Open Source Software Adoption in non-profit Organisations – Socio-Technical perspectives

Guoli Zhang

A thesis submitted in partial fulfilment of the requirements of Napier University for the Degree of Master of Philosophy

Edinburgh Napier University
School of Computing
December 2009 (Amended)

Abstract

Open source software has grown from a small sub-community of developers and users with their own ideologies to a significant element in the IT strategies of major vendors.

Open source communities and practices have been researched extensively and the business side of open source has also been investigated. Research has typically been into either the corporate environment or developer communities. This research concentrates on open source adoption in non-profit organisations, which are often small and frequently run by volunteers.

What factors influence the adoption of open source software in non-profit organisations? Technology does not develop deterministically, the socio-technical nature of technology has to be taken into account because technology shapes and is shaped by social context. Engagement with technology depends on individual values and technology adoption depends on organisational cultures. A useful conceptual framework is the Socio-Technical Interaction Network (STIN), and in this research the idea is adapted to the needs of describing technology adoption. A number of authors have pointed out the similarity between evolution and technology adoption, with environmental feedback processes. Here, the STIN is re-conceptualised as a Socio-Technical Feedback Network (STFN).

Hypotheses were formed about factors influencing open source adoption in non-profit organisations after identifying discussion topics in online forums for non-profit organisations. It was decided to conduct an online survey and also to conduct a small number of interviews to obtain more detailed information about social context. Quantitative data from the questionnaire was analysed with SPSS, using various statistical tests. The results were used together with the interview material to provide interpretations of the observed phenomena and to test the hypotheses.

From the statistical results of the survey and follow up interviews, the following conclusions were made:

- Computer users with IT awareness are more likely to use OSS.
- Computer users with IT awareness are more likely to believe that IT has more general, educational benefits.
- Preference for personal contact over mass media makes OSS use less likely (such users are less likely to be innovative).
- Different styles of organisational decision-making can influence the likelihood of OSS adoption: non-technical decision-makers are less likely to choose OSS; organisations with committee decisions are in general less likely to use OSS; some individual ‘lead-users’ may have enough influence to bring OSS to an organisation.

In summary, this study provides insight into the factors influencing the adoption of open source software in non-profit organisations, conceptualised in terms of STFNs, an extension of the idea of STINs to contexts of technology adoption.

Declaration

I, Guoli Zhang, confirm that this dissertation and the work presented in it are my own achievement.

Signed: Guoli Zhang

Date: 04-Jan-2010

Matriculation no: 02007031

Acknowledgments

Thanks to my director of study Kathy Buckner, who gave me advice. Also thanks to my second supervisor Dr Keith Horton, who helped throughout especially towards the completion of the thesis.

Guoli Zhang

Contents

Tables:

Figures:

Chapter 1. Introduction

Open source software (OSS) has had a radical influence on the IT world. There are many large-scale open source projects now and magazines devoted to Linux, the free Unix “clone”. There has been a large amount of media attention with open source in the news because of projects like LiMux (Linux migration in the public administration organisations of Munich). How far has open source been adopted? Certainly open source dominates in certain areas – web server software for example. It is also widely used in software development. However, there has been a variable level of adoption in general and it can be expected that smaller organisations will present an interesting case because the effects of organisational and personal differences will be easier to study.

There are two main objectives of this research. One is to build up a model of OSS adoption in non-profit organisations, particularly in relation to the decision processes involved. The other is to use that model to determine which factors are most important in decisions on whether to adopt OSS, and predict which factors are most likely to lead to success or failure in adoption.

Non-profit organisations are chosen as the target of study because since these are typically organisations with small budgets, it might seem on the face of it that OSS would be ideal, but the situation is not that simple. A certain proportion of non-profit organisations have large budgets, however, adoption has been slow, partly because of lack of staff time, or because of the expense of change, or other social reasons.

Adoption of OSS depends on the decision making process in relation to ICT procurement strategy, and that is influenced by policy, organisational structure and networking. Few studies have considered non-profit organisations and their adoption and use of OSS. At this particular time, however, it is an excellent chance to observe an evolving system at a crucial stage.

Organisations such as NOSI (Non-Profit Open Source Initiative) have sprung up to support non-profit organisations in any trials or adoption of OSS. Many feel they need advice, and there has been a general lack of information among staff working in non-profit organisations about implications of IT policy.

Research on open source software so far has included Scacchi's work on STINs (Scacchi, 2005) and von Hippel's work on innovation theory (von Hippel, 2005). This research aims to build on that work by introducing elements from diffusion theory. Rogers (1995) emphasises communication channels for example and study of communication channels is a part of this research.

The first stage of the research involved informal discussions with people with an interest in open source software, and with people working in non-profit organisations. Those people are individuals known by the author. The purpose of this was to identify some preliminary issues for investigation. The research then proceeded to an analysis of messages posted to the NOSI discussion forum, which is a forum aimed at non-profit organisations (Non-profit Open Source Initiative). The purpose of this is to confirm what issues are suitable for investigation during the research. After that stage there is further empirical study through a survey, and hypotheses from the theoretical considerations are evaluated.

Chapter 2. Literature Review and Research Issues

First there is a review of material from literature on open source and on technology adoption in general. The purpose of the review is to identify areas for investigation in the case of open source adoption in non-profit organisations, and to aid in the construction of a conceptual framework for the investigation. The review will also be used to identify areas of research which can usefully be extended so that they are more relevant to investigation of the adoption of open source software in non-profit organisations.

2.1 Open Source and the Open Source Environment

As Lerner and Tirole (2001, p.819) say, “Open source software has attracted substantial attention in recent years”. This is for both technological and social reasons. Some supporters of free/open source software have strong ideological views while others avoid them or think they are relatively unimportant, concentrating only on the practical benefits of the ‘open source way’. The different motivations and ideologies have been studied as much as the technical features of open source (Ljungberg 2000, Raymond 2001). Open source has been described as a ‘revolution is software’ and certainly it is an innovation in terms of working practices and in terms of licensing. Central to any investigation of the adoption of open source are theories on the diffusion of innovations.

Several open source projects have been dramatic successes, for example the Apache web server, which is the dominant Internet web server with a market share of approximately 70%, and the Linux operating system which is now a real competitor to Microsoft Windows. The development of open source software is done mainly by groups of developers who collaborate through the Internet and its organisation is non-centralised, with shared responsibilities among developers rather than traditional management structures (Scacchi 2004). Another feature of its social organisation is the close involvement of

users, who are involved in testing and bug reporting. There are several different styles of project organisation in open source. Some projects are run mainly by one person, some are run by loosely organised groups and others are run in a more organised manner with management committees and formal voting systems. What they all have in common, however, is heavy use of the Internet and Internet-based tools designed to support distributed collaborative working. These tools include, for example, the CVS version control system, bug tracking systems such as Bugzilla, and online forum management tools. There are many specialist open source websites and importantly there are sites offering specialist hosting facilities for software projects, with special purpose management utilities, for example sourceforge. The sourceforge has demonstrated the rapid growth of open source with the number of hosted projects growing significantly every year. Now there are over 10,000 open source projects on sourceforge.

This raises several issues for research on factors influencing the adoption of open source software in general:

- Why do some open source projects succeed while others fail?
- What social and 'environmental' factors influence open source adoption?
- Is user involvement necessary for open source projects to succeed?

To gain an understanding of the open source software phenomenon it is necessary to consider its history, both in terms of its technical development and in terms of the ideas surrounding it. Open source has been a major influence in the commercial software world only over the last ten years and it has come to exist because of the appearance of the Internet as a communication medium, but also because of ideology, so analysis of its origins and growth is not straightforward.

Now consider the growth of open source software. Open source has been described as an innovation in software development, and since the 1990s, open source has experienced tremendous growth. How has this come about?

In fact the open sharing of information about computing has a history as old as computing itself. In the early days, as Webber explains, "…code was something you naturally collaborated on and shared. This was natural because everyone was just trying to get their boxes to do new and interesting things, reasonably quickly, and without reinventing the wheel" (Webber, 2004). This was at a time when businesses were not involved in the use of computers – they were being used by academic researchers working on the basics of computer design and programming.

A significant development was the development of the Unix operating system, which was typically used by researchers in universities. Unix was initially developed by AT&T and was licensed to universities with no support, 'as-is', so that users were often forced to find their own solutions to problems. Later on, Unix was developed at Berkeley University into BSD Unix (the Berkeley Software Distribution). Unix has a philosophy of creating software tools for specific purposes and allowing programs to interact through 'inter-process' communication (pipes for instance, to allow the output from one program to be used as the input for another). By its basic design, therefore, Unix is 'modular'. The Unix philosophy is significant in the development at a later time of open source software, which is usually based on Unix-like operating systems. As Webber puts it, "The programming philosophy behind Unix and its derivatives still reflects these modest beginning – and it is central to the intellectual culture of open source" (Webber, 2004, p.26). Questions arising from this discussion include

- Does the modular nature of open source software increase flexibility and encourage adoption, or does it make it appear complex and discourage adoption?

