified factors specific to local authorities in OSS adoption. The lack of OSS champion or a leading authority, lack of skills, lack of support, training, guidance and TCO found to be inhibitors to the adoption of OSS in local authorities. Interoperability, compatibility, vendor independence, stability and reliability considered as the influencing factors. The findings lead to the conclusion that there is a strong need for an OSS champion who can provide accountability, support and guidance to local authorities. Another conclusion drawn is that the OSS is rarely free and there is switching costs associated with the adoption. Local authorities are happy to adopt OSS if it offers solution to the business problems by means of delivering the products on time, on budget and on quality.

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Abbreviations

AB	Actual behaviour
FSF	Free Software Foundation
GPL	GNU Public License
GNU	GNU's Not Unix
HTTP	Hypertext Transfer Protocol
IT	Information and Technology
LGMA	Local Government Management Agency
LA	Local Authorities
OSI	Open Source Initiative
OSPC	Open Source Practice Centre
OSS	Open source software
PU	Perceived usefulness
PEOU	Perceived ease of use
ROI	Return of Investment
SN	Subjective norm
TAM	Technology acceptance model
TCO	Total Cost of Ownership
TRA	Theory of reasoned action
TOE	Technology Organisation and Environment
UTAUT	Unified Theory of Acceptance and Use of Technology
WWW	World Wide Web

1. INTRODUCTION

Introduction

OSS is a software whose source code is available free or under a license that allows users to utilise, modify, and customise the software, and to redistribute it in a customised or unmodified form and is often developed in a public and collaborative manner (LGMA, 2012). OSS products range from Apache web servers, Linux and Postgre SQL in database area and Open office or Mozilla in office suites and desktop tools. Another area where OSS products are competitive includes Internet tools, management suites, blog and wiki engines (Europe, 2009).

Irish local authorities counterparts in Europe, such as those in Munich, Zaragoza, Bilbao and Badajoz, Portugal's Vieira do Minho, Arhus, Ede, Grygov and Jihlava, Arles, Poznan and Bologna have all adopted open source (Hillenius, 2013). European governments are taking into consideration Open Source Software as an alternative to proprietary software. From operating systems to content management systems, OSS has increasingly become popular in public sector organisations (Hillenius, 2013).

One of the premier open source software deployments in Europe is the migration of Munich city from Windows NT to LiMux, the city's customised work of Linux. Governments across Europe are now incorporating the OSS in policies, for instance UK government's OSS policy recommends, that the, OSS should be given fair consideration alongside proprietary software when making decisions on solutions (Smith, 2010). By 2001, countries such as Peru, France, and Mexico all had measures pending that would mandate the use of free software on government computers (Chan, 2004).

A number of studies examined the adoption of open source by governments around the world. However, according to a study conducted by Grant Thornton, the Irish local authorities have been something of an exception to this trend and are approaching OSS with caution when compared with other

European public sectors administrations (Harbison 2008, Ryan and Harbison 2008).

The early researchers in OSS focused on the motivational factors of developers contributing to the development of OSS (Hertel, 2003). Further studies focused on the adoption of open source in public sector and commercial organisations around the world (Glynn, Fitzgerald et al. 2005, Hauge, Ayala et al. 2010). The focus of the researchers then shifted to understanding why OSS was significant to organisations, what organisations are adopting OSS.

This research report gives organisations useful guidance on which factors they should consider when deciding on adopting OSS.

Problem Statement

Around the world, public sector organisations are assessing availability and potential of OSS based solution (Morgan and Finnegan 2007). In Ireland, OSS has transitioned into the realm of local government and OSS products are either being considered for adoption or adopted in the local government sector (Harbison, 2008). An Illustration of one such adoption in the local government sector is the implementation of Libre Office by the Limerick city council (Council, 2001-2014).

Furthermore, an Open Source Practice Centre (OSPC) was set up by the Local Government Management Agency (LGMA) to promote collaboration between local authorities on the use of OSS, to understand OSS and its application and to implement OSS based solutions at the national level on behalf of 32 councils (LGMA, 2012). This, while the local government sector in Ireland is taking important steps towards adopting OSS products, adoption has been slow and sporadic. The aim of this research is to identify the factors influencing OSS adoption decisions in Irish Local authorities and to understand the barriers that inhibit OSS adoption. The research study does not boundary the types of software and includes software ranging from desktop applications to IT infrastructure software.

Research Objectives

This study aims to determine the factors influencing or inhibiting the OSS software adoption in Irish Local authorities. The identified adoption factors relevant to local authorities will be beneficial for others to reach informed decisions on OSS adoption decisions in the hereafter. This research concentrated mainly on identifying the influential factors and barriers for adopting OSS and not the ideological motivations of the Open Source Software movement.

1.3.1 Research questions

The primary research question relates to the factors influencing or inhibiting OSS adoption in the Irish Local Government sector. The question is as the following:

What are the factors influencing and inhibiting the adoption of OSS in Irish local authorities?

The following secondary research questions answers the research question:

1. **What OSS products did local authorities adopt?**

The scope of this research is limited to examining the perceptions of senior members of the local authorities with some knowledge of the topic. Together they provide a representative sample from local government. This research does not extend beyond the local authorities and LGMA. The study is limited to the perceived benefits and barriers to open source, the possible opportunities it presents and aims to provide suggestions as to how best to proceed with any implementation.

One of the beneficiaries of this research is the research community as it seeks to contribute to the limited academic research that already exists on the topics of open source. Irish public sector organisations should also benefit from this research since it provides an insight into opportunities open source presents, by identifying benefits and barriers to open source.

Road Map

Chapter 2 is the Literature review. The literature review starts with the OSS definition, a brief history of OSS and a section on factors of OSS adoption. It continues with the general technology adoption investigation and then touches on technology adoption models used in OSS adoption research. OSS adoption literature reviewed from global, regional and Irish Local authorities' perspectives.

Chapter 3 describes the research method followed, sample selection and the building of the research questions posed to interviewers. Each question formulated based on the literature.

Chapter 4 provides a background to the research and describes the method of analysis used. It presents the analysis and findings from the interviewees and concludes with a discussion of the key findings.

Chapter 5 the conclusion, identifies the influencing factors and barriers to the adoption in Irish Local authorities. It also contains recommendations for the sector that have to make decisions about software adoption as well as recommendations for possible further research in the field.

2. LITERATURE REVIEW

Literature review introduction

Over the last, few years as the OSS became more common the availability of the literature on OSS has increased. Initially much of the focus of the research has been on the motivational factors of individual developers who are contributing to development of the OSS products. Then the focus shifted to identifying the motivational factors of the individuals and organisations contributing to the OSS products. Raymond (1999) in *The Cathedral and the Bazaar* described OSS development methodologies while explaining the nature and organisation of OSS adoption. Recent OSS research has focused more and more on the adoption of OSS software by governments and big businesses.

This section examines the literature on OSS and OSS software adoption and is composed as below; the open source software and free software definitions discussed first, followed by review of studies of technology adoption in broad spectrum. Assessments of studies that look at the motivational factors of individuals who contributed to the development of OSS discussed next. Commercial organisation's involvement in OSS examined, followed by a review of the available literature on OSS adoption. The chapter ends with a review of literature relating to different software adoption factors.

Definition of OSS

The Open Source Initiative (OSI) website defines the OSS as below: "OSS is software whose source code is available free or under a license that allows users to utilise, modify, and customise the software, and to redistribute it in customised or unmodified form and is often developed in a public and collaborative manner" (Initiative, 2012).

The non-professional's understanding of OSS is software that gives the end-user, access to the source code, whereas proprietary software vendors just provides the client with the executable of the product. The end-user does not

have access to the source code of the proprietary software. It is additionally important to note that commercial and proprietary software are not synonyms.

The openness of OSS and flexibility connected with free software is by and large managed by the software licence. A large number of OSS licenses exist, with contrasting degrees of flexibility, however, not all Open Source Software is free (Stallman, 2009).

Casadesus-Masanell and Llanes (2011) refers to the existence of many different business models. These models are often combination of OSS and proprietary software and are regarded as a mixed - source model or hybrid source models. Vendors, offering hybrid-source models often release an open-source derivative of their software and then obtain revenue from selling proprietary, complementary code.

Backdrop of OSS

The origins of OSS can be traced back to beginning of computing era in 1950s. All, including rivalry companies in the software industry worked together to develop and produce a fundamental set of tools for the computing platforms and programming environment. Coordinated effort was necessary as none of the individual contenders had the assets to handle an essential set of software tools on their own (Weber, 2004). In the late 1970, organisations first began charging for software licenses and began forcing lawful restrictions on new software developments.

In 1991, Linus Torvalds made the first version of the Linux operating system. A Dutch researcher developed the Linux kernel. Linux is similar to MINIX, a Unix-like computer operating system based on microkernel architecture. None of the source code of the Linux kernel was based on MINIX code, permitting Torvalds to pick a permit for the source code. Torvalds released the Linux kernel source code under the General Public Licence (GPL) as published by the Free Standards Federation (FSF). Under the GPL licence agreement changes to the source code must be distributed (Leach, 2012).

In 1995, the Apache web server project began as an arrangement of patches to a current Hypertext Transfer Protocol (HTTP). HTTP is the standard for exchanging data on the World Wide Web (WWW). It has been the most well-known web protocol on the Internet since 1996 (Liu, Sha et al. 2003).

Another notable event in the historical backdrop of OSS was the arrival of the source code for Netscape Communicator in 1998. Some individuals in the FSF coined the term open source in response to the Netscape Communicator source code distribution. After the source code release, America Online acquired Netscape Communications for $4.2 billion. Netscape was included in the browser wars with Microsoft Internet Explorer in the late nineties and its share of the overall industry tumbled from a 90% in 1995 to just about nothing. Microsoft was investigated by US anti-trust authorities for packaging the Internet Explorer browser with their operating system, bringing about a significant increase in their total market share (Windrum, 2004).

OSS development

Much of the research focused on identifying the motivational factors of people who are contributing to OSS projects. Lerner (2000) describes the motivations of developers in the work. Lerner analysed motivational factors of developers and found that the developers contributed to prove their worth and demonstrate their value by demonstrating the quality of their work, and as the source code is noticeable, it could upgrade their reputation.

Weber (2004) sets out six types of motivation that can be identified in contributors to open source projects: reputation and identity, job as a vocation, belief systems art and beauty, working against a joint enemy and ego boosting. Weber notes that the OSS phenomenon has political and social ramifications.

IT vendors who are generally involved in selling proprietary software started investing heavily in OSS (Iansiti, 2006). Investments generally made on the OSS products that are complementary to the proprietary software. Two of the biggest infrastructure vendors, IBM and HP support OSS-based environments indicating backing for OSS (Forge, 2006).

A number of big and well known IT vendors have moved to a hybrid source model where they are offering OSS and proprietary components while keeping up with OSS licence requirements. Casadesus (2011) argues that the real value of firms is in using a mixed/hybrid source software development model. Companies using hybrid source models have various options, some keep their core software open source and sells proprietary components with the core software, others keep their core software proprietary and open sources the extension software. A number of IT vendors, including Microsoft, follow the hybrid source approach.

Individual Technology Adoption

The literature on OSS adoption review technology adoption in general. Studies considered the adoption of OSS under the general adoption theory. General technology adoption considered because OSS is another new technology option.

According to Dedrick and West (2004), adoption decisions made independent of the ideological reasons for OSS development. A large number of frameworks created to depict adoption of technology. Technology adoption is depicted by the diffusion of innovations (DOI) or innovation diffusion theory (IDT), promoted by Rogers in 1962.

The technology diffusion methodology comprises of pre-decision, in-decision and post- decision steps. Throughout the pre-decision step purchasers look for/get data that shape their convictions around an innovation. The in-decision stage used to settle on the choice of receiving or dismissing a particular innovation. The post-choice stage begins quickly after the choice made. Throughout this stage, non-adopters may discover data that leads them to embrace an innovation and adopters may discover the motivations reject the innovation.

A bell-curve separates technology adopters, innovators, early adopters and late adopters. All technologies have qualities that impact the adoption decision,

including complexity, trail-ability, the relative advantage of the technology, compatibility, and observability (Rogers, 2010). From all the factors, three factors; relative advantage, compatibility and complexity have been repeatedly linked with the technology selection (Tornatzky, 1982).

Some studies based the OSS adoption on the technology acceptance model (TAM) (Davis, 1989). The technology acceptance model is focused around four builds; perceived usefulness (PU), perceived ease of use (PEOU), intention to use and the usage behaviour of technology. The four builds examine the actual behaviour (AB) of a client who is adopting the new technology. Perceived ease of use has a direct impact on perceived usefulness. Perceived ease of use and usefulness are both controlled by external factors and have a direct impact on the wish to adopt another innovation.

At first the subjective norm (SN) was not an element considered in the first TAM by Davis, yet it was later included by Venkatesh and Davis (2000), focused around studies outlining the importance of the subjective norm. The reason for the direct impact of the subjective norm on adoption factors is that individuals may decide to adopt if they believe that one or more organisation or individual successfully adopted may motivate others o consider and adopt OSS.

The technology acceptance model2 (Tam2) was formed when job relevance, voluntariness, image, output quality and result demonstrability was added to TAM by Venkatesh and David (2000). Four external factors affecting the TAM are as follows; software quality, system capability, social influence and software flexibility (Gallego, 2008).

The technology acceptance model (TAM) and the theory of planned behaviour (TPB) are combined by Riemenschneider, Harrison and Mykytyn (2003) for their study of small business IT adoption. They found that the combo of the two models better clarifies technology adoption behaviour. TPB states that the behavioural proposition will eventually bring about the activity (Azjen, 1991).

Eight distinctive acceptance models consolidated in to the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, 2003). UTAUT symbolise a blend of elements of the theory of reasoned action (TRA), technology acceptance model, motivational model, theory of planned behaviour, TAM and TPB, model of PC usage, innovation diffusion theory and social cognitive theory. Joined factors from the eight models consolidated to define direct factors for technology adoption and usage.

Organisational technology adoption

Organisational behaviour parallels individual technology acceptance. It has, however additionally been demonstrated that in an organisational context, these perceptions can change because of external factors. Factors changing individual perceptions incorporate organisational facilitators, personal innovativeness and social use (Frambach, 2002). The Technology Environment and Organisation (TEO) framework is utilised within other literature on OSS adoption (Dedrick, 2004). Technology factors considered are compatibility with existing innovations and abilities, cost, perceived reliability and costs.

According to Tornatzky and Fleisher (1990), the context of technology includes the external and internal technologies that are relevant to the Organisation. The context of Organisation takes account of resource and characteristics of the Organisation, including the Organisation's size and managerial structure. The environmental context includes the size and structure of the environment (Oliveira, 2011).

The TOE framework places attention on boundary spanners, human and budgetary assets and the innovativeness of the organisation. Boundary spanners are staff with a past technology background that optimistically influences the adoption decision and builds an organisations confidence in the prospective technology (Dedrick, 2008).

Individual factors such as existence of individual OSS champion help motivate others to consider the adoption decision. Dedrick and West (2008) boundary spanner is similar to the adoption champion.

The TOE model factors were taken and enlarged in to additional definite innovative, organisational and environmental factors by Chau and Tam (1997). Technological factors record the perceived barriers, perceived benefits, perceived importance of standards compliance, interoperability and interconnectivity of the Open Systems Technology.

Organisational factors in the Chau and Tam (1997) model are; satisfaction with existing systems, formalisation on system development, the complexity of the IT infrastructure, and management. The external environment just takes market vulnerability into the record. Barriers to adoption and satisfaction with existing systems discovered to be noteworthy factors in OSS selection. A few factors included in the adoption model of Chau and Tam (1997) found in a prior examination on technology diffusion, i.e. interoperability and inter-connectivity of the Open Systems Technology.

Adaptive experiences, compatibility, enhanced value, perceived benefits, perceived difficulty and suppliers' commitment are the six factors that influence the technology adoption. The individual outside environment did not impact the establishment of a behavioural aim to adopt (Au, 2000).

OSS adoption

Developmental business models and software distribution has seen a change in perspective with the introduction of OSS in the software industry (Gallego et al., 2008). The increase in OSS adoption implies that it must maintain a different community membership. It is in essence impossible for IT organisations to overlook the increasing existence of OSS in important sections of the IT business (Gartner, 2009). OSS adoption has been the subject of a lot of research. The subject has been analysed from different points. The following section re-examines OSS adoption literature from a number of distinctive perspectives to identify the factors included in current

OSS adoption. The ideological factors identified with OSS adoption contrast to the pragmatic methodology to OSS adoption. Factors that influence or inhibit the adoption discussed, including access to source code, cost, and freedom of alternative options and control to the organisation and support. The TOE structure, utilised by Dedrick and West (2004) and Ellis (2004) and Van (2009) adds environmental factors to the discussion. The exploration by Dedrick and West (2007) makes a distinction between factors that are critical to the OSS development community (ideological factors) and factors that are vital to business clients (realistic factors).

Freedom and control factor

The OSS developer community and the organisations and individuals who use OSS agree that OSS offers a choice and the control (Dedrick, 2004). Users of proprietary software are at a disadvantage as the vendor does not make the code available and the user only acquires the executable of the code. The proprietary software user also pays licence fees and to customise the code or to maintain the software the user becomes dependent on the vendor. If the vendor disappears the users faces additional difficulties. Vendor independence plays a major role as an influencing factor in the adoption of OSS.

OSS gives the organisations an extra choice and freedom to choose. Pass over of control from the supplier to the customer, in this way decreasing vendor lock-in (Ven et al., 2008). With the use of open platforms and open standards, the user is not dependent on the vendor, this limits the power of vendor. Integration and compatibility with other software products improves with OSS.

Organisations found that the adaptability to create their own specific update cycles. In addition, the freedom to update some of the parts of a system is an important influencing factor for OSS. By bypassing the vendor, the software created to suit the needs of an organisation unequivocally and staying away from vendor lock-in found to be a unique business benefit to organisations by Morgan and Finnegan (2007).

A specific benefit related to the adaptability of choice is the versatility of usage that OSS gives us flexibility energizes customisation and experimentation. One more business benefit indicated is the versatility of OSS software licenses. Past use of proprietary software and vendor lock-in can furthermore be an inhibitor to OSS adoption as the sunk costs associated with getting and keeping up proprietary software adds to the switching costs (Goode, 2003).

Once, organisations not under a contractual agreement with a vendor also known as vendor lock-in, the organisation has more choice in the event that the vendor goes bankrupt or quits supporting an item (Hwang, 2005; Nagy et al., 2010). Studies have demonstrated that more freedom from software vendors is an influential factor in adopting OSS, especially in the public sector (Dedrick and West 2004)

OSS gives a chance to increase national IT sovereignty and helps in the decrease of software robbery and intellectual property issues (Hwang, 2004). For some countries, adopting OSS additionally means the lessening reliance on foreign software companies (Ellis & Van Belle, 2009). Another influential factor is that OSS empowers companies to switch vendors and provider of service without agonizing over changing the software. Keeping a single vendor out of owning all parts of an IT division is a factor that is considered in OSS adoption cases (Hayes, 2009).

Source code accessibility factor

Free and OSS supporters state that access to source code is an essential empowering agent of OSS adoption. In some of their past exploration Dedrick and West (2004) found that access to source code is appealing to a few organisations, some organisations however keep away from changing source code by and large. Ven, Verelst and Mannaert (2008) assert that access to source code is not important to all organisations. Organisations frequently adopt mature OSS products for use and do not customise the code, as they do not have the skills and support. Not many organisations have the abilities to roll out improvements to the source code. Kamseu (2004) additionally found

that access to source code is not generally the essential reason behind adopting OSS.

Access to source code seen as a preference in the public sector, Richter, Zo and Maruschke (2009) found that in Brazil, access to source code gave a chance to create software to suit their needs and expand IT acumen, prompting the occupation creation inside the nation. Developing nations commonly see OSS as an instrument to create value. Access to source code makes it conceivable to create custom applications and redistribute changed code (Ghosh, Krieger, Glott & Robles, 2002).

The availability of source code provides an opportunity for developers to customise the software as per client requirements. The proprietary software does not make the source code available to the clients (Gopalakrishnan, 2006). Having permission to access source code gives some transparency, expanding the trust that the software being used is free of purposeful and deliberate security issues.

Access to source code gives favourable circumstances as far as software quality. Raymond (1999) detailed Linus' Law expressing that given enough eyeballs, all bugs are shallow, and i.e. a wide group of programmers can discover software bugs speedier than a small group of programmers creating software.

The accessibility of source code as an element in OSS adoption choices rely on the kind of organisation. A similarity made between the typical build or buy decision and the significance of the accessibility of source code in OSS adoption. Organisations without a software improvement capacity would regularly purchase software off the shelf or by means of a software seller or advisor. Accessibility of source code is not imperative to these Organisations, as they do not have the assets or competencies to utilise it.

Organisations that want to make their own particular software discovers extraordinary value in OSS as the accessibility of source code permits them to utilise data installed as a part of the source code to make tweaked adaptations

for themselves. On the off chance, that customisation is impossible, the accessibility of source code gives knowledge of the internals of the platform, making it less demanding to make software to run on that platform.

Cost factors

The cost factor of OSS is the important aspect in the Dedrick and West (2007) exploration of OSS. The cost associated with OSS broadly discussed in literature on OSS adoption. General perception is that the OSS products are cost effective and the migration to OSS project is cheaper. Lower costs acknowledged by two factors, the first is the nonexistence of licence fees for OSS software and software updates. The second cost factor is associated with the interoperability and the ability to integrate. OSS frequently runs on hardware and that it runs all the more adequately on different hardware (Dedrick and West 2004).

The idea that OSS is free is a common misunderstanding; a few OSS vendors offer OSS products in enterprise edition that made available with certification and support services. Companies who do not have in house capabilities, perhaps, may require support services for the successful adaptation of the OSS. Software costs are additionally not just limited to, licensing costs, the total cost of ownership (TCO) is utilised to focus the cost of adopting software and considers acquiring, operation, and maintenance and transfer costs.

The TCO studies are frequently conflicting and have a tendency to be environment particular (Ven et al., 2008). Cost measures like TCO and rate of investment (ROI) are regularly not utilised as a part of OSS selection choices, regardless of the acknowledgment that cost ought to assume a huge part in adoption choices (Yuan, 2009).

Switching costs (Ven et al., 2008) and sunk costs (Nagy, Yassin et al. 2010) refer to costs of earlier software deployments that need to be considered before adopting different software.