Unix, as just explained, was commonly in use within universities. In fact this was the main market for the Unix operating system in its early days. The licence from AT&T was not very restrictive and user bug-fixes and improvements were valuable in improving the reputation of the operating system. However, eventually this situation changed and AT&T began more

significant commercialisation of Unix and licences became more expensive. This was part of a general trend, as companies started to realize the possibilities of making money from the software market. Previously, hardware and software had been ‘bundled’ together (Moody, 2001). This was the approach of IBM for instance, who sold computer hardware along with the required software for doing a particular job. This was marketed as a ‘complete solution’ in the days when very few people had knowledge of computers. Separation of the hardware and software had dramatic effects – of course the vendors saw the possibility of increasing their profits, but as well as that, there were changes in how systems were developed. Previously computer engineers had been responsible for designing both hardware and software, but with the realisation that these were really different specialisms, the role of ‘software engineer’ came into existence. Still, however, the academic world was still the main area where software development was done.

2.2 Free Software and Ideology

One of the people who worked in such an environment was Richard Stallman, who worked in the department of Artificial Intelligence at MIT. In this environment developers shared their work freely in the spirit of research, but there came a time when this changed. According to Stallman (2002), he began to think about the issue of software ownership and sharing when he was denied information about a printer driver for the Xerox 9700 laser printer (Moody, 2001). The changes in software licensing were linked with the U.S. Copyright Act of 1976. In 1983 Stallman announced the GNU project, a project to provide a free version of Unix and associated tools (editors, compilers and so on). In 1984 he left MIT to work full-time on GNU.

Stallman published the GNU manifesto in 1985 and his aim was to present an alternative to commercial software, allowing users unrestricted rights. He also created the GPL (GNU Public License) to provide a legal basis for software to be distributed this way. His stated aim was to encourage freedom, not in the sense of cost in money terms, but in the sense of allowing users to do what

they want with software and allowing them to make modifications. As Stallman himself says, “I want to encourage free software to spread, replacing proprietary software that forbids cooperation, and thus make our society better” (Stallman, 2002 p.91).

All of this raises several questions, about the motivations for developers becoming involved in free software and attitudes of users towards software and software licences, as well as questions about the viability of free software and the quality of its products. A programmer may wish to be involved in free software for ideological reasons, like Richard Stallman (2002), or to gain new knowledge and skills.

Ideology, then, has been a major motivation for some people to get involved in the development of open source software, but this is only one of several possible motivations.

Ljungberg has written on the open source movement and has observed that open source has “a culture that encourages people to contribute and share, i.e. getting credit for good contributions is what brings status and influence” (Ljungberg, 2000). Ljungberg and others have described open source as a ‘gift culture’ where individuals are able to build up ‘social capital’ based on the contributions they make. As Ljungberg puts it, “In a gift culture social status is determined not by what you own or control but by what you give away. The giving of gifts is therefore a way to gain power and control” (loc.cit.). In the case of open source software this ‘gift giving’ can be a way of starting communities or of building up communities. Often, open source projects are started by one person (Raymond, 2001), for example the Linux operating system was started by Linus Torvalds working alone, the programming language Perl was created by Larry Wall. As Ljungberg points out, “Gifts of information and advice are often given to groups or communities as a whole, rather than individuals” (ibid) and for open source software, this can also apply to complete software packages. Torvalds, for example, took the approach of simply placing his initial version of Linux on a public server, then posting a message inviting contributions.

2.3 Open Source Social Structures

Many authors have investigated the phenomenon of open source. Von Hippel (2002) has investigated open source as innovation “by and for users” in what he terms “horizontal innovation networks”; Raymond has discussed the social organisation of open source, likening it to a ‘bazaar’, and has considered business motivations for use of open source as well as its loose organisation with large scale volunteer contributions and user bug-reporting. Scacchi and others (Scacchi 2004, Raymond 2001) have analysed open source in terms of the building of communities, project management and user involvement.

Horizontal innovation networks are networks where innovation can occur in a system different from the traditional ‘vendor-driven’ innovation. The usual picture of innovation is of manufacturers and suppliers creating new technologies as part of their research and development effort, geared towards creation of new products which can be sold to customers. The classic text on diffusion of innovations is by Rogers (Rogers, 1995) and this largely concentrates on the ‘traditional’ view of innovation. In this research there will also be consideration of the ideas on authors like von Hippel and van Krogh about innovation based on the activities of innovating *users*. This kind of approach is applicable in situations where vendor-driven innovation is no longer the norm. It takes account of the way that technological development depends on social factors as made clear for instance in the work of Pinch and Bijker on social constructivism (Pinch and Bijker, 1984). As von Hippel explains, innovation ‘manufacturers’ are “firms or individuals that expect to profit from an innovation by selling it in the marketplace”(von Hippel, 1988), so the clear aim is to make more money and this will involve the required marketing as well as research and development. In this traditional scheme, with innovation driven by manufacturers and vendors, user requirements may not be fully met – the users make a choice among the available alternatives as offered. However, in open source there is more opportunity for innovating users to modify or develop a product.

Von Hippel claims that the alternative of a ‘horizontal innovation network’ composed only of innovation users (in fact users/self-manufacturers) can exist given a number of conditions:

1. At least some users have sufficient incentive to innovate
2. At least some users have an incentive to voluntarily reveal their innovations
3. Diffusion of innovations by users is low cost and can compete with commercial production and distribution

(von Hippel, 2002).

These horizontal innovation networks have advantages over manufacturer-led innovation since “they enable each using entity, whether an individual or a corporation, to develop exactly what it wants rather than being restricted to available marketplace choices or relying on a specific manufacturer” (ibid.).

To investigate whether horizontal innovation networks are significant in the context of software use in non-profit organisations, it is necessary to investigate the non-profit organisations but also the other groups with which they have links. As von Hippel expresses it, a user network is a set of nodes “interconnected by information transfer links which may involve face-to-face, electronic or other form of communication” and he points out that user networks “can exist within the boundaries of a membership group but need not” (ibid.). Non-users may also contribute to user innovation networks, for in the case of open source software, manufacturers of complementary goods or providers of complementary services. They may be motivated to contribute because doing so allows them to profit from, for instance, improved interoperability with one of their commercial products. This has been seen for example with the Apple computer corporation, who have based their latest operating system on FreeBSD, an open source version of Unix. Apple benefits in several ways: they use FreeBSD as a well-tested ‘core’ of their OSX operating system and can take advantage of the contributions of volunteers working on FreeBSD, and their reputation is good in the open

source community because they have given back their own enhancements to the open source community.

2.4 Open Source and non-Profit Organisations

First of all, it is necessary to define what non-profit organisation is and the significance of the non-profit sector. As Grobman (2008) defines it, a non-profit organisation is an organisation that does not distribute its surplus funds to owners or shareholders, but instead uses them to help pursue its goals. Also Vernis (2006, p4), “Nonprofit organizations are challenged to adequately exploit the opportunities afforded by communications means and new technologies to improve their work and enable their workers – both volunteers and employees.”

Non-profit organisations play a significant role in the social and financial aspects of the UK. Vernis (2006, p1) says, “The relationship among the nonprofit organisation, public administrations, business corporations, is like a three-legged stool, these three sectors have to work together to drive societies toward balance. According to Almanac (an organisation providing statistics), In England and Wales, in 2002, there are 185,948 charities on the Register, the estimated value of the total assets of registered charities is over £70 billion. In Scotland, 2002, the total income of charities is £2.1 billion, and expenditure is £1.94 billion, employing around 4% of the Scottish workforce. In Northern Ireland, the gross income for the voluntary and community sector is £657.1 million, and accounts for 4.5% of the Northern Irish workforce. From the Office of National Statistics 2009 (Office for National Statistics), the Final individual consumption expenditure of NPISH in 2008 was £32,984 million, but there is no more detailed information on IT expenditure.

How does this relate to the adoption of open source software in non-profit organisations? First it is necessary to ask what is the role of technology (specifically IT) in non-profit organisations? How significant an element is it as an influence on the activities of an organisation? As acknowledged by Pinho

and Macedo (2006), “Most peer-reviewed research has focused on for-profit organizations, with few published articles on nonprofits and technology”. Certainly this seems to be so, but technology is significant to non-profits: as observed by Fine (2003), “Determining the impact of information technology (IT) on nonprofits’ organizational structure and outcomes has become a crucial task for nonprofits and grantmakers”.

- Are the software needs of non-profit organisations being met by existing open source software?
- Are users in non-profit organisations likely to contribute to open source projects as innovators?
- Are groups linked with non-profit organisations likely to contribute to open source projects?
- Are users in non-profit organisations who customise or create software likely to share their work with others?