The significance of cost in OSS adoption choices is subject to the scale of adoption. In Belgian firms, for small scale adoptions, lower cost assumed a noteworthy part as it empowered experimentation with a small budget (Holck, Pedersen et al. 2005). In large-scale adoption, proprietary software permit rebates turn into an inhibitor to OSS adoption as the near TCO is comparative contrasted with proprietary software. Studies of Brazilian private companies disaffirms the perception that just small Organisations profit from cost reserve funds, 73 percent of Organisations with more than 1000 workers are using OSS. Organisations in Germany and India utilise OSS to decrease costs. Reduced TCO is expressed as one of the main influencing factors behind OSS adoption in Brazilian Organisations, as the OSS platforms are often available free or at a low licence cost, maintenance and repair costs (Richter et al., 2009).

When considering the drawbacks and benefits of OSS adoption, reduction of cost considered as the main benefit (Morgan & Finnegan, 2007). The business case for OSS selection is determined by lower costs, however is subject to the application area, Organisation size and cost flexibility in the business sector. Application area and adoption scale is essential as it may be expensive to migrate starting with one platform, then onto the next (Holck, Pedersen et al. 2005). The level of importance of software to the business assumes a part in adoption choices. Software with low importance and high value affectability has a tendency to be better competitors for OSS selection (Kwan & West, 2005). In the German public sector, low cost base is one of the fundamental drivers of OSS adoption. The German foreign office began moving to OSS in 2002 and by 2005, it was the least expensive service in German government regarding IT consumption.

Through a joint effort with local businesses, costs minimized and national competitiveness in software commercial enterprises might be enhanced (Hwang, 2005). Low cost is the main influencing factor in selecting OSS products in developing countries. When the total cost of ownership considered in developing countries, the impact of software licence fees is more prominent. Lower labour costs imply that licence charges constitute a greater rate of IT costs (Paudel, Harlaka & Shresta, 2010).

The cost advantage due to low licence costs and software upgrade cost is one of the factors motivating the government's OSS approach (Webb, 2009). The lower costs connected with OSS were additionally specified as an empowering influence of OSS selection by Ellis and Van Belle (2009). The business case for OSS selection is determined by lower costs, however is subject to the Organisation size, structure and cost (Holck, Pedersen et al. 2005).

Support factor

Another factor that affects the adoption decision is the level of the support required. Organisations in Australia have demonstrated that an absence of reliable support is an inhibitor to the OSS adoption (Goode, 2005). OSS supporters argue that the OSS community can provide better support over proprietary software vendors. Organisations are uncomfortable with community based support as the community cannot be considered responsible (absence of ownership) when things happen. The requirement for support is dependent on the level of OSS knowledge and expertise in an organisation. Organisations with better internal OSS skills are less reliant on support from external vendors. The accessibility of outside support is fundamental to the OSS adoption for the organisations where the necessary skills to support the OSS product are not available internally (Dedrick & West, 2007; Richter et al., 2010).

Dependence on external support is seen even in those companies who already adopted OSS as found by Ven (2009). Organisation utilised OSS without external support where there are excellent internal IT skills within the organisation. Organisations without external vendors use the OSS community of the OSS developers as support vendors to save costs. While trying to increase the cost savings, a few OSS adopters decide to utilise OSS without any commercial support. This can result in reduced overall business value and increase the risk of failure. The Brazilian government migrated to OSS through the support of big Organisations like IBM, Novell and Cisco (Ven, 2009).

Technological factors

The literature related to OSS adoption agrees that technological factors play an important role in OSS adoption. Technological factors influencing OSS adoption decision in organisations include security, stability, maturity, usability and performance. Quality and nature of support is an applicable factor as examined above. The environment in which software is used plays an important role when considering the software maturity (Ven and Mannaert 2008).

Reliability is an essential part of software development also matured software additionally seen as reliable. It is useless to compare OSS and proprietary software as both types can extend from being very stable to being unstable. The important factor is to assess software products for a specific solution. OSS can be anything from being more reliable (Morgan & Finnegan, 2007) than proprietary software to being unreliable to the alternatives. OSS software is primarily utilised in systems infrastructure in Singaporean organisations, bringing about scalability and stability (Yuan, 2009).

Organisation's experience with OSS assumes a part in capacity to choose. Organisations with no experience in OSS are better off picking software that they are familiar. James and Van Dame (2008) have discussed the maturity of the organisation managing OSS. Their measure of maturity considers the application inside the organisation, accessibility of support and the maturity of the development community behind the software. Stability, performance and security of OSS software prompted higher dependability and trust by Organisations in Brazil (Richter et al., 2009). Interestingly, high dependability noted as a negative factor by some product advisors or vendors as it lessens the open doors for providing consistent support to organisations (Morgan & Finnegan, 2007).

Another typical view among organisations is that OSS is an immature technology, not yet ready for business use. Numerous people and companies accept that products accessible free of charge must be of poor quality when contrasted with the paid proprietary software. To plant instability and

uncertainty proprietary software vendors regularly utilise this observation within their displaying. Extensive scale of OSS adoption and support of real software vendors, however, counters the impression of immaturity and a few OSS development models have been produced to help organisations focus on the development of software (Nagy, 2010).

James and Van Belle (2008) highlight maturity factors that are organisation driven, result driven or outside element driven. They found that the maturity of the software under assessment is subject to its proposed application inside the organisation. Compatibility is an influencing and significant factor to OSS adoption. OSS adoption choices influenced by the similarity with existing advances, skills and undertakings (Dedrick & West, 2004; Morgan & Finnegan, 2007). Two sorts of incompatibilities exist when considering OSS adoption, the first is inconsistent with existing legacy software, and the second is incompatibilities because of OSS project forking (Nagy et al., 2010). Resemblance to the existing software products elevate user acceptance, expanding the likelihood of adoption (Richter et al., 2010). Organisations see the incompatibility of OSS products with Microsoft products as an inhibitor to OSS adoption (Goode, 2003). In the longer run, companies will profit from adopting OSS on IT infrastructure because of the large amount of interoperability and maintainability. According to Holck (2005), in the long term adoption of OSS might extend from applications to wider infrastructure.

Where a group of developers split up due to difference and takes the existing code down two different paths, this is referred to as forking (Weber, 2004). If an OSS project forks, the client is stuck on one side of the fork. The software may get incompatible to the opposite side of the fork. In the event that the opposite side of the fork is more successful, chances are that your side of the fork may soon get extinct and incompatible until you switch (Weber, 2000). A pragmatic user will only adopt mature OSS products. Open standards play a very important role in the public sector adoption choices. Open standards allows integration and interoperability (Hwang, 2005).

Supporters of OSS claim that numerous individuals reviewing the OSS software diminish the security risks connected with OSS. The probability of

somebody discovering a security issue and resolving that issue is higher in the instance of OSS (Weber, 2000; Hwang, 2005). Concerns exist around purposeful security gaps. Access to source code guarantees that organisations, and governments that the software they are utilizing is free of both purposeful and non-deliberate security gaps (Hwang, 2005). Obscurity does not enhance security and a security is only as good as its secret (Raymond, 2004). Enhanced security is regularly referred to in the public sector as a key influencing factor of OSS adoption (Weber, 2004). Security was an element in Brazilian private sector OSS adoption choices (Richter et al., 2010). According to Mtsweni (2008), the developers who are collaborating in the OSS development community have a better chance of discovering and fixing security issues.

Organisational factors

Human factors assume a part in adoption decisions and the human factors are interrelated with all the adoption factors noted above. The idea of OSS champions, OSS supporters and boundary spanners mentioned all through OSS adoption literature. As said, the expertise in an organisation will determine the decision of seeking external support. User Acceptance and Top Management support are the two other factors that are crucial for the successful adoption of OSS in an organisation.

An important human barrier to OSS adoption is the individual resistance to change specially for large-scale migrations (Holck, 2005). Clients should feel convinced by the benefits technologies have to offer, not by force. Clients are not interested in the ideology behind the technology they are only interested in the usability of the software (Richter et al., 2009).

Top management and leadership buy-in are the influencing factors in the adoption decisions (Richter et al., 2009). Skills and competencies needed to support the OSS software and the right staff are the factors influencing top management adoption decisions (Morgan & Finnegan, 2007). James and Van Belle (2008) found that lack of social interaction in staff is a barrier to successful migration of OSS. The accessibility of in-house OSS skills is an

essential adoption factor. Lack of skills prompts reliance on outside help (Nagy, 2010). Organisations with existing OSS skills are better prepared to mitigate risks connected with OSS adoption and they have lower training costs (Goode, 2003). Van (2010) found that lack of skills and awareness identified as the Inhibitors to adoption.

By having, OSS champions and boundary spanners in an organisation lack of awareness should be resolved. To connect an organisation with new technology boundary spanners can play a key role and help provide the knowledge and skills needed for successful adoption (Ven & Verelst, 2009). Morgan & Finnegan (2007) argue that organisations and individuals can possibly be influenced by the existence of OSS champions. Dedrick and West (2007) found that the amount of influence OSS champions have within an organisation is determined by the institutional limitations in the organisation and their position within the organisation.

Environmental factors

An inhibitor to OSS adoption is the absence of practical experience in OSS technology and the experience in adopting and implementing OSS. When an organisation adopts OSS successfully, other organisations follow the lead. Proof of successful OSS migration could lead to other organisation migrating to OSS. Lack of relevance found as an inhibitor to the OSS adoption (Morgan & Finnegan, 2007). Table 2.1 below summarises the factors that may affect OSS adoption.

Factors of OSS Adoption 2-1

Technological Factors	
Relative Advantage	Relative Advantage is the degree to which an advantage perceived to be better than the idea it supersedes (Rogers, 2003).
Compatibility	The degree to which an innovation perceived as being consistent with the existing values, past experiences and needs of potential adopters (Rogers, 2003).
Complexity	Complexity is the degree to which an innovation perceived as difficult to understand and use (Rogers, 2003).
Trialability	Trialability is the scale to which the innovation is divided small chunks over time (Rogers, 2003).
Observability	Observability is the level to which the results of an innovation are visible to the technology adopter (Rogers, 2003).
Organisational Factors	
Total Cost of Ownership	Total Cost of Ownership is the cost of acquiring and using an innovation (Wouters, 2005).
Boundary Spanners	Individuals within an organisation who connect their organisation with external information and can bring the organisation in contact with innovations (DePietro, 1990).
Relevance to the Organisation	Relevance is the perception that benefits of the innovation are relevant to the organisation (Goode, 2005).
Top Management Support	Senior management support the adoption of the innovation (Glynn, 2005).
Environmental Factors	
Market Conditions	Market conditions are the competitive forces and levels of uncertainty in the market (Chau and Tam, 1997).
Skills and Services	The availability of level of skills and services that are required to utilise OSS (Dedrick, 2003).
Real World Experience	Real world experience is the practical experience of OSS migration (OGC Report, 2002).
Well-performing business model	Well-performing business model is an explicit model for profitability (Barnes, 2003).
Individual Factors	
Skills	Skills are the abilities of the individual to use the innovation (Barnes, 2003).
OSS Champion	OSS Champion is someone with drive and charisma supporting the adoption (Glynn, 2005).

SUMMARY

The review of literature has uncovered a huge collection of studies with the focus on OSS adoption in organisations. In spite of distinctive types of organisations, a number of factors have emerged that influence or inhibit the decisions around OSS adoption. Considerable research focus on factors that facilitate OSS adoption within organisations (Dedrick and West 2004). Other research identified inhibitors to OSS adoption within organisations. Literature identified OSS adoption depends on factors such as availability of internal and external support of OSS, switching cost, institutional pressures to adopt OSS, software's reliability, source code availability, avoiding vendor lock-in (Bonaccorsi and Rossi 2004, Dedrick and West 2004, Fitzgerald 2006, Shah 2006, Moreno-Sanchez, Anderson et al. 2007, Morgan and Finnegan 2007).

And other benefits that may impact OSS adoption includes: quality (Krishnamurthy 2003), performance (Forge 2006), flexibility of use; large developer and tester base (Krishnamurthy, 2003); low cost (Initiative 2012); flexibility allowed by licenses (IDC, 2005); user support from a community (Krishnamurthy, 2003), increasing collaboration (Agerfalk et al., 2005) and encouraging innovation (Wheeler, 2005; Forrester, 2000). The inhibitors to the OSS adoption identified in the literature review includes compatibility (Webb, 2001), security risks (Herbsleb, 2002), lack of skills (Krishnamurthy, 2003), lack of user support (Webb, 2001), lack of ownership (Kenwood, 2001; Guth, 2006) and higher training investment in OSS (Forrester, 2004). The literature review has made it clear that the factors affecting technology selection choices frequently include an exchange between diverse factors. A number of the factors specified in the technology adoption literature assume a greater part in OSS adoption choices in organisations. The kind of organisation, a sort of software and the environment of the organisation in which the OSS product will be used impacts the adoption.

3. METHODOLOGY AND FIELDWORK

Introduction

This section depicts the philosophies, approaches, methodologies, decisions, systems and methodology considered and chosen throughout this examination process. It gives the basis behind these determinations and present moral contemplations, boundaries, and lessons learned by going through this process.

Research Philosophies

Personal viewpoint, practical considerations and epistemology influence the research philosophy. Epistemology *"concerns what constitutes acceptable knowledge in a field of study"* (Saunders *et al*. 2009, p. 112). Tashakkori and Teddlie (1998) suggest it is more appropriate to think of the philosophy adopted as a continuum rather than opposing positions. Three philosophies were examined; positivism, interpretivism and pragmatism.

Remenyi et al. (1998, p.32) describe positivism as "working with an observable social reality and that the end product of such research can be law-like generalisations similar to those produced by the physical and natural scientists". The researcher in this case is more concerned with observable facts gathered from the social reality. This type of research conducted in a supposedly value-free way because of the fact that the researcher is external to the process and cannot affect or contaminate the data collected. However, it can be argued that every researcher has included some form of their own values in the sense that they have chosen to pursue a particular research topic or objectives. The emphasis of the positivist approach tends to be on what is quantifiable and facilitates statistical analysis. However, there are cases where positivism is adopted using data collected in interviews, but the emphasis tends to be to quantify data collected through interviews.

Orlikowski and Baroudi (1991) highlighted that Information Systems research had previously exhibited a single set of philosophical assumptions regarding what constitutes valid knowledge and suggested that this single research perspective was too restrictive. They noted that it was unclear whether the researchers consciously examined their prevailing assumptions that were

rooted in the natural sciences, and believed that these assumptions taken for granted. They presented an additional research philosophy for consideration; interpretive. The key difference between a positivist and an interpretivist is that the former believes that there is an objective reality out there that can be objectively (or almost objectively) measured and *"such studies serve primarily to test theory"* to draw inferences about a phenomenon (Orlikowski and Baroudi 1991, p.5).

Pragmatism not dedicated to any one method of philosophy or reality. Researchers focus on the 'how' and 'what' of the research question (Creswell, 2003, p.11). Mertens (2005, p.26) argues that the pragmatists "rejected the scientific notion that social inquiry was able to access the 'truth' about the real world solely by virtue of a single scientific method". The pragmatic paradigm places "the research question" as central and applies all approaches to understanding the question (Creswell, 2003, p.11). Pragmatism was considered for this research because it places the research question as central and applies all approaches to understand the question (Creswell, 2003, p.11).

The pragmatist epistemology stands in contrast to existing positivist and interpretivist vision of scientific discovery. Whereas positivism focuses on the objective, properties of the actual issue in hand and the reality that is independent of observation, interpretivist focuses on the creative role of active, subjective participants, one of whom owns a claim on truth. Pragmatism, on the other hand, rejects positivism, on grounds that no theory can satisfy its demands and rejects interpretivist because practically any theory would satisfy them (Pansiri, 2005). To a pragmatist, it is important to facilitate human problem solving but it is not important to find the reality or the truth because the existence of the truth or reality is in dispute (Morgan, 2007).

Research Strategy

Considering the pragmatist paradigm already selected for this research, the semi structured interview strategy selected as most appropriate.

Sampling

Data collection was carried out using semi-structured interviewing ten Information and Technology (IT) managers. The Head of Information Systems

who are the IT managers for the local authorities were invited to participate by email, mainly because the IT managers have the authority to take the technology adoption decisions. Invitation was sent to 31 managers in local authorities and LGMA. Ten mangers participated in the interview, though the number of interviewees was low, four from the city councils and four from the county council and two from LGMA participated in the interviews, providing good range of perspective.

Approach and Validity Concerns

It is important that the methods employed during a research project and the conclusions drawn can stand up to close scrutiny. Research design is key to reducing the possibility of drawing the wrong conclusions, thus the emphasis is on two elements of design; reliability and validity. Reliability is the extent to which data collection techniques or analysis procedures will produce consistent findings (Jones, 2009). Since the approach to the interviews was of a semi-structured nature, reliability was a concern; would another researcher reveal similar information, could there be interviewer or interviewee bias, might there be generalisability issues. Validity concerns are the measure of accuracy and whether they are actually measuring what they are intended to measure. (Golafshani 2003).

Planning and preparation for the interviews was important to ensure credibility and obtain the confidence of respondents, particularly given the seniority of the interviewees and the value placed on their time. It was important to have a high level of knowledge of both the subject area and the organisation in which the interviews would take place. The ability to draw on this type of information proved valuable during the interviews, particularly when it gave respondents the opportunity to discuss particular projects or initiatives that they may have been closely associated with. Preparation involved immersion in any documentation or commentary on the subjects of open data and open government.

Saunders *et al.* (2009) point out that credibility can be promoted by supplying information to interviewees prior to the interview. An information sheet containing background information on the study and what was trying to be

achieved was forwarded to interview participants in advance of interviews to give them insight into the study. The research question and theme were also provided in advance to allow participants to consciously or subconsciously think about their own opinions in advance and to ensure the interviewees were comfortable and did not feel as though they were being put on the spot. This approach proved particularly successful as it made the initial stage of the interview more comfortable since the interviewee already had some idea of the rationale behind the research, the type of data being collected and commitments to anonymity, easing any potential for anxiety. It also meant participants were already open to consenting to the interview and in many cases the participants were in a position to suggest and in some cases provide supporting documentation that might be helpful during the research.

Care was also taken in the approach to questioning to reduce the scope for bias, thus increasing reliability of data collected. *"The use of open questions should help avoid bias"* (Easterby-Smith *et al.* 2008, cited by Saunders *et al.* 2009, p.332) and provides the opportunity to follow up with more probing questions. This approach was taken and leading questions were avoided. To further reduce the scope for bias, the questions followed were developed based on the literature that had been reviewed, reports, and documentation from a wide range of sources, rather than personal experience of the topic. The research supervisor also reviewed them.
Notes were taken to assure the interviewee of the importance of their responses. Triangulation, the use of two or more independent sources of data or data collection, was deemed good practice for this research, to strengthen conclusions.

Research Choices

Semi structured interviews was used in this research; interviews were used to collect the data to answer the research question. More precisely, this was a qualitative study using in-depth interviews, which were analysed using qualitative procedures.

Techniques and Procedures

The development of a research proposal in the early stages of this research helped to refine the original topic area into distinct objectives. A good research

question is *"just right for investigation at this time, by this researcher in this setting"* (Clough and Nutbrown 2002, p. 34, cited by Saunders *et al*. 2009, p. 33). The research question was discussed with the research supervisor and it was agreed that the topic selected was one of interest now. It is important that this research would reach clear and unambiguous conclusions, so that appropriate action may be taken. In the case of this research, questions were posed to discover where deficiencies may exist and why they exist. To gain a better understanding of the area of study, a review of the relevant literature was completed. The conclusions drawn in the process of reviewing the literature were of central importance when the approach to the research process, including the formation of questions for interviews, was being considered. In order to obtain a clear view of the attitudes towards open source within local government, data were collected in the form of semi-structured interviews. This data was collected because of the absence of this type of data due to the boundaryed research in this field in Ireland. In certain cases, particularly the publication of the E-government action plan in April of this year, helped in some way to prompt discussion during many of the interviews. It underscored the fact that the area of Open source in Ireland is just now coming under the spotlight and some progress is being made during the course of this research project. It was important to keep abreast of news on the topic to ensure the research remained relevant.

While deciding on the approach that should be taken, an important factor was the period allowed and capability of gaining access to the data required. Saunders *et al.* (2009, p. 22) note that *"certain, more sensitive topics, such as decision making by senior managers, are potentially fascinating. However, they may present considerable access problems".* Access to senior decision makers, which are the IT managers, was a concern, but the perspective they would have was an essential part of this study. Ten people at senior decision-making level came forward for one-to-one or telephone interviews. Of these, all were serving in senior positions in local government authorities. Each individual was invited to participate by email, in some cases the possibility of an interview was discussed in person in advance, but this was always followed up with email correspondence to ensure each individual was fully aware of the subject matter and what might be expected of them.

The email consisted of a description of the research proposal, the research questions, an information sheet and an informed consent form copies of which can be found in Appendices 1 - 4.

The participants were invited to suggest a date, time and location for the interview and this was strictly adhered to. The semi-structured nature of the interviews meant that, though the questions were compiled in advance, each interview provided ideas for sub questions in later interviews, adding a degree of flexibility that could not be gained from structured interviews. The interview questions were designed to prompt discussion on areas of interest in this study, but were open enough to allow interviewees to bring up new topic areas which may not have been considered otherwise. The interviews took place over a period of one month and lasted between 30 minutes and 80 minutes. Given the status of the participants, the level of time taken for the interview was extremely generous.

As suggested by Saunders *et al.* (2009), the data were then linked using codes, in this case the date of the interview and the sequence number of the participant, in order to preserve their confidentiality and anonymity. The notes relating to their interviews would remain confidential, that participation in the study was voluntary and that it was not necessary to answer all questions. The interviewees were advised that they would not be named in the research document and that the notes relating to their interviews would be deleted on the 31st of October 2014, once the study has been completed, in order to comply with the Data Protection Act. Ethical approval was sought from the Research Ethics Committee at the school of Computer Science and Statistics on the 25th of May 2014 and approval granted on the 25th of June. Supporting documentation sent to the Research Ethics Committee can be found in Appendices 2 - 4. The entire interview was documented that evening by the interviewer to ensure everything was noted and correct, and where interviewees made comments *"off the record"* that these comments were excluded from the transcripts. This was also an opportunity for the researcher to reflect on what had been discussed during an interview and think about how best to proceed with the next one. Qualitative data analysis was performed on the transcripts from interviews along with documentation. Chapter 4 of this document elaborates further on the analysis.