There are several aspects of the relationship between non-profit organisations and open source (Peizer, 2003). First of all, there are technical concerns, such as how suitable the available software is for their purposes, whether it can be used with their existing software, how easy it is to install, configure and use, and so on. Secondly there are issues regarding the open source way of doing things – complications like the thousands of different Linux distributions, or concerns about the availability of support. Non-profit organisations need to consider the strategic value of using open source software as well as its technical features. Organisations such as NOSI (Non-profit Open Source Initiative) have been set up and the information and advice available can have a significant effect on decisions made in non-profit organisations.

Technology does not exist in isolation – it exists in a social context (Feller & Fitzgerald, 2002). It will certainly be necessary to consider social factors affecting technology adoption. Indeed it is expected that various social factors will be the main influences in non-profit organisations on decisions on adoption of open source software. The reason for this expectation is that IT use in non-profit organisations is at a less advanced stage than in business in

general and the organisations and their ‘networks’ are smaller, so personal influence is likely to be greater. One area of research is to investigate what influences in non-profit organisations are the most significant in affecting decisions on whether to adopt open source software.

First, note that there are several obvious factors which should be considered. Cost is clearly a factor, and this is traditionally expressed in terms of TCO (Total Cost of Ownership) (Lee, Moisa & Weiss, 2003). Analysing TCO is difficult because costs have to be analysed over both the short term and the long term, and while some costs are clear, others are less obvious – the cost of licences can be measured easily enough, but measuring the cost of staff training in the use of new software, for example, is significantly harder.

Another factor to consider is the ‘fit’ of open source software to the requirements of non-profit organisations (NOSI Primer, 2007). This depends on the types of software that non-profit organisations use and also on the open source software which is available (and its quality). Non-profit organisations exist operating in many different fields but there are likely to be common software requirements. Standard ‘office’ software such as a word-processor and spreadsheet program are likely to be needed; it is likely there will be a need for a web browser, possibly database software will be required. An organisation may need to manage information related to its clients through use of CRM (Customer Relationship Management) software. The availability and quality of these as open source products is not consistent – there is very good database software and professional standard CRM software, but in general, commercial office software (and other desktop software) is more advanced.

Related to the idea of ‘fit’ is *compatibility*. If open source software is to be used together with commercial software, users will need to ensure that the two can function properly when used in combination. This may be a question of *flexibility* – if the software is flexible enough (e.g. it can be suitably configured) then compatibility is likely to be improved.

Clearly cost is significant. Licences for software can be a major expense, but open source software is available free of charge. The debate on TCO (Total Cost of Ownership) is a complex one, since some costs are not as obvious as others and may be difficult to measure. As well as the cost of licences, there are possible costs in the form of staff training in the use of new software and the cost of 'migrating' data. Staff training costs will depend on how 'computer literate' staff are, and the extent to which the existing software is the only software they are familiar with. For that reason it is an important factor how much staff already know about open source software. Typical computer users (non-specialists) are familiar with Microsoft Windows and unfamiliar with Unix, which is the operating system the vast majority of open source software is based on. The cost of data migration of course depends on the amount of data an organisation holds, and it also depends on the type of data. For instance if the only software used is for web browsing and the only data stored is HTML from web pages, the cost of data migration will be very low. However, if a large amount of data is held in proprietary formats (such as Microsoft Word), the cost will be higher.

In the specific case of non-profit organisations, the cost issue is even more complex. Many of them have made use of donated equipment and so the cost of licences is reduced. As well as that, non-profit organisations may be eligible for discounts on licences because of their status. Issues to consider are therefore

- What is the cost to a non-profit organisation of software licences?
- Does the non-profit organisation use donated equipment?

The viability of free (or open source) software depends on the existence of a large enough number of developers willing to give their time – it is necessary for there to be a 'critical mass' of developers. As well as that, it is necessary for there to be sufficient number of users and that is an aspect which merits some consideration. At first, free and open source software was mostly 'by hackers, for hackers'. By 'hacker', we mean someone who is interested in working with computers mainly for their own interest. Businesses using

software, at the time of Stallman creating the GNU project and the Free Software Foundation, were users of software from large commercial software vendors (Feller & Fitzgerald, 2002). This was a result of the usual business culture of requiring guarantees from suppliers about the reliability of their products and the desire to have support contracts so that help was available when something went wrong. The alternative of free software appeared unattractive since it was regarded as unreliable, lacking in support and with unknown long-term prospects. The matter of 'business culture' was investigated by West who found "evidence of an inherent clash between the hacker culture of F/OSS developers and the corporate or organizational cultures of potential adopters" (West, 2005, p.21). One aspect of this was the nature of the software licence used by free software, the GPL. The GPL states that, because the software is licensed free of charge, "…there is no warranty for the program". It also says that "The entire risk as to the quality and performance of the program is with you. Should the program prove defective, you assume the cost of all necessary servicing, repair or correction". This kind of licence was not considered favourably by managers, who wanted software companies to accept responsibility for problems and take the necessary steps to correct them.

2.5 Heterophily

These concerns are related to 'heterophily'. Heterophily is the name given by Rogers to the social differences between different groups. The term used for similarity between groups is 'homophily'. As Rogers (1995) explains, heterophily tends to inhibit the flow of information between groups, and is therefore something which slows down the diffusion of innovations. People are more likely to communicate with and share information with others they believe have similar ideas. The example just discussed, of the 'clash' between hacker culture and corporate culture, is an example of heterophily on the level of ideas about 'doing business'. Another clear example is the heterophily between the group of software developers and the group of software users. The developers are of course well-informed about technical matters and are

likely to discuss problems in technical terms, while typical users are not familiar with the technical details of the software they use and they may be unable to follow the discussions of developers. One aspect of this problem can be that users experiencing problems with software may be dissatisfied with explanations coming from developers and may be unsure about the likelihood of problem resolution if this is explained in technical terms. Issues arising from heterophily related to adoption of open source software in non-profit organisations are

- Do users feel comfortable communicating with developers?
- Do developers find it easy enough to understand users' concerns and their requirements?

A critical factor in attitudes towards open source was therefore the licensing and perceived lack of availability of proper support. In the early days of open source, only the more adventurous businesses were willing to use it – these businesses were 'early adopters' as Rogers calls them (Rogers, 1995). This changed with the growth of open source, as open source vendors started to offer support contracts, and when a pool of resources (online help, documentation, forums etc.) became available. As explained by West, "The earliest case studies, advocacy reports and academic research on F/OSS adoption (e.g., those with data from 1999 or earlier) would of necessity focus on the earliest adopters, in this case primarily programmers/hackers and users who have bought into the movement's ideology. Meanwhile, our Linux and Apache users show adoption patterns consistent with the early majority, who Rogers (1962) terms 'deliberate' and Moore (1991) refers to as 'pragmatists'". (West, 2005, p21).

Being conscious of these difficulties, a group of open source supporters led by Bruce Perens decided to set up the OSI (Open Source Initiative) to promote open source software among businesses. As Perens put it, they wanted to "…market the free software concept to the people who wore ties" (Perens, 1999).

2.6 Network Effects and Adoption Phases

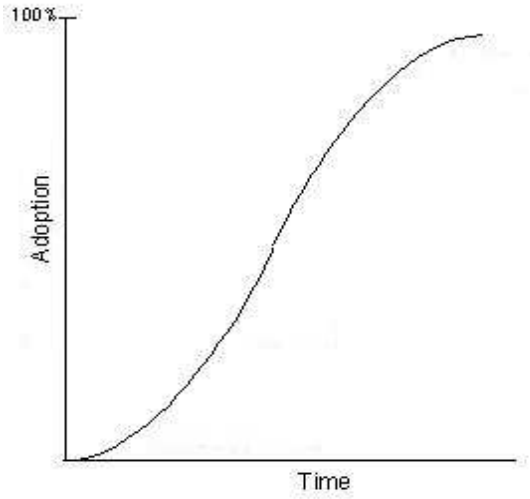
Some authors (e.g. Lehman, 1996) have pointed out that technology adoption is similar to evolution and 'feedback' effects are significant. Lehman observes that the global software process, including technical, business, marketing, user and other activities "constitutes a multi-loop, multi-level feedback system". Consider the initial growth of the PC market in the 1980s – at first, IBM targeted business users with the PC, and the hardware was too expensive to be considered by most members of the general public. However, PC 'clones' started to appear which were available at a much lower price, and this allowed many more people to own a PC. This led to an increased market for software as well as additional PC hardware, and the result was positive feedback which resulted in an explosive growth of PC sales. Further, as part of the feedback process, all manufacturers began to offer PCs at a lower price and this led to even more rapid growth in the sector.

Technology adoption may exhibit feedback in the form of 'network effects'. As outlined by Bansler and Havn "Commonly associated with economics, the concept of network effects can also be used in an organizational context to study adoption dynamics and use patterns when new information and communication technologies are introduced". (Bansler & Havn, 2004). These authors summarise the three phases of technology adoption where "The notion of positive feedback is crucial to understanding the adoption of new technologies in markets where network effects are significant" –

- An early phase of slow adoption
- A phase of rapid growth
- Levelling off

and these three phases lead to an 'adoption curve' as shown in Figure 2.1.

Figure 2.1 The S-Curve Time Sequence of Adoption (Source: Rogers, 1995)



The identification of this ‘S-curve’ goes back to the work of Rogers (1995). Network effects exist in various forms, they can be both positive (reinforcing change) or negative (inhibiting change). Bansler and Havn also introduce the notion of the ‘start-up problem’, where someone must adopt an innovation first in a group of potential adopters, but where “…early adopters cannot communicate via the new technology with many other members of the community” (ibid.), so that introduction of a new interactive medium tends to be ‘all or nothing’.

Research issues arising from this are

- What characterises ‘early adopters’ and what influence do they have?
- Do different sources of influence act mainly during specific phases?
- What causes changes in the flow of information in a network?

There are several possible approaches to the investigation of technology adoption. Rogers discusses the ‘innovation decision’ in terms of organisational decision-making based on various criteria describing how potential adopters view a technology. These are what Rogers calls ‘perceived attributes’ (Rogers, 1995). Perceived attributes include compatibility, complexity, trialability and measurability. In Rogers (1995), these attributes

are mainly connected with flows of *information*: information channels are the most significant element in Rogers's work and central to his theories. Other approaches include 'psychological' theories of individual decision-making, and 'acceptance models'.

The theory of Rogers (1995) has value as a description of processes occurring in adoption of technological innovations, but it is less useful in giving explanations or in making predictions. This is its main weakness and to overcome that it is necessary to adapt some of the ideas and place them in a different context. However, various ideas from Rogers give an indication of issues suitable for research into the adoption of open source software. It is certainly true that adoption of open source by businesses was influenced by perceptions of open source products, in terms of quality and reliability for instance.

It can be seen immediately then that issues for research include

- What factors are considered when deciding whether to adopt an innovation?
- What sources of information are most significant in informing the decision?

2.7 Software Lock-in

As explained in the NOSI Primer, "The use of open standards can help to prevent 'lock-in', a common problem where organizations are forced to continue using the same product because data migration would be too expensive". Lock-in can be a significant problem leading to increasing costs for an organisation – if the organisation continues to use the same software, then it is dependent on the supplier for updates, as well as having to pay the required licence fees, which may be raised by the supplier. The user is locked in to a cycle of upgrading and paying for new licences: to break out of the cycle can require conversion of data from one format to another and this may

be expensive (or even impossible). In the context of this research, then, another issue to investigate is

- How much are non-profit organisations locked in to their software?
- What data formats are in use within non-profit organisations?

This has a bearing on the adoption process since if a user is very committed to use of particular software and its data formats, it will be a greater effort (therefore a higher cost) to move to a different system with data held in another format. There are proprietary standards and open standards for data formats, sometimes competing directly with each other and sometimes operating in different areas. These standards have a great influence on the ability to share information. Users require programs which can read the file formats and on the infrastructure level software is needed to allow computers to communicate across networks. What concerns are there when proprietary standards are used?

- Reading files in proprietary formats may require proprietary software
- Converting from proprietary file formats may be difficult
- Data may be difficult to access if the vendor goes out of business
- Communication between computer systems may be difficult
- There may be lock-in to using a particular vendor's software

Open standards are discussed in the COSPA report. COSPA is the *Consortium for studying, evaluating, and supporting the introduction of Open Source software and Open Data Standards in the Public Administration*, a project funded by the European Commission under the Sixth Framework Programme.

It is clear that standards are not just important for exchange of information, they are also important for the basic communication between computer systems. Open standards for data formats make information exchange easier

and open standards for software and communication protocols make it easier to connect systems to each other.

Further research issues coming from these considerations are

- How much concern to non-profit organisations is lock-in through data standards?
- How much awareness is there in non-profit organisations of alternatives to proprietary software, based on open data standards?

The first of these may be related to the amount of data stored in particular formats.

Lock-in can be a significant concern, as described earlier, because of costs of one sort or another – either the cost of data migration if the user changes to different software, or the cost of software licences if the user continues to use the same software.

Licence fees and service contracts may be important in an organisation's decisions on what software to use – typically a user may purchase software licences and also enter into a contract with a vendor or a third party for support.

2.8 Conclusion

As noted already, some view OSS as a 'software revolution' – software is developed by volunteers (who may also be professional programmers) and it is available free of charge. There are specialist hosting websites where open source software can be found. Not all OSS projects are successful, however. For instance, while there are over 10,000 OSS projects on sourceforge, a fairly high number of these are inactive. A project can be inactive because of a small number of developer, or because the group of users is so small that the project does not achieve 'critical mass'. What is essential to understanding

of the success or failure of a project is knowledge of the social and environmental factors influencing its development and adoption.

Ideology has certainly been an influence in the development of OSS – the Free Software Foundation for example was formed by Richard Stallman exclusively because of his ideology (that software should be free because it can improve society). However, it is not clear to what extent ideology influences users of the software, and that is something which needs to be investigated in the case of non-profit organisations. Where OSS is being used, is ideology a factor in its adoption, or is its adoption influenced only by availability and cost?

Open source software can develop in a 'horizontal innovation network' (von Hippel, 2002) – this is as opposed to traditional 'vendor-driven' innovation. In such a network, innovations are created by innovating users. Vendor-driven innovation is based on the profit motive, but motivations may be different in a horizontal innovation network. Based on von Hippel's ideas about the necessary conditions for existence of a horizontal innovation network, it is reasonable to investigate whether anyone in non-profit organisations contributes to OSS. Certainly motivation to modify an OSS package (or create one) is more what should be considered. This mainly depends on the software requirements of non-profit organisations.

Specifically in relation to non-profit organisations, software requirements can be expected to play a major role in determining OSS adoption. Cost is expected to be less of an issue, due to the licence subsidies available for non-profits. In relation to software requirements, anticipating the results appearing later (see chapter 4, p.47), content management is very significant to non-profit organisations. It was found that content management is discussed in approximately one fifth of postings in the NOSI forum, for instance. It is hypothesised that this relates to a need for software making it easy to maintain a website without expert knowledge.

Open source software certainly at one time had a ‘geek’ image, so it was felt to be more suitable for people willing to get involved in the technical side of computers. Also, the documentation of OSS had a bad reputation. This is an issue of communication and it raises the question of how confident individuals in non-profit organisations are in reading OSS documentation or communicating with OSS developers.

Adoption of new technologies occurs in phases, and this corresponds to individuals or organisations being more innovative or less innovative. A small group are early innovators – what characterises this group. From Rogers (1995) it may be expected to coincide with use of mass media, specifically the Internet in relation to ICT. Also significant is how different groups perceive the attributes (advantages/disadvantages) of an innovation.

Chapter 3. Conceptual Framework and Modelling Open Source Adoption

It is necessary to develop a conceptual framework for investigation of the adoption of open source software in non-profit organisations. This conceptual framework is used to guide the research by highlighting certain areas for investigation and by indicating what may be the most important research questions.

The conceptual framework will take ideas from a number of sources: theories on adoption of innovations, theories of collective working, theories like Social Network Analysis and Socio-Technical Interaction Networks.

The main elements in the conceptual framework are

- What factors influence IT adoption decisions
- How potential adopters obtain information about IT
- Network effects
- Feedback and critical mass

Following on from construction of a conceptual framework, in order to inform the empirical work, the following stages are necessary:

- Creation of hypotheses
- Decisions on how the hypotheses can be tested
- Construction of test instruments for testing the hypotheses

Now consider each of the elements of the framework in turn –

3.1 Factors Influencing IT Adoption Decisions

The focus is on what are termed ‘perceived attributes’ (Rogers, 1995). In this seminal work, Rogers introduces many concepts which have become central to later investigations of the adoption patterns of technological innovations. Examples of later work include research done by Redmond (Redmond, 2002). This author considers competition among producers as a stimulus for innovation, building on the work of Rogers in terms of interpersonal communications, but introducing new elements. Those new elements include the practices of marketing through new communication technologies (such as the Internet). Redmond explains that an analysis is more effective if a whole group of innovations is considered together, rather than a single innovation. Interconnectivity occurs because information about innovations is provided through communication media which users access frequently, so that they learn of other innovations as well. So the interconnectivity phenomenon links a number of innovations together and adopters of one are more likely to adopt the others, simply because they are exposed to information. Taking research into marketing even further, Bloom and Gundlach (2000) describe how marketers employ social science theories to guide planning – those theories are used by marketers since they can get ideas on what will change behaviour, and it is very important for ‘audience analysis’. This clearly demonstrates how in any modern communication environment, there are likely to be complex social phenomena at work, influencing the adoption of innovative technology.

In summary, perceived attributes are the views potential adopters have of a technological innovation and these views influence the decisions they make. Those potential adopters may be individuals or organisations, but in the case of an organisational decision, the situation is rather more complex.