Lessons Learned

It was estimated that interviews would take between 40 minutes to 1 hour. Since a cross section of senior decision makers were interviewed, it became clear that some had more to say about the topic than others. In some cases, the interview lasted just over half an hour with others lasting over an hour. This range wasn't anticipated in advance, but it did not appear to cause any issues. Where interviews were shorter than anticipated, answers to all questions were still provided. Where interviews lasted longer than expected, the interviewee was given the opportunity to display specialised knowledge or examples of experience in the subject area. All questions were asked of all participants and in the same sequence, however, given the open nature of the questions, all participants began to partially answer some of the later questions during their initial answers. The important thing was that certain topic areas were covered and the required responses were elicited by prompting the interviewee to discuss their views. This made an analysis of the responses a little more time consuming, but the richness of the responses merited this approach. The questions were not always read as from a script, but were asked in a way that was appropriate to the interviewee at the time. Some responses prompted sub questions to try to draw out more information or to follow up on a previous question. The interviews began with an interviewee who was particularly interested in the research topic and was helpful in providing feedback about the questions covered. A lesson learned during the interviews was the more preparation done in advance and the more knowledge acquired about the interviewee's organisation, the better the interviews went.

4. FINDINGS AND ANALYSIS

Introduction

The chapter on the research findings presents the results of the qualitative data collection process. The influencing and inhibiting factors of the OSS adoption, discovered during the interview process discussed in this chapter. The chapter concludes with a summary of the research findings as obtained during the semi-structured interviews.

Background and Context

Around the world, public sector organisations are assessing availability and potential of OSS based solution (Morgan and Finnegan 2007). In Ireland, OSS has transitioned into the realm of local government and OSS products are either being considered for adoption or adopted in the local government sector (Harbison, 2008). An example of one such adoption in the local government sector is the implementation of Libre Office by the Limerick city council (Council, 2001-2014). Furthermore, an Open Source Practice Centre (OSPC) was set up by the Local Government Management Agency (LGMA) to promote collaboration between local authorities on the use of OSS, to understand OSS and its application and to implement OSS based solutions at the national level on behalf of 31 councils (LGMA, 2012). While the local government sector in Ireland is taking important steps towards adopting OSS products, adoption has been slow and sporadic. The aim of this research is to identify the factors influencing OSS adoption decisions in Irish Local authorities and to understand the barriers that inhibit OSS adoption. The research includes software ranging from desktop applications to IT infrastructure software.

Analysing and Interpreting the Research Data

An inductive approach adopted for the analysis of the qualitative data collected from the source:

- Transcripts from semi-structured interviews

Preparation for analysis followed the data display and analysis approach based on the work of Miles and Huberman (1994) who look at analysis in the form of three concurrent sub-processes:

- Data reduction;

- Data display;
- Drawing and verifying conclusions.

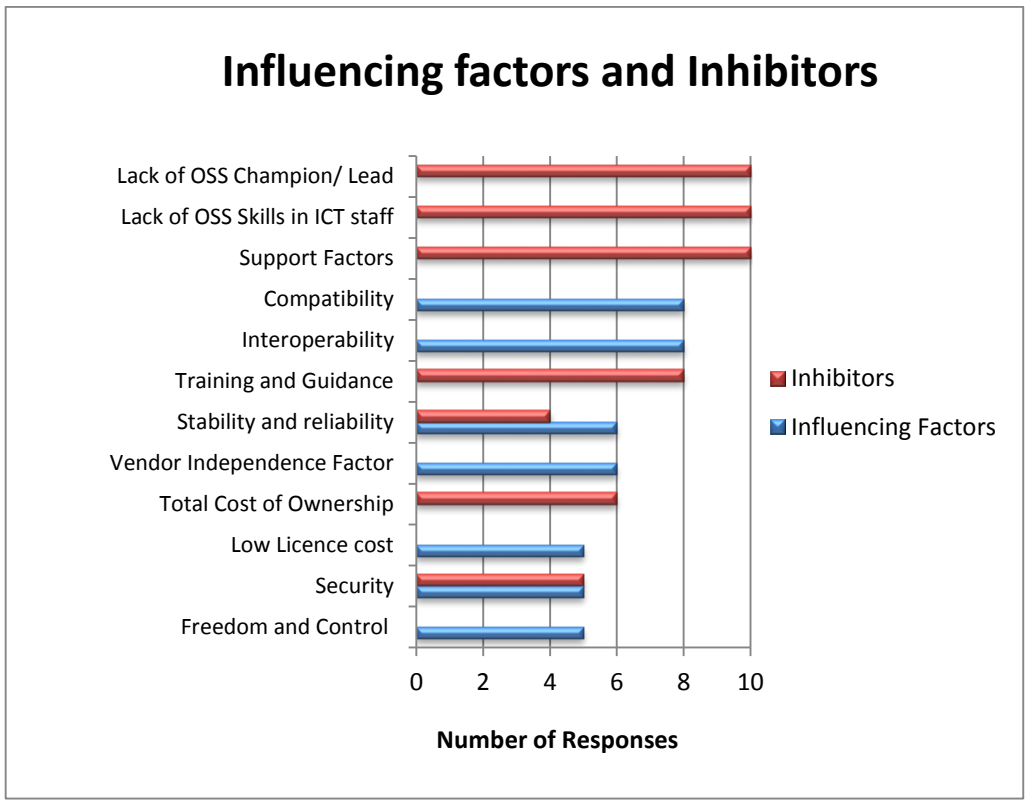
This was identified as being most useful in the context of the research question and objectives of this study.

Semi-Structured Interview Analysis and Findings

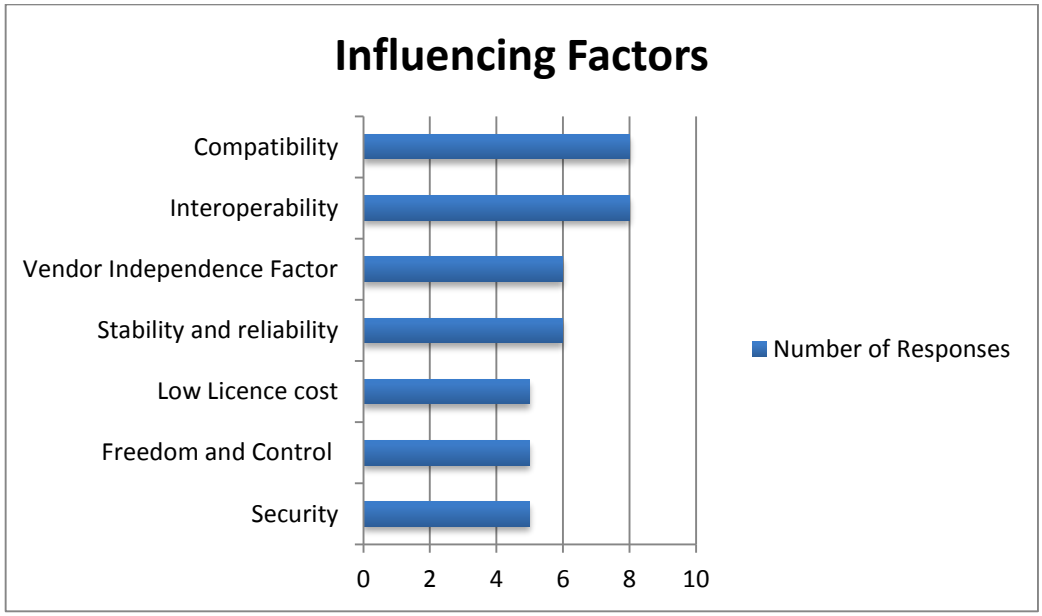
Based on the literature review the interview responses are categorised under headings representing specific factors identified in the literature review. The primary purpose of the discussion is to determine the factors influencing or inhibiting the adoption of OSS in Local government sector.

Figures 4.1, 4.2 & 4.3 below, depict responses of the interviewees against the influencing and inhibiting factors. All of the ten interviewees agreed that the lack of the OSS champion or a leading authority on OSS, lack of skills in ICT staff, lack of support, training and guidance are the inhibitors in the adoption of OSS local authorities. In addition, vendor independence and technological factors such as interoperability, compatibility, stability and reliability identified as the influencing factors.

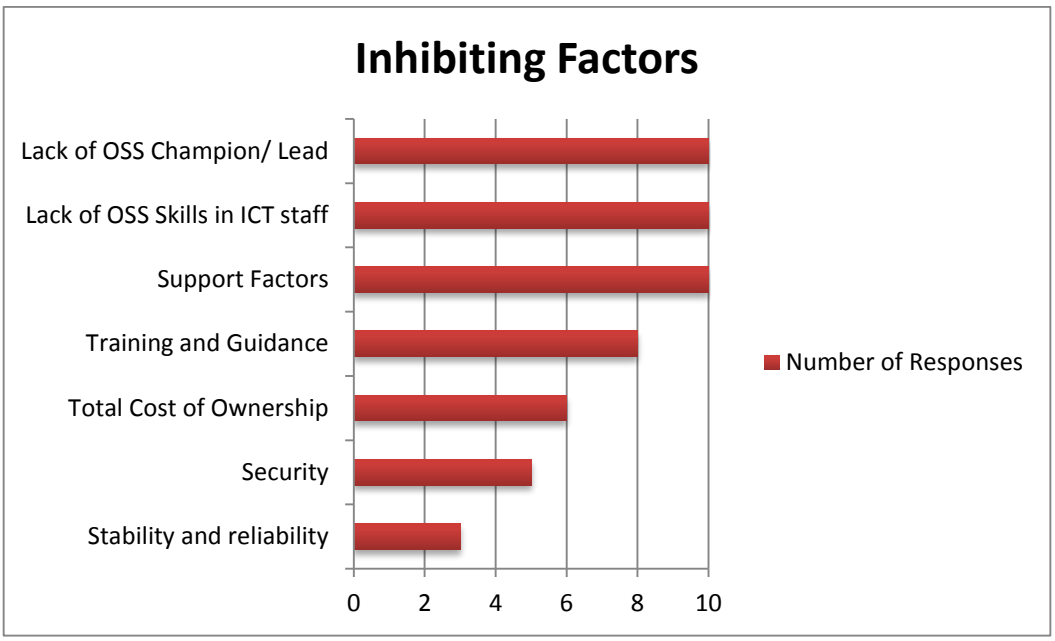
Influencing and Inhibiting Factors 4-1



Influencing Factors 4-a



Inhibiting Factors 4-b



The Table 4.1 below summarises and lists the influencing and inhibiting factors specific to local authorities.

Influencing and Inhibiting factors in LAs 4-1

Influencing Factors	Inhibiting Factors
Interoperability	Lack of OSS Skills in ICT staff
Compatibility	Lack of OSS Champion/ Lead
Stability and reliability	Total Cost of Ownership
Vendor Independence	Training and Guidance
Freedom and Control	Support Factors
Low Licence cost	Security

4.4.1 OSS definition

All the interviewees have good understanding of the definition of OSS and most of them expressed the view that the accessibility of source code is an important aspect of the OSS definition. For example, one interviewee defined OSS as follows:

"*OSS is software whose code is available for free or under a licence. But if our local authority downloads and modifies the code, the modified code has to be distributed*".

The freedom of switching vendors and the possibility of enhancing the products are specified as a feature of the OSS definition, particularly by city councils as they have the resources for developing and customising the code.

4.4.2 Access to OSS source code

Throughout the interviews it was made clear that access to source code is beneficial, however, since the local authority IT staff are not familiar with OSS programming languages such as PHP, the developers in most of the local authorities will not be in a position to change the code without training and support.