In the case of an individual decision-maker, the perceived attributes are evaluated during the decision-making process and based on their relative importance and so on, a decision is made. However, there is no direct

interaction with other individuals during the decision-making itself. In the case of an organisational decision, this is different: decisions can be made by a committee, or a management group, or by voting among employees, for example, and in those situations there are various decision mechanisms, some formal, some informal. The effect that has is to make the relationship to perceived attributes less obvious, since the decision is an aggregate decision reached by a group of people.

As well as the perceived attributes and their influence on technology adoption, it is necessary to emphasise the role of communication channels. This is especially true in modern times, with mass electronic communication. Obviously vendors of software are aware of the influence they can have through these media and there is a great effort in marketing and 'packaging', to attract new users – just think of the television advertisements from IBM and Microsoft, which clearly encourage the view that using their products will make business life 'easier'. Also, communication 'habits' (e.g. websites visited, discussion groups used, and so on) are very relevant in shaping *what* information an individual obtains, and this is crucial to adoption decisions.

3.2 How Potential Adopters Obtain Information About IT

Rogers emphasises the role of communication channels in the adoption of new technologies and their diffusion across a network of organisations. This is very clearly likely to be a major factor in decisions on IT, since the Internet hosts a large amount of information on IT in general – vendor websites, open source project websites, tutorials on software, tutorials on programming languages and so on. However, not all IT users make equal use of the Internet: some use it a great deal and it is their primary source of information; others use it only occasionally. Patterns of Internet usage, then, can also be expected to have a large influence on decisions on adoption of open source software, which is largely propagated through the Internet. The pattern of Internet usage can be represented by frequency of Internet use, sites visited

and so on. Note that patterns of use change over time, especially since the information available on the Internet has changed over time.

Communication through the Internet is inherently subject to network effects. It is indeed a very large network with many millions of users. Communities form, communities grow and communities disappear, and just the number of Internet transactions per day worldwide is huge. Even in this case, a simple figure of 500,000,000 users and 45 billion emails per day worldwide hides the complexity of the situation. An interesting report comes from Market Research (the world's largest independent market research organisation, with access to more than 160,000 reports with data taken from 600 global organisations). This covers email use over various sectors (corporate, business, consumer). It is also worldwide. Points are raised there about the way issues like viruses and spam, and regulation, have affected the growth of email. So although the number of email users increases steadily and although the number of emails worldwide per day increases steadily, there are periods when there is change because of external factors.

3.3 Network Effects

Network effects in Internet usage are on such a large scale, then, that effective analysis in detail is impossible – the amount of data is simply too large. Some way of analysing general trends is required. For that, concepts from SNA (Social Network Analysis) are useful: concepts such as connectivity and centrality. In addition, the idea of a STIN (Socio-Technical Interaction Network) (Kling, 1999) is useful, since it addresses the matter of how to relate social change and technological change. Social change and technological change are so closely linked, especially for the Internet, which is growing rapidly and also changing rapidly, that they must be considered together. Social aspects influence technology growth and technology directly affects social behaviour.

3.4 Feedback and Critical Mass

The dynamics of growth involves feedback. Feedback occurs in many situations. There are examples in physics, biology, economics and elsewhere. Taking an example from biology, at the moment there is a large decline in the number of honey-collecting bees, and this affects the reproduction of the plants the bees pollinate. Reduction in the number of plants causes a reduction in the number of bees, since the bees usually specialise in feeding from specific plants only. This is feedback, because the original effect is reinforced by the changes. The standard example in physics (electronics in fact) is the combination of loudspeaker and microphone, where a person speaks through a public address system but a loud whistle appears through the loudspeakers because the volume is turned too high. Feedback, however, can be both positive and negative. Positive feedback reinforces an existing process, while negative feedback inhibits it. Positive feedback is responsible for growth, and possibly rapid growth, or in extreme cases an explosion (the atom bomb is an example). Negative feedback is responsible for *controlling* growth. An example of negative feedback can again be taken from biology: an animal population may grow, but once it reaches a certain size, some limiting factor will take over. This could be, for instance, the size of the area where the animals can feed – the area available can only support a certain number. The population becomes stable when the positive feedback (causing growth) and the negative feedback (causing slowing of growth) are in balance.

The concept of critical mass is relevant here. The term comes from the atomic bomb, mentioned just now in terms of ‘explosive growth’. This is a chain reaction, but there has to be enough material (critical mass) for the explosion to occur. There are always nuclear reactions inside the Uranium, but it is only when there is sufficient Uranium that the reaction can be self-sustaining (though uncontrolled). Similar ideas can be applied elsewhere. As an example, think of a ‘chain letter’ where one person writes a letter to another person (maybe chosen at random) and asks that person to send out several similar letters. If everyone *does* send several letters, the growth is very rapid.

However, if people do not send out letters, the process ends rapidly. The required number of letter-senders (or the proportion of them) is similar to critical mass. It is well recognised (and see the interview material later) that OSS projects may fail to achieve ‘critical mass’ and then a project will probably not be developed further. The software will then become increasingly out of date, so fewer people will want to use it, and the software becomes less popular and disappears.

3.5 Perceived Attributes

Concentrating on perceived attributes emphasises the role of decision-makers in the process of technological diffusion. Decision-makers in the Rogers model obtain information about innovations, form opinions based on the information they have and make a decision on whether or not to adopt an innovation based on an evaluation in terms of the perceived attributes. The perceived attributes are the main criteria applied and it is therefore necessary to investigate how decision-makers view an innovation to discover the reasons for its acceptance or rejection.

Relative advantage is “the degree to which an innovation is perceived as being better than the idea it supersedes” (Rogers, 1995, p.229). This includes the cost of the technology as well as social factors. The cost aspect is of course something which may have an influence since organisations will always hope to reduce the financial burdens of using technology so as to get ‘value for money’. However, as Rogers points out, social factors may also be important, in particular social status may be an important consideration. Innovators and early adopters are more motivated by social status than the majority, wanting perhaps to be ‘the first’ and gain prestige among members of their community for understanding the situation and having the foresight to try a new technology before it has become generally accepted. Relative advantage also has to take into account the time factor – some innovations will give benefit immediately, while others may not give benefit for some length of time. An example of this in an ICT context could be, for example,

that an organisation discards its existing word-processing software because the new program is faster, has a better user interface and can be customised more easily, but when making the changeover, it is necessary to convert the format of all the existing documents. The full advantage would not be experienced at first since it would take time do carry out the necessary data migration.

Compatibility is "…the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (Rogers, 1995, p.15). As confirmed in various studies on ICT adoption, lack of compatibility can have a negative effect on use of IT systems (McKenzie, 2001). Compatibility can be an issue in more ways than one. Computer systems are frequently linked in communication networks and all computer communication depends on protocols (e.g. TCP/IP for basic network communication, HTTP protocol for reading web pages). If two systems operate different protocols, this can lead to difficulties – it may be necessary to deploy 'middleware' to allow the systems to communicate. If no suitable middleware exists, it will be impossible for the systems to communicate. Another incompatibility is connected with data standards: documents in a specific format created by a particular program may be unreadable by another program. This naturally becomes a more significant issue the more data is stored in a particular format, with conversion required to read data with different software.

If a technology is perceived as complex then its adoption is less likely. This is particularly relevant in the case of open source software, which has a reputation for being harder to install, configure and use than commercial software. Of course this depends partly on the level of knowledge of potential adopters and in the case of open source software this can be a problem not only because of problems with installation, configuration and use, but also because the majority of open source software is based on Unix-like systems (such as Linux) and knowledge of Unix is less common than knowledge of systems like Microsoft Windows. On a non-technical level, from the point of

view of general users (rather than technical staff) this may be simply a matter of ‘user-friendliness’ of software.

Trialability is positively linked with rate of adoption. An organisation may try a new software system on a limited basis, for instance, before deciding whether to use it more widely. A simple example might be an organisation installing a new web browser for a certain number of employees on a trial basis so that opinions can be collected and a decision can be made on whether it is worthwhile changing over completely from the browser originally being used. The more an innovation is tried, the more quickly it is adopted, so this can be an important element in technology adoption decisions. In the case of open source software trialability is easy since the software can be downloaded and installed without paying money and without the software being restricted in any way. Commercial software is not available on a trial basis in the same way. Trial versions of programs are typically restricted so that they do not function fully (for instance data cannot be saved).

Observability may also be conceived as the degree to which the results can be measured (for instance tests may be done to determine how fast two web servers are compared with each other, or how many simultaneous requests they can process). Observability is also positively linked with rate of adoption.

All of these attributes are important in the investigation of factors influencing the adoption of open source software in non-profit organisations and is a significant part of the conceptual framework. The emphasis is on the way that individuals and groups form their opinions, through communication with others. It is of course critical in the formation of opinions where information is obtained. Also, it is important to understand how influences change over time and this will be understood in the context of network interactions.

As mentioned in Dedrick and West (2005), Tornatzky and Klein (1982) have done a meta-analysis of prior studies and they found that of the attributes mentioned by Rogers, compatibility, relative advantage and complexity are consistently linked to technology adoption. However, the initial investigation

for this research indicated that trialability is likely to be important, since so many OSS users are convinced they should try to show OSS products to potential users, and then they will be able to see that some of it works very well, so may start using it.

On this basis, the current research will concentrate on the following –

Fundamental Perceived Attributes

- Relative Advantage
- Complexity
- Compatibility
- Trialability

Others may be relevant to a lesser degree, but there are the attributes which are targeted with the research methods used for the research.

3.6 Information Paths

Information flow is crucial in the conceptual framework, where information is conceptualised as a flow of a resource within a Socio-Technical Interaction Network (STIN) (Kling, 1999). Acting within a STIN, information is viewed as a determinant in adoption decisions made by 'agents', which in this context are organisations, but as well as that there is modelling of factors influencing the flow of information and factors influencing adoption decisions. The work of von Hippel on 'user innovation networks' is considered and certain ideas from von Hippel are applied, in particular the concept of 'lead user'.

Consideration of information paths is crucial in analysing how potential adopters obtain information about innovations (and specifically in IT). On the most basic level, activity on the Internet can be viewed as activity in a network of servers and clients. However, this does not capture the real-world activity – for instance, although an online forum is hosted by a central server, the users

(clients) communicate with each other by posting messages. The flow of data is best understood as an aggregate, with local features like clustering, where a particular group of users may communicate more within the group than they do outside. This can clearly have an influence on the quantity and quality of information that potential adopters obtain, since that depends on which group they are a member of. That said, links on the Internet are constantly changing, and it is easy to access different groups (for example, just visit a different selection of websites).

The fundamental idea in the conceptual framework is the idea of a ‘network’, and to this are added various other elements considered relevant to the discussion of technology adoption.

Most importantly, first consider the work that has already been done to investigate the way that technology diffuses through society (Rogers, 1995). The notion of technological diffusion is that technology ‘spreads’. In this way it is similar to a number of things that have been closely studied, such as migration patterns of humans as they colonised the Earth and the spread of infections diseases like influenza. Many of those sorts of phenomena exhibit similar features: the start of the process is often slow, but at some point in time the growth may suddenly become ‘explosive’. In the case of infections diseases, for instance, explosive growth occurs during an epidemic or pandemic. Another similarity is that *contact* is required for diffusion to occur. Rogers, in the classic text on diffusion of innovations, discusses contact in the form of information exchange, which is central to his whole model of diffusion of technologies (Rogers, 1995).

3.7 Types of Adopters

Part of the conceptual framework is a representation of the different levels of innovativeness. Innovators are willing to experiment with new ideas. Part of this is that they are prepared to deal with unsuccessful innovations, and also uncertainty about the innovation (for instance there may be competing

standards at an early stage of an innovation, so that innovators may adopt a new technology before its details have been finalised). Rogers also explains that innovators are ‘gatekeepers’ as he calls them, bringing innovations in from outside. This may have an impact on their social standing within an organisation, since their tendency to take actions ‘outside the norm’ may lead to a lower level of respect within the group they are a part of. Innovators are also likely to have a higher level of technical knowledge than later adopters. These individuals are the ‘lead users’ in the terminology of von Hippel.

3.8 Decision Stages

Rogers discusses the ‘innovation-decision’ in terms of five stages, connected with obtaining information and processing it to arrive at a decision on whether to adopt an innovation. The decision process is a central focus of the conceptual framework and the adoption model, specifically, extending the concept of STIN by adding feedback paths to communication channels, so modelling a significant network growth factor in the formation of communities of users.

The first stage, *knowledge*, is the stage at which a potential adopter first learns about the existence of an innovation and seeks information about it. In the *persuasion* stage the potential adopter forms either a positive or negative attitude towards an innovation. In the *decision* stage a choice is made on whether to accept or reject an innovation. Rogers describes a number of different decision types: *optional*, *collective* and *authority* decisions. These may be described as follows:

- Optional – each individual may accept or reject an innovation
- Collective – a consensus decision is made to accept or reject an innovation
- Authority – those with power make the decision and others follow

At the *implementation* stage, an innovation is actually used in practice. At that stage, 'reinvention' is possible. This is "the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation (Rogers, 1995, p.180). Rogers points out that the more reinvention takes place, the more rapidly an innovation is adopted.

At the *confirmation* stage, the decision to adopt the innovation has already been made, but the decision may be reversed. Discontinuing use of the new technology can happen during the confirmation stage in several ways –

- An innovation may be replaced with a superior, even newer one
- The innovation may be found not to meet the requirements as expected
- Its performance is unsatisfactory in some way

Scacchi (2002, 2004) has investigated many scenarios involving use of ICT in terms of Socio-Technical Interaction Networks. He identifies several areas where a description in terms of STINs is particularly valuable in analysing open source communities:

- Participating, joining and contributing
- Forming alliances and building community
- Cooperation and coordination

This research takes STINs as a starting point for an investigation of open source in the context of non-profit organisations. STINs are heterogeneous networks of elements linked by the flow of resources. The elements may be individuals, organisations, computer systems and so on; the resources may be money, data, staff, expertise, information and so on.

As part of the analysis, then, it is necessary to determine what elements to include in the network, and to identify the resources flowing in the network which are significant for the research. Analysis in terms of STINs needs

careful consideration because the most important factors have to be picked out. This can only be done by looking at the situation in a ‘sympathetic’ way and interpreting the network activity after finding out what really matters to the actors involved.

The flow of information about innovations and the influences on opinion is conceived as taking place in a socio-technical network, where there is an interdependency between the technical and social. This is a link ‘between the message and the medium’. This can be thought of in terms of the ‘ideology-artefact complex’ (Davenport & Horton, 2006), where attitudes and ideology develop in parallel with technological change. In the ideology-artefact complex, sometimes changes in ideology drive changes in technology, and sometimes changes in the technology drive changes in ideology.

This setting motivates the description of the ‘co-evolution’ of the technological and social in terms of socio-technical interaction networks. Socio-technical interaction networks (STINs) model the intimate link between the technical and social aspects of systems heavily dependent on technology, such as environments where ICT is used to a significant level. The idea of STINs is a response to earlier models of technological change, presenting a model which is non-deterministic but which also gives more importance to purely technological developments than social constructivism.

Social constructivism stresses the idea that technology is ‘socially shaped’, but Kling (Kling, 1999) takes the view that this is an inadequate way of dealing with complex ICT environments, based on his long-term studies of ICT use within organisations. Kling’s view that technological and social change are so intimately linked that in effect they cannot be separated led to the concept of STIN. Kling defines a STIN as

“A network that includes people (including organizations), equipment, data, diverse resources (money, skill, status), documents and messages, legal arrangements and enforcement mechanisms, and resource flows. The

elements of a STIN are heterogeneous. The network relationships between these elements include: social, economic, and political interaction"
(Kling, 2003, p11).

This research will analyse the interactions between the open source community, software vendors and non-profit organisations in terms of STINs. The emphasis is on influences on OSS adoption and STIN theory is extended to model processes occurring in technology adoption.

It has been said that adoption of technology is a 'feedback' process. For instance Woiceshyn views adoption as "…a process of organizational learning which proceeds in a feedback loop from observing, interpreting, integrating to acting" (Woiceshyn, 2000). A decision-making system can be viewed as one with competing 'feedback paths' with different influences increasing or decreasing over time. One feedback path may be dominant but with change in levels of influence, another may dominate at a later time, so a 'critical change' may occur, resulting in a decision to adopt a new technology. Technology adoption occurs as greater numbers of decision-makers choose to make use of an innovation. The increased number of users can make adopting the innovation more valuable so this is a feedback effect. Within the decision-making context, there are also feedback processes, for example opinions are reinforced by influence from the media, as decision-makers obtain information from their preferred sources.

3.9 Open Source Adoption in non-profit Organisations: A Research Model

Technology adoption occurs because of decisions made either by an organisation or an individual and the model constructed is based on a representation of decision-making in a 'network' context, with flows of information and with influences acting between organisations or individuals. This network is conceptualised as a STIN (Socio-Technical Interaction

Network), so the influences may come through technology or through social interaction, and may influence technology or social organisation.

Because in a STIN it is impossible to separate the technological and social aspects of network interactions, the approach adopted is to abstract the idea of an adoption decision (a decision to adopt a technology) as a probability of adoption, where that probability may be influenced by network factors. This approach relates to the approach of 'decision network', and various authors have written on this subject, including the concept of 'Bayesian belief network'. For instance this is discussed by Reverberi and Talamo (1999) who introduce a probabilistic model for interactive decision-making, and describing a computer simulation of human behaviour, Yu and Terzoppoulos (2007) employ a decision network framework. The concepts of decision network and belief network are similar: in each case there are nodes which may enter certain states (outcomes) and there are influences which act on the nodes, affecting the probabilities of the various outcomes. Reverberi and Talamo (1999) aim to create a model of information- gathering and decision-making, where information may be uncertain and obtaining it, has a certain cost.