During the interviews, it emerged that access to the source code is not relevant to the local authorities. All the interviewees felt that access to source code has no relevance mainly because they do not have the necessary skills. The lack of importance or relevance to availability of source code in the local authorities is consistent with literary findings. Similar findings were made by both Dedrick and West (2004) and Ven, Verelst and Mannaert (2008). They revealed that the availability of source code is irrelevant to some organisations.

4.4.3 Local authorities' adoption of OSS

All the interviewees who participated in this study are IT managers in local authorities, who have authority, to take decisions on the technology adoption. Local authorities use both community and vendor based OSS.

Strategic decision within the sector to outsource in-house development is resulting in organisations choosing vendor-based software. One interviewee expressed a view that,

"*Ideally, I would like to train internal developers, working on OSS products. But a decision is made by the top management to outsource the development as a result I'm forced to select the vendor based OSS products*".

Lack of skills is the other factor for choosing vendor-based software. Vendor based software is a OSS software made available by vendor. The vendor also provides the support and guidance as the added advantage. The Community based software however does not have the accountability.

One interviewee noted that,
"*Since, I am new to php programming language it took a while to learn and customise the OSS software and hence the project was delayed by at least 3 months, I would prefer vendor based software, so that I have the support and accountability from the vendors who are supplying the OSS product*."

Local authorities have opted for both community and enterprise OSS products. It is evident from the interviews that the vendor-based OSS is more prevalent than the community based OSS products in the sector.

4.4.4 OSS products used by Local Authorities

The local authorities interviewed use OSS products such as Drupal, Alfresco, Sugar CRM, Libre Office, Open Office, Linux, MySQL, PostGres, Post Mail, Zarafa, and all the authorities are currently using national software systems delivered in open source technology such as Drupal, Sugar CRM and Linux Operating System. During the interviews, it was evident that Alfresco, Drupal, Linux, Apache web server and Firefox are most commonly used OSS products. Adoption of Linux operating system found to be dominant in Germany, Brazil and India in both public and private sectors (Richter *et al.*, 2006). From the interviews, it was also evident that a shared service financial system is working of the Linux Operation system. A general trend is evident that the local authorities are increasingly using more OSS applications in the sector.

Other Applications mentioned in the interviews with IT managers include web browsers such as Firefox and email clients. One interviewee noted that their local authority uses OSS applications as replacements for proprietary software that provides similar functionality but comes with a license fee (e.g. Libre Office).

All the interviewees noted that the Open Source Practice Centre in LGMA has implemented centrally hosted business critical application for the sector in open source technology. For example an interviewee expressed a view that; "*Successful use of OSS products for the national shared service system leads to other authorities experimenting with OSS*".

Many local authorities are considering the use of OSS products. An another notable view expressed by an interviewee is that for the end users the technology used is irrelevant as long as the system is user friendly.

OSS Products used in Local Authorities 4-1

	Carlow County	Cork County	Cork City	Fingal County	Galway City	Leitrim County	Limerick Council	Meath County Council	Wicklow County Council	All the local authorities
Drupal	✓			✓			✓		✓	
Alfresco		✓				✓		✓		
Sugar CRM		✓				✓		✓		
MySQL		✓		✓			✓			
Postgre Sql		✓		✓			✓			
Post Mail		✓		✓			✓			
Zarafa		✓		✓			✓			
Linux		✓		✓			✓			
Libre Office					✓		✓			
Open Proj					✓		✓			
Firefox										✓
Apache										✓

Table 3.1 above lists the OSS products used by Local Authorities. Local authorities with in-house software development capability are using OSS

products such as Drupal Content Management System to create public facing portals. Sugar CRM as Customer Relationship Management System. Two national shared services systems delivered using the Apache web server and Linux, implies that all the local authorities are using the web server, Apache and the Operating System (OS) Linux. The high usage of Apache and Linux is in line with the literature findings. However, the web server and OS are the only such OSS products that are widely used by local authorities.

4.4.5 The strategic importance of software adopted

The Local authorities provide a wide range of services to citizens from building control to housing. Information and communication technology is the first choice for the delivery of a wide range of local services to all citizens.

One of the interviewees also stated that; "OSS provides councils with a cost advantage and help deliver mission critical applications for low costs".

One of the interviewee expressed a view that;
"*Recently, LGMA has implemented two national shared services project that are delivered using OSS products. The two projects are critical for business and have significant strategic importance*".

The above response from the interviewee suggests that the local government sector is adopting OSS products for the strategically important projects.

When asked why the OSS products used to deliver the strategically important projects, the interviewee replied that, "*I believe the OSS products used are stable, reliable and interoperable*".

4.4.6 Freedom and control factors

One Interviewee expressed that, "*OSS provides an opportunity for local authorities to gain IT independence and also aids in the decrease of software piracy and intellectual property concerns. OSS allows organisations to change vendors and service providers without tormenting about changing the software being used. Avoiding a single vendor from owning all features of an IT department is a factor to be taken into account in OSS adoption decisions*".

Another interviewee expressed a view that, "*the existence of OSS products provided the freedom of choice in relation to software selection, an opportunity to consider new innovation and allows to have control on the software implemented*".

Another interviewee expressed that,
"*OSS might provide the freedom and control, but when technology is considered for a particular business problem, it is the business problem that dictates the technology not the other way around*".

Five of the interviewees consider the freedom and control as an influencing factor while the other five believe that the freedom and control is insignificant and what matters is the appropriate technology for a business problem. This finding contradicts the literature finding, studies have demonstrated that more freedom from software vendors is an influential factor in adopting OSS, especially in the public sector (Dedrick and West 2004)

4.4.7 Technological factors

- ***Relative Advantage***

Five respondents noted that the relative advantage of low licence cost is the factor that is influencing OSS adoption in the local authorities. The reduced costs are associated with software licenses and upgrades. While the other five respondents believed that in the end, the total cost of ownership of the OSS products is higher.

One Interviewee strongly expressed his position by stating,

"*I believe the prompt of this whole new direction towards OSS products is the cost, so if open source is cost effective compared to proprietary software then yes, we will definitely use OSS into the future*".

Another viewpoint expressed by couple of respondents who used OSS products in the past and now reverted to Microsoft products,
"Cost benefit analysis exercise should be made mandatory, so that it can be established that the product/technology adopted would prove sustainable and deliver the value. It does not matter if the product is Open Source or proprietary, but the value, the product offers matters the most. Choosing the technology as per the business requirements is the key. If the decision about the product is made before considering the business requirements, just simply on the basis that OSS product can be deployed on the reduced cost. Well, it will not work for all the business problems. At some point, we will need to cross that threshold because OSS software could be equally as expensive as the commercial products due to supporting and customising costs. Over the long run it is not sustainable".

One interviewee noted that, "*the Dual Open Source Approach should be considered at the local government sector level. Moreover, that this approach offers the most potential to Local Government. There are few Open Source products in the OSS field that follow the Dual Approach, such as Alfresco, Sugar CRM and many more each of these solutions offer an Enterprise Application which costs similar or in the case of CRM more than the equivalent proprietary product. Each also offers a community version, which has no cost for the license. However, the costs for support, maintenance and bug fixes can be very high. The only way to counteract the risk of high costs, according to the interviewee is to become an active part of the community or share the risk across the whole Local Government Community*".

The local authorities realise that the development and maintenance cost of OSS is expensive and the only cost savings are made in licensing costs for some OSS products.

- ***Compatibility***

An interviewee expressed a view that;

"*The technological factor such as ease of access, ability to collaborate, open platform (PC, Mac & Linux Compatibility) and open standards such as an open document format makes OSS a better option*".

Another interviewee expressed that the products such as Linux, MySQL and Apache are quality software. In addition, key software components available for integration and ability to make changes to open source code for extra value and development and run time environments for fast and iterative deployments (PHP, Perl, Python, and Ruby on Rails) and Open Source as an Engine for Web 2.0 are all the technological factors that influence the adoption of OSS.

A factor relating to software compatibility is the possibility of OSS being compatible with multiple hardware platforms. Another factor mentioned is the compatibility of the user experience. The user experience related to the usability of the software.

One of the interviewees also stated that; "*OSS provides councils with a cost advantage and help deliver mission critical applications for low costs*".

Interviewees expressed those OSS office products most compatible with versions of proprietary office productivity software than the proprietary software upgrade (i.e. Open Office is more compatible with Microsoft Office 2003 than Microsoft Office 2010). The perceived incompatibility of OSS with Microsoft products (Goode, 2003) was therefore not relevant to all local authorities.

One of Interviewee stated that, "*OSS is not user friendly as the OSS development community is highly technical and not as dependent on user interfaces. The main focus of some OSS is on providing functionality which is compatible rather than the usability*".

Eight interviewees expressed a view that the OSS products are compatible.

- ***Security***

Four respondents believed the proprietary software is more secure than the OSS. Six respondents believed that OSS is secure, mainly due to the OSS development model. The OSS development model provides a large developer base the opportunity to detect and resolve security issues.

Another factor mentioned in relation to security was the human need to uncover the hidden. OSS provides no incentive to uncover the hidden as all the source code is available. Proprietary software provides a challenge to uncover the hidden and therefore experiences more security attacks in the form of hacking and viruses.

One interviewee expressed a view that;
"*People have this reception that OSS products are not secure, since the source code is available to edit, but people should take into consideration that code is reviewed by other developers and any security gaps are identified by them before it is released*".

Mixed views expressed regarding security this is broadly in line with the literature review.

- ***Stability and reliability***

One of the respondents suggested that,
"*Operating System (OS) Linux is considered and has been used to implement financial shared services project. The Linux operating system implemented by LGMA for a project is widely used by most of the local authorities. Linux has been chosen not just to save costs, but because of reliability and stability offered by the product*".

All the interviewees expressed a view that the stability and reliability of the OSS software depends on the OSS product chosen. In addition, they all noted that OSS software products such as Linux are more reliable and stable. Research also suggests that the OSS software is primarily utilised in systems infrastructure bringing about expanding scalability (Yuan, 2009).

- ***Interoperability***

Almost all the interviews agree that the OSS products are interoperable. One interview stated that, "*I believe that OSS products are interoperable and can operate on any platform*".

A view expressed by another interviewee is that, "*The government's policy suggests that the open standards should be incorporated in delivering e-services and OSS products offer open standards*".

All the interviewees expressed a view that the OSS products interoperability is the key influencing factor. OSS frequently runs on hardware and that it runs all the more adequately on different hardware (Dedrick and West 2004).

In general, the perception of the technological factors influencing the adoption of OSS varied across different local authorities. A perception often varies based on the organisations familiarity of the software be it OSS or proprietary. The difference found was not between OSS and proprietary software domains, but between factors influencing software development projects. As is the case with proprietary software, maturity of the software related to the maturity of the organisation developing the software. Many community based OSS projects have a single developer, resulting in the projects considered as immature. Organisations generally avoid using software from immature projects as it increases their software adoption risk. OSS or proprietary software generally perceived to be mature when developed by well-known vendors.

In summary, the technological factors influencing the choice of software related to the software in question and not the choice between OSS and proprietary software.

4.4.8 Support Factor

Almost all the interviewees noted that lack of support for OSS products has been a major inhibiting factor. The local authorities' especially smaller local authorities do not have the skills and resources to provide support and accountability. One interviewee expressed a view that, "*There is a need for a*

lead an OSS champion who can provide support and guidance to the local government sector".