The work of Yu and Terzopoulos (2007) is in computer simulation of human behaviour, and is based on the idea of a 'utility' value for a particular action. A decision-maker acts under certain influences and chooses the action perceived to have the highest utility (usefulness/appropriateness).

This research takes elements of these frameworks and applies them in the context of a STIN, in order to have a model which can operationalise the decision-making process. So there will be a quantitative model which considers only outcomes and influences, ignoring the complexity of motivations and attitudes and ignoring the complexity of interactions between technical and social factors in a STIN. The behaviour will be modelled in other words, but not the reasons for the behaviour.

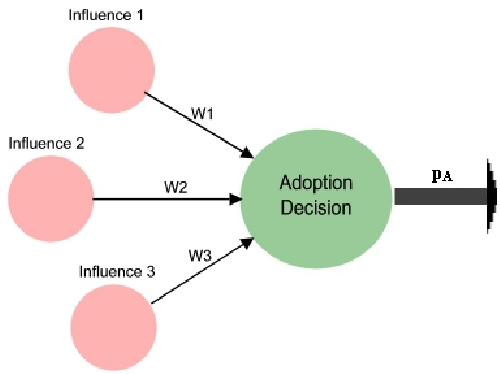
In addition, if 'network effects' are to be modelled, there has to be some way of modelling change over time. In existing probability models of decision-

making the description is a static one. The models represent a decision-maker at a particular moment in time, with influences of varying levels of importance and with outcomes occurring with certain probabilities. The model described in this research introduces a time element by extending the probability model to a series of ‘snapshots’, each representing a moment in time. This is used to model changes in the probabilities, or other changes in the network.

Applying this to the research topic, the model will be used to represent the decision network in the case of deciding to adopt open source software. There are only two possible outcomes for this decision – a simple yes/no on adoption OSS.

The basic unit of the model is a decision-making node. Each node in the network is an organisation which makes a decision on whether or not to adopt a new technology – in this case, open source software. A node is thought of as having a certain probability of deciding to adopt, and this probability can be influenced by external factors (see Figure 3.1):

Figure 3.1 Influences on Adoption-decision from One Decision-maker (source: this author)



The arrows directed towards the node represent influences on the node. These influences act to alter the probability of the node making a decision to adopt OSS. The influences come from other elements in the network, so how a node is influenced depends on what it is connected to. In terms of what these influences are, they come from flows in the STIN and are most likely to be sources of information, or direct influences such as guidance from a head

office. The effect on the node is to change the way the node evaluates the perceived attributes of OSS. For example a node may be influenced by information from a forum and decide to try a particular open source software package.

The way the model is envisaged, it could be used as the basis for a computer simulation. Yu and Terzopoulos (ibid.) consider a computer simulation of human behaviour based on a probability decision model, and there could be benefit in doing this for the case of OSS adoption. With the 'snapshot' probability model, the computer simulation would run as follows:

A network configuration is set up in the simulation, so there will be decision-nodes and there will be links between different elements of the network. The configuration of nodes and links defines the network topology.

The probabilities and weights in the network are initialised.

The simulation is then run with data as initialised in the previous step. This results in a new set of values for the probabilities.

This last step is repeated, so at each stage when the simulation is run, it operates on data generated from the previous run.

The method for calculating the new node probability during a run of the simulation has to take into account the node itself (the current probability) and the influences on the node. This is represented as follows:

The node is given an 'importance index' **I** between 0 and 1. This defines how important the node is compared with the influences. If **I** = 1 the node ignores the influences.

The weights on the influences are used to calculate the 'normalised influence' value **E**, which gives a value between -1 and 1 representing the size of the effect the influences have on the node.

$$\mathbf{E} = (w1 + w2 + \ldots + wn) / (|w1| + |w2| + \ldots + |wn|)$$

where |w| is the absolute value of w. Note that weights may be positive (pressure to adopt OSS) or negative (pressure not to adopt OSS).

The initial node probability P_A = p0 is used along with **I** and **E** to obtain the new value P_A = p1.

$$p1 = p0(1 + p0(1-p0)(1-\mathbf{I})\ \mathbf{E})$$

It should be noted that this is not the only possible calculation method, however, any method should meet the following conditions, as this method does.

p1 must be between 0 and 1.
If **I** = 1, p1 = p0 since the node ignores influences.
If **E** = 0, p1 = p0 since the influences have no overall effect.
If **E** > 0, p1 > p0.
If **E** < 0, p1 < p0.

Use of such a computer simulation is expected to allow certain types of investigation. The idea would be to run simulations on many different network topologies (e.g. with a small number of ‘central’ nodes, or with nodes all of equal importance (equally connected), or other patterns of connection). Also simulations would be run with different values initially given to the probabilities and weights. Running the simulation should result in different rates and patterns of adoption, and an investigation could be made into the relationship between network topology and patterns of adoption. This could then be tested in the real world to see if network factors could be identified which match the model. The adoption behaviour could then be compared with the results of the simulation.

To complete this model, there must be some representation of rejection of a technological innovation after it has been adopted. This is conceptualised in more or less the same way as the decision to adopt. As each step a node will have a basic probability of rejecting an innovation already in use – this rejection is something that may happen at the confirmation stage as described by Rogers. This probability will also be influenced by external factors, but the way it changes over time is different from the way the adoption probability changes. It is expected that the probability of rejection, call it r0, decreases with time: after an organisation has invested in a new technology it is less likely to give it up the more it has invested.

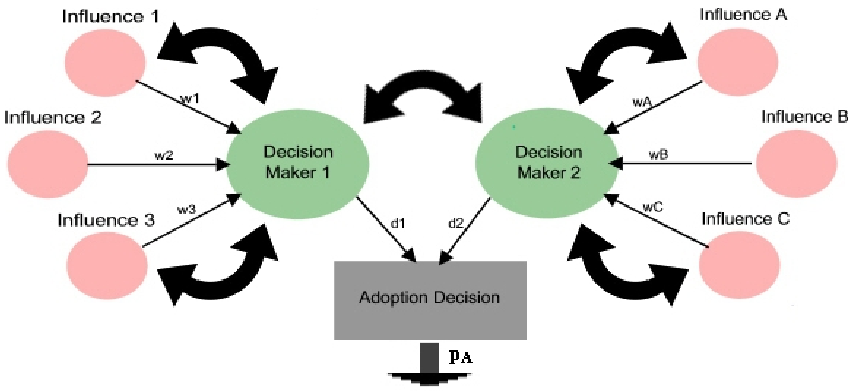
The fundamental idea in representing a 'decision node' this way is that the external influences can have an effect on the probability of the decision to adopt. This is conceptualised as follows –

- A node will have a certain probability of deciding to adopt and without external influences this will not change.
- External influences can change this probability, either by increasing it or by decreasing it.
- After some time without further external influence, the probability will move back towards the original value.

There may be cases where decisions are made by more than one individual (or group) within an organisation and that situation is modelled with the appropriate number of decision-nodes contributing to the final decision. The individual decision-nodes may have different levels of importance in reaching the final decision and this is represented by further 'weights'. For instance, the opinion of the general manager may be twice as important as the opinion of the deputy manager. In addition, there are feedback paths reinforcing different influences and this may alter over time so that decisions may be made differently.

Nodes may be combined into a ‘decision network’ with influences acting between nodes and with feedback paths affecting levels of influence (see Figure 3.2):

Figure 3.2 Influences on Adoption-decision from Two Decision-makers (source: this author)



The Figure3.2 shows two nodes but this can easily be extended to any number. The explanation above represents only a *static* situation, however. In order to model a *dynamic* situation another element has to be introduced, and this additional element is time. In real organisations decisions are made at certain specific times – an AGM (annual general meeting) for example would be typical, or meetings may be arranged on some other schedule, but we will conceive of them as happening at regular intervals. In addition, the action of the external influences is not constant, it will also be conceived as happening at regular intervals. For instance a decision-maker may access one website weekly and another website monthly. Meetings with external IT consultants may happen yearly, and so on.

This network model of decision-making with feedback paths can be used to describe the system of influences which lead to changes in technology use. There will be times when the technology being used does not change and there will be times when change is rapid. The way this is conceptualised in the model is that during ‘stable’ periods there will be feedback loops which ‘balance’, but during times of change, one particular feedback loop dominates and leads to a shift in the balance of influences.

3.10 Operationalising the Decision-Making Process

In the research, a model is described which gives probabilities to decision-making nodes in a network, with network feedback effects. The network effects are represented by changes in probability of adoption of OSS. This model has the potential to be applied in other situations – anywhere there is a network with feedback effects in a decision-making process. It is not restricted to description of non-profit organisations, though that is what it was developed for. The decision-making process is modelled by each node having a certain probability being changed by the network feedback. This kind of model, then, can be used to operationalise the decision-making process anywhere there is such a network. The model does not make any claims about motivations, it is simply a descriptive tool which models the network effects quantitatively. Further refinement could be included in the model by modelling different patterns in the change of adoption probability – at the moment this is loosely described in terms of a network effect changing the probability, then that probability moving back towards its original value if there is no further influence or adoption happening when a critical value is reached. This could be made more precise. However, any real use of the model would involve a large amount of empirical work (fieldwork and maybe computer simulation) to obtain that level of precision. Nonetheless, the model, being quite general in its description, has the potential for further applications in other areas.