One interviewee noted that, "*our local authority do not want to adopt community based software due to lack of support, we need accountability and support so that we can be assured if something goes wrong it can be corrected in timely fashion and effectively* ".

It is evident from the responses that there is a clear requirement for an authority that is responsible for providing support and guidance. Lack of the support and accountability has emerged as the inhibiting factor in the sector. The literature review also suggested that lack of accountability and support as the inhibiting factor for the adoption (Morgan, 2007).

4.4.9 Vendor independence factor

One interviewee suggested that the business requirements dictate the selection of the software and that vendor lock-in or independence will not affect the selection of the product.

And another interviewee from a large local authority noted that all the products available in the commercial market and the OSS arena should be explored before making the selection decisions. Interviewee also expressed an opinion that the authorities can negotiate with the commercial software vendors as they now have an alternate option in the form of OSS products.

Six interviewees believed that vendor independence is the influencing factor and four interviewees believed that it not considered as a factor for OSS adoption decisions. Studies have demonstrated that vendor independence is an influential factor in adopting OSS, especially in the public sector (Dedrick and West 2004)

4.4.10 Organisational factors

- ***Total Cost of Ownership***

The costs related to adopting software is not just limited to the costs related to licence, there are other costs such as software switching costs, operation, maintenance and upgrade costs, development costs, support and training costs. All the other costs together constitute what is known as total cost of ownership (TCO). The results of TCO studies tend to be specific to environment and differing (Ven, 2008). Literature suggests that the measures of cost such as TCO and return on investment (ROI) are often not used in OSS adoption decisions even though the cost plays a role in the adoption decision (Yuan, 2009).

However in the local government sector the TCO is determined as the important factor and the overwhelming response to this question has been that every adoption of Open Source Software needs a Total Cost of Ownership (TCO) to justify it. Local authorities determine the TCO of software, usually over a period of three to five years. Costs taken into account in the TCO calculation include all costs associated with the software over the lifetime of the software such as license fees, support costs, development and repair costs. Other costs includes, the cost associated with customisation of source code and in some cases the cost of obtaining the source code if it is not included. OSS cost advantages are not limited to software costs, but also the cost of hardware that the software runs on.

One interviewee expressed a view that, "*OSS migration may perhaps be expensive, when in-house skills to customise the software does not exist and the organisation is dependent on community based OSS. Development & system maintenance costs, infrastructure & infrastructure support costs and training costs contribute to the overall costs associated with the adoption of OSS products*".

A view emerged that the switching costs associated with training and transition should be included in the TCO. Finally, the cost advantages of OSS can only be determined by taking into account not only the costs associated with

software, but also the costs of hardware that the software runs on and the supporting organisational infrastructure.

Almost all the interviewees express the view that at the outset, the cost of OSS product may be low, but the total cost of ownership is always on par or above to the proprietary software products.

One Interviewee expressed a view that "*the existence of OSS vendors such as the ones we used for our portal is indication to the fact that OSS is not necessarily free in monetary terms and that viable business models exist for supplying OSS*".

The Total Cost of Ownership turned out to be more of an inhibitor rather than an influencing factor. This finding is contradicting the literature findings, Webb (2009); Ellis and Van Belle (2009) argue that the lower cost of OSS products is the key influencing factor in OSS adoption.

- ***Top Management Support***

Management buy-in appeared as the major organisational factor that could influence the adoption decision. One interviewee expressed that the top management is in favour of the products be it OSS or proprietary as long as the product fits the requirements.

One Interviewee stated that, "*I would like to see a recommendation from the government to at least include OSS products in the technology evaluation stage. The recommendation might compel the management to rethink the OSS option*".

4.4.11 Environmental factors

- ***Skills of ICT Staff***

Four of the respondents expressed a view that the lack of programming skills in the Open source technology and total dependency on the vendors for customisation is creating a risk of single point failures.

One Interviewee noted that "Existing ICT staff are proficient in Microsoft products and migration to OSS products are often found to be time consuming as a lot of time is spent learning the programming language to customise the code."

All the interviewees noted that the OSS skills are hard to find in the local government sector and hence there is reluctance in adopting OSS. There is a need to address the problem of lack of knowledge and skills in the sector and LGMA should play a role in addressing the issue. This study discovers that the lack of skills as an inhibitor to OSS adoption in Irish government, this is in line with the findings of Ellis & Van Belle (2010) who argued that the skills of ICT staff affect the software adoption decisions.

- ***Training and Guidance***

One interviewee suggested that the software migration costs are quite high in the local government sector. A view that highlighted during the interviews is that the end users are quite happy to adopt software provided in OSS as long as the system is user friendly.

Another notable point raised is that the migration should be seamless to the end users. In addition, an interviewee suggested that the OSS training and guidance was found to be neglected by some organisations. James and Van Belle (2008) have found, the training and guidance can help the OSS adoption.

- ***OSS champion***

One interviewee expressed a view that, "*LGMA should try to become OSS champion and a lead authority, the technical background of the agency staff will help them become the champion and understand the technical advantages of the OSS development methodology and the software that it produces. The existence of OSS champion in the sector will help reduce some of fears of the local authorities' by providing the skills and knowledge needed for successful adoption*".

The existence of the OSS champion discovered to be an influential factor to OSS adoption. Existence of OSS champion is in line with literature findings, according to Ven (2009) the existence of OSS champion is an influencing factor.

It emerges that the existence of a champion in the sector could influence in number of local authorities to adopt OSS products. Existence of software champions is an influencing factor. In the local government, any one authority does not champion OSS.

SUMMARY

Interview responses also revealed that software adoption decisions are rarely about choosing between OSS and proprietary software. Software adoption decisions are about choosing the technology as per the business requirements.

The factors that found to be not consistent with the literature is the TCO, the local authorities consider the TCO of OSS to be an inhibitor; this finding contradicts the literature findings. This study identified factors specific to local authorities in OSS adoption. The lack of OSS champion or a leading authority, lack of skills, lack of support, training and guidance, TCO and lack of wide range of reliable and stable OSS products found to be inhibitors to the adoption of OSS in local authorities. Interoperability, compatibility, stability and reliability considered as the influencing factors. The findings lead to the conclusion that there is a strong need for an OSS champion who can provide accountability, support and guidance to local authorities. Another conclusion drawn is that the OSS is rarely free and there is switching costs associated with the adoption. Local authorities are happy to adopt OSS if it offers solution to the business problems by means of delivering the products on time, on budget and on quality.

5. CONCLUSIONS AND FUTURE WORK

Introduction

This chapter discusses the conclusions of this research along with some limitations. The purpose of this research was to establish the influencing factors and inhibitors of open source adoption in local government. Understand the factors that affect the adoption may help others to make an informed technology adoption decision.

Answering the Research Question

This research answers the core research question of: what are the influencing factors or inhibitors to the adoption of open source in local government?
The findings deliver a number of specific influencing and inhibiting factors, which fall under the more general headings of; technical and organisational related concerns.

The intention of this research was to investigate why Open Source has not progressed largely in Irish local authorities sector, with the following key objectives:

1. To determine what factors influence the adoption of Open Source
2. To determine what barriers exist hindering the adoption of Open Source

The findings from the interviews help answer these objectives. While many may believe the factors influencing or inhibiting the OSS adoption to be well known, this research actually provides relevant factors influencing or inhibiting the adoption of OSS in local authorities. This research highlights that in its most basic form the OSS adoption decision remains a technology adoption decision and the factors that influence general technology adoption decisions apply. It highlights that the software adoption decisions are rarely about choosing between OSS and proprietary software. Business requirements should dictate the choice of the software. Decisions made totally on the business requirements will yield greater benefits.

The lack of OSS champion or a leading authority, lack of skills & support, lack of training and guidance are the inhibitors in the adoption of OSS local

authorities. Vendor independence and technological factors such as interoperability, compatibility, stability and reliability identified as the influencing factors.

5.3.1 Access to source code

It is evident from the interviews that the availability of source code is possibly the most important factor in OSS adoption decisions, not because it allows anyone to change the software, but because it enables the OSS development methodology that results in better quality software. The OSS development methodology also encourages the use of open standards that reduces the risks associated with vendors when adopting new software.

Mainly large city councils have the ability to use source code in their software development process to improve products and reduce development time by reusing existing code. Such councils considered access to source code as a positive influencing factor. However, the majority of the IT staff in local authorities is proficient in Microsoft products. OSS is a new or unfamiliar technology for the staff and hence the sector is spending money on customising the OSS products. Apart from the couple of large authorities', access to source code is not of relevance to most of the local authorities.

Access to source code is commonly associated with the ability to change the source code. In an enterprise environment, changing the source code is actively discouraged as changes to software break the certification and reduces the suitability of the software. The lack of relevance for access to the source has, to some organisations was found by Dedrick and West (2004).

5.3.2 Software adoption costs

The costs associated with adopting software found to be relevant in OSS adoption decisions. The local authorities are aware that the community editions of OSS products may be free, but the cost of customising the code, migration costs, training costs and support costs and in turn the total cost of ownership of the OSS products are high.

It is evident from the interviews that the local authorities are considering and adopting an approach where the enterprise OSS products supplied by a vendor who offers support certification and the ability to train users on the use of OSS software. The same approach used to deliver a national local government shared services project using an OSS product. The factor that emerged is that OSS can run on multiple platforms, dropping the reliance on a particular vendor, increases competition and reduces adoption costs. It is interesting to note that the local authorities consider total cost of ownership of OSS as high but acknowledges the low licence costs.

5.3.3 Freedom and control

Since the development, method of OSS produces software that adheres to open standards and runs on multiple platforms. Local authorities are therefore not bound to a particular hardware and software vendors, when OSS products adopted. To have control and access to source code allows the organisations to determine the quality of the software they are using and switch vendors if quality or functionality is not up to standard.

While some interviewees believed that OSS provides government with an alternate option and freedom to choose and control, others believed that the option of freedom and control is significant as the technology chosen based on the business needs be it OSS or any other technology.

5.3.4 Technological factors

In summary, the technological factors that are influencing the choice of software related to the software in question and not the choice between OSS and proprietary software. The OSS development methodology allows a large development community to access and improve the source code of the software they produce. However, local authorities consider some OSS products mature, stable and reliable for example, Linux operating system. In summary, some OSS products considered stable and reliable while other products considered less stable and reliable.

As with any technology adoption, choosing the technology suitable to the business requirements is the key. In addition, it is also very important to take

into account the credibility of the vendor providing the technology and the support and the accountability the vendor can offer.

Opinions seem to be dividing on the security of the OSS product. OSS proponents argue that security problems are more noticeable and very much fixable in OSS as the possibility of finding security issues are much higher due to the number of developers looking at the source code increase. The OSS products considered worse than proprietary software in terms of usability. Often the usability of the products has been better suited to the IT staff than the public.

5.3.5 Support factors

Support considered as a significant inhibiting factor when taking adoption related decisions. Local authorities are adopting vendor-based OSS, so that they can avail the support offered by vendors. Using certified OSS enables local authorities to get support from both software and hardware vendors, but often the cost of support is high.

5.3.6 Organisational factors

Organisational factors such as management buy-in and the inhibitors related to adoption of new technology is the lack of training and guidance. It is important that users of the technology are equipped with the needed skills through training.

5.3.7 Environmental factors

Evidence of successful implementation of OSS products is an important factor in OSS adoption. OSS adopted in the local government sector is not widespread, but evidence of successful adoption does exist. The Local Government Portal and Building Control Management Systems are two national shared services projects successfully delivered using community based OSS products. Only some factors found to be relevant in literature emerged relevant in the Irish context. Interviewees raised concerns around the availability of support for the community based OSS products. From the interviews, it is evident that that future software adoption decisions will include

both proprietary software and OSS options. The interviewees expressed the point that OSS provides a viable alternative to proprietary software.

Conclusion

Early research in the OSS arena focused mainly on the motivations of the developer who contributed to the development of the OSS products that they end up giving away free. Literature in early days focused in the motivations of the OSS developers' and then the focus of the researchers shifted to understanding why OSS was significant to organisations. This research report gives organisations useful guidance on which factors they should consider when deciding on adopting OSS.

A range of factors influences the decision to adopt new or unfamiliar technology in an organisation. OSS has been in existence for some years, yet OSS products still considered with suspicious view. It is evident from the responses that the suspicion is due to lack of accountability and support for OSS products. IT staff in Local authorities are familiar with proprietary software and hardware, but are unfamiliar with OSS programming languages, such as PHP and hardware products. Lack of an OSS champion, lack of skills, lack of support and accountability emerged as the major inhibitors. It was evident from this study and the responses that there is a need for a lead authority and an OSS champion and it was suggested that the LGMA should develop expertise in OSS programming languages such as PHP and operating systems such as Linux and become the lead authority, to make recommendations, provide support and guidance to local authorities. However, it also emerged that the OSS products such as Linux operating systems used to deliver strategically important national shared services projects. This reveals that stability and reliability factors positively influence OSS products such as Linux. In addition, the other factors that influence the adoption include compatibility and interoperability and vendor independence. It is interesting to note that the local authorities consider total cost of ownership of OSS on par with the proprietary software and TCO emerged as the inhibitor.

Recommendations

The following recommendations emerge from this research:

- The local government should establish policies concerning the use of Open Source Software. Recommending that, during the technology consideration phase, OSS products should be given fair consideration.
- Sustainable business models are critical for example, the Dual Open Source approach should be considered at the local government sector level.
- During the OSS product migration, a change management system should be deployed to review, approve, and track the use of OSS projects.
- Cost benefit analysis exercise should be made mandatory before the OSS adoption, so that it can be established that the product/technology adopted would prove sustainable and deliver the value.
- The LGMA should continue to research, understand the community and maturity of Open Source products, and provide guidance to the local authorities.
- The LGMA should develop skills and expertise in the OSS arena and become an OSS champion to provide support and draw recommendations for the local government sector.

Limitations of the Study

This research is based on responses from the interviewees thus its generalisability should be treated with an element of caution and further research is required to improve the generalisability of the study. The research could have been strengthened by increasing the number of interviews and by conducting case studies on local authorities that adopted OSS. It is worth noting that the semi-structured interviews give a perspective from inside the local authorities, but this research could have included participants from outside the local authorities to get a different perspective. However, given the time constraints this was not possible. The level of detail required from participants and the importance of the context meant the interview approach was the most appropriate, though time-consuming. All participants were IT managers in the Local Authorities and LGMA and were well informed about the

topic. As such, the research uncovered strong findings, which may be relevant to other public sector organisations.

FURTHER RESEARCH

This study serves to improve the knowledge of OSS in Local authorities and has contextualised some of the international research by interviewing representatives from local authorities. However, further room for research into OSS, an increasingly important aspect of ICT adoption and growth in Ireland is suggested.

Further research on OSS adoption in Government organisations could include the following:

- A Study of OSS adoption in Local and Central government.
- A study into the availability and perception of OSS vendors in Ireland.
- Case studies investigating OSS adoption successes and failures in the Irish Government.

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7. Appendices

Appendix 1 – Email Request to Participate in Interview

Dear <PARTICIPANT'S NAME>,

I am inviting participants to complete an interview with me. This interview is part of a series of interviews I am arranging with a carefully selected sample of staff from your organisation as part of my final year research project for my masters in Management Information Systems in Trinity College Dublin (TCD). This study aims to explore the factors affecting the adoption of OSS in local authorities.

Understanding the factors that affect the adoption may help others to make an informed technology adoption decision.

I attach an information sheet for participants. An outline of my proposed interview structure is also attached, although it is not my intention to follow this rigidly. I am hoping to conduct these interviews in June and envisage that each interview will last between 40 minutes and one hour. The interview can take place in person or over the telephone. I am aware of the need to treat my findings with the utmost confidentially. No source or individual will be identified. Participation is voluntary and all research findings reported will be on an anonymous basis.

No name or email address will be associated in any way with participant's responses. All personal information is treated with the utmost confidence and is password protected with encrypted security. When the research is complete, all respondent's names and email addresses will be deleted by 31st October 2012. One of my intentions is to form a chapter in my dissertation summarising the research findings. Should participants wish to view the research findings from this study, an electronic copy of this dissertation is available on request to me at the end of the study. I would be extremely grateful if you could let me know a suitable time for a telephone interview. And suitable time and venue for

an interview at your convenience, by either replying to this email or telephoning at the numbers provided below.

Should you have any queries or questions please do not hesitate in contacting me.

Kind regards,
Himabindu Achanta
Email: achantah@tcd.ie

Appendix 2 – Information Sheet for Interview Participants

Information Sheet for Interview Participants

Before participating in this research study, please read this information sheet carefully.

Study: Open Source Software in local authorities and factors influencing and inhibiting the adoption

Dear Sir/Madam,

I am currently undertaking MSc in Management Information Systems at Trinity College Dublin. As part of the postgraduate programme I am required to complete a research study. I am conducting a qualitative pragmatic study exploring factors influencing and inhibiting the adoption of Open Source Software (OSS) in local authorities.

This study aims to explore the factors affecting the adoption of OSS in local authorities, I hope the study of the factors influencing or inhibiting the adoption of OSS will help managers to take an informed decision on future adoption of OSS products.

The study has received ethical approval from the college Ethics Committee. Participation involves completing an interview, which will take approximately between 45 and 60 minutes. The IT managers in the Local authorities are invited to participate in the study via this email. Please note that I have access to the LA IT managers' group email. I will not influence or pressurize you to participate in the study, the decision to participate is your own decision, please do not feel obliged.

All information obtained will be treated confidentially and no individuals shall be named throughout the process. The study data will not be linked with any names or personal details, and will be stored in a secure place and not shared with any other persons without your permission. Participants have the right to withdraw from the study at any time throughout the process, without penalty.

If you require any additional information or have any further questions relating to the study, please email me at achantah@tcd.ie. If you would like to participate in the study, please sign the attached consent form and scan and send it to the email address- achantah@tcd.ie given below. If I do not hear from you I will assume that you do not want to participate and I will not contact you again. If you have any questions before making a decision, please feel free to contact me at achantah@tcd.ie

DECLARATION:

- I am 18 years or older and am competent to provide consent.
- I have read, or had read to me, a document providing information about this research and this consent form. I have had the opportunity to ask questions and all my questions have been answered to my satisfaction and understand the description of the research that is being provided to me.
- I agree that my data is used for scientific purposes and I have no objection that my data is published in scientific publications in a way that does not reveal my identity.
- I understand that if I make illicit activities known, these will be reported to appropriate authorities.
- I freely and voluntarily agree to be part of this research study, though without prejudice to my legal and ethical rights.
- I understand that I may refuse to answer any question and that I may withdraw at any time without penalty.
- I understand that my participation is fully anonymous and that no personal details about me will be recorded.
- I have received a copy of this agreement.

PARTICIPANT'S NAME:

PARTICIPANT'S SIGNATURE:
Date:

Statement of investigator's responsibility: I have explained the nature and purpose of this research study, the procedures to be undertaken and any risks that may be involved. I have offered to answer any questions and fully answered such questions. I believe that the participant understands my explanation and has freely given informed consent.
RESEARCHERS CONTACT DETAILS: E-mail: achantah@tcd.ie

Appendix 3 – Informed Consent Form

INFORMED CONSENT FORM

RESEARCHER: Himabindu Achanta

Study: Open Source Software in local authorities and factors influencing and inhibiting the adoption

I am currently undertaking MSc in Management Information Systems at Trinity College Dublin. As part of the postgraduate programme I am required to complete a research study. I am conducting a qualitative pragmatic study exploring factors influencing and inhibiting the adoption of Open Source Software (OSS) in local authorities. This study aims to explore the factors affecting the adoption of OSS in local authorities, I hope the study of the factors influencing or inhibiting the adoption of OSS will help managers to take an informed decision in the future, in the adoption of OSS products.

The study has received ethical approval from the college Ethics Committee. Participation involves completing an interview, which will take approximately between 45 and 60 minutes. All information obtained will be treated confidentially and no individuals shall be named throughout the process. The study data will not be linked with any names or personal details, and will be stored in a secure place and not shared with any other persons without your permission.

Participants have the right to withdraw from the study at any time throughout the process, without penalty.

If you require any additional information or have any further questions relating to the study please contact me at 08XXXXXXXX or email me at achantah@tcd.ie

I have read this consent form, fully understand and voluntarily consent to participate in this study.

DECLARATION:

- I am 18 years or older and am competent to provide consent.
- I have read, or had read to me, a document providing information about this research and this consent form. I have had the opportunity to ask questions and all my questions have been answered to my satisfaction and understand the description of the research that is being provided to me.
- I agree that my data is used for scientific purposes and I have no objection that my data is published in scientific publications in a way that does not reveal my identity.
- I understand that if I make illicit activities known, these will be reported to appropriate authorities.
- I freely and voluntarily agree to be part of this research study, though without prejudice to my legal and ethical rights.
- I understand that I may refuse to answer any question and that I may withdraw at any time without penalty.
- I understand that my participation is fully anonymous and that no personal details about me will be recorded.
- I have received a copy of this agreement.

PARTICIPANT'S NAME:

PARTICIPANT'S SIGNATURE:

Date:

Statement of investigator's responsibility: I have explained the nature and purpose of this research study, the procedures to be undertaken and any risks that may be involved. I have offered to answer any questions and fully answered such questions. I believe that the participant understands my explanation and has freely given informed consent.

RESEARCHERS CONTACT DETAILS: E-mail: achantah@tcd.ie

INVESTIGATOR'S SIGNATURE:

Appendix 4 – Interview Questions

Interview Questions

1. Do you use open source software?
2. What are the benefits you are hoping to realise through the use of open source software in your local authority?
3. Do you seen any issues in using open source software if so what are they?
4. Is your local authority planning to use more or less open source software in the next 2 years?
5. What are the major financial, operational, and organisational concerns associated with software implementation in your organisation? Please explain.
6. What has been the impact of open source software on the productivity of employees as well as your business processes?
7. List the types of OSS you adopted, also list the names of the specific software packages adopted.
8. What is the strategic importance of the OSS that has been considered or adopted in your authority?
9. Do you consider access to source code an important factor when choosing software? If so, why?
10. Which costs do you take into account when determining the costs associated with adopting software?
11. Do you estimate overall costs of software projects quantitatively?
12. Determine if TCO or ROI are used to estimate the costs associated with adopting software.
13. Which factors relating to support do you consider in software adoption decisions?
14. Is vendor independence a factor in software adoption decisions?
15. Which organisational and human factors do you take into account in software adoption decisions?
16. Does evidence of software adoption successes or failures influence software adoption decisions?
17. Which factor had the most influence on the decision to adopt or reject software?