Chapter 4. Research Hypotheses

4.1 Introduction

To proceed with the fieldwork, hypotheses are necessary. Those were conceived after reading the literature, and after an initial investigation (see 3.2). The initial investigation was in two parts: the first part was based on discussions with personal contacts working in various local organisations; the second part was based on textual analysis of the postings in the NOSI online forum.

4.2 Initial Investigation

4.2.1 Local Interviews

At the earliest stage of the research there was an investigation based on interviews and visits to local organisations. Initial contacts were with university colleagues (at the same university and at other universities in the city of Edinburgh) and the local Linux user group (EDLUG). An effort was made to conduct interviews with people who were supporters and users of OSS, and also with people who were not. The main aim of this investigation was to gain an understanding of what were perceived as the main factors influencing the adoption of OSS. Ideally, it was decided, these people should be asked questions which were as open-ended as possible, so that their views would be freely expressed, so these were ‘unstructured interviews’.

The perception of OSS being difficult to use was mentioned quite often. Many OSS non-users said they believed open source software was hard to set up. The most commonly mentioned open source software was Linux, so the operating system itself, rather than OSS running on an existing operating system. When these people were asked about the Firefox web browser

running on Windows, for example, they usually reported a positive experience, but expressed a negative opinion on OSS in general. Nine OSS non-users were interviewed on twelve OSS users were interviewed. Two of the OSS non-users reported that they had tried to install Linux but had wither been unable to get it working correctly or had found it difficult. Three of the others had no opinion on OSS, either positive or negative, and the remaining four said they had either heard or read that Linux was difficult to set up. Of these, most when asked if they were likely to try open source software in future replied that they were not (or at least not unless it changed significantly).

Also from these conversations, it became obvious that most OSS non-users were not aware of the origins of OSS, were not aware that much of the infrastructure of the Internet is based on OSS, and were not aware that several popular programs (e.g. Firefox) were in fact OSS products.

4.2.2 NOSI Forum Analysis

The NOSI organisation (Non-Profit Open Source Initiative) has the aim of giving advice and support to any non-profit organisation considering use of open source software. From time to time the organisation produces the NOSI Report, which contains information intended for non-profit organisations on OSS use in non-profits. The NOSI Report also gives some background information on OSS in non-profits. In particular, the report points out that general awareness of OSS in non-profits is low (the literature produced by NOSI aims to address this issue). NOSI also produced the "Open Source Primer for Nonprofits" (Choosing and Using Open Source Software: A Primer for Nonprofits), which pointed out that, at the time of writing, staff in non-profit organisations were in general not familiar with OSS. The primer was written to give enough information on open source software for non-profit organisations to make an informed choice on whether they would be able to use OSS, and if so, which OSS products might be suitable given their requirements.

In addition to the primer and NOSI Report, NOSI runs an online forum where members can discuss topics of interest. At an early stage of the research, the NOSI forum was evaluated as a source of data regarding use of OSS in non-profit organisations: the forum topics, it was decided, could give an indication of what some of the important issues are to software users in non-profits. The method chosen to do this was a simple form of document analysis.

From the NOSI website it was found that archives could be downloaded of previous postings, so a complete archive could be obtained from the beginning to the present time. The archive consisted of plain text with header information identifying the person who posted the item, date and time as well as subject. The files were extracted (they were downloaded as zipfiles) and a few simple programs were written (in Perl) to gather simple statistics.

First, the subject lines were extracted and these were reviewed by hand in order to compile an initial set of keywords. In fact the concept of “keyword” was extended to “key terms” – these may be single words (e.g. “compatibility”, “usability”) or groups of words (e.g. “total cost of ownership”, “user friendliness”). Care was taken to include variants of key terms. This was necessary since the key terms may appear in slightly different forms, e.g. “webserver” and “web server”. Also, certain terms were considered together because of their close relationship, e.g. “usability”, “ease of use” and “user-friendliness/user-friendly”. The groups of related keywords will be referred to as *key terms*. An initial set of key terms was chosen after inspection of the subject fields in forum postings, and this was expanded after reading the text of the postings. In addition, once some results were obtained, these were used to suggest further related key terms. Frequencies of occurrence were measured of key terms in the whole archive text. The frequency was taken to be the number of separate postings containing the key term. With that measurement, multiple occurrences of a key term in a single posting do not bias the measurement. As well as the measurement of frequency, postings were grouped by week and frequency of key terms as measured in each week. In that way it was possible to get an idea of level of activity in

discussing a particular topic. The aim was to find the pattern of exchanges on the forum. It was found that typically once a subject appeared, first there were only a few postings, then the number of postings would increase over the next few days, then the number would decrease again, and after a week or two the subject would not have any new postings. This data, giving the number of postings on a subject week by week, was useful for an indication of how much interest forum members had in a particular topic, since a higher number of postings represents a higher level of interest.

The approach to document analysis is now summarised:

Key terms emerged in several categories --

+ Technical IT issues
+ General IT issues
+ Software categories
+ Operating systems
+ Open Source

and the reasoning for each of these is as follows --

Discussion of technical IT issues indicates engagement by the forum members in these matters, rather than just a casual involvement simply as end-users. As well as that, comparing how frequently technical matters are discussed gives an idea of how important they are to the members, compared with non-technical issues. Various software categories (e.g. database, web browser) were included to find out how often these were discussed and certain specific software packages were included (e.g. firefox, apache). An immediate result from this was the discovery that content management software was discussed more frequently than anything else. Content management software such as zope and plone allows users to maintain a website, without knowledge of the technicalities of HTML, so the discussion indicates an interest in that.

Operating systems were included to find out how often these were discussed, and indeed Linux is mentioned in a large proportion of the postings. Windows is mentioned too and FreeBSD is mentioned occasionally. Certainly this indicates a certain level of awareness of OSS.

A number of OSS-related keywords were searched for, including well-known OSS repositories sourceforge and freshmeat.

A summary of the results is as follows (see Table 3.1):

Table 3.1. Summary of Key Terms and Occurrence Frequencies

Key Term	% Occurrence
Linux	28.52
Content Management	20.49
Windows	14.35
Microsoft	11.37
General Public License	7.04
Openoffice	7.04
sourceforge	6.05
Firefox	5.51
Ubuntu	5.42
Mysql	4.96
Apache	4.51
Mozilla	3.70
Debian	2.35
Red Hat	1.89
Thunderbird	1.71
Web Server	1.44
Total Cost of Ownership	0.18 & licence cost 0.99
Mail Server	1.17
FreeBSD	1.08
Word Processing	0.9
Fedora	0.63

System Administration	0.54
freshmeat	0.36
Staroffice	0.27

Note that the open source Openoffice is mentioned significantly more often than its commercial version Staroffice.

Note also that references to licence costs were searched for using “licence fee”, “licence cost”, “license fee” and “license cost” – US spelling is “license” and that accounts for 0.45% of occurrences while “licence” occurs in 0.54% (so roughly the same).

4.3 Hypotheses

Because of the lack of literature on IT/OSS in non-profit organisations, it was necessary to conduct an initial investigation at the beginning of the research, as described earlier, and this included discussion with concerned individuals in the local area as well as use of online resources such as the forum run by NOSI (Non-profit Open Source Initiative). However, it should be remembered that the context of the technology is important. As Fine (2003) says, “…not even the strongest information technology can replace the need for personal interaction: the core of what nonprofits do to make a difference, build stronger communities, and effect social change will always be people”. In an investigation of the technology in context, then, there is a need to understand the personal aspect – an individual’s views and opinions, who they communicate with, who influences them. Hypotheses were derived from both the literature review and this initial investigation, and the hypotheses are summarised in Table 3.2.

Table 3.2. List of Hypotheses

H1	Most OSS non-users have not considered using OSS.
H2	Most OSS non-users are not aware of the nature of OSS
H3	Most OSS users are likely to continue using it.
H4	OSS users are more likely to rate Internet information as important, compared with personal contact. OSS non-users are more likely to prefer personal contact to information obtained from the Internet
H5	OSS use is less likely in an organisation where decisions are made by a committee or other management group, rather than by one person or a small group with IT knowledge
H6	Greater use of the Internet is linked with a higher probability of using OSS
H7	Organisations where workers rely mostly on personal contact for information on IT are less likely to use OSS
H8	Ease of use is a major factor considered in software choice
H9	Compatibility is not considered a major factor
H10	OSS ideology has little influence on OSS adoption
H11	Cost is not a major concern in non-profit organisations

Now, a summary of the rationale for each hypothesis in turn.

4.3.1 Likelihood of OSS non-users considering OSS

H1. Most OSS non-users have not considered using OSS.

'The basis for this hypothesis is as follows: since Open Source Software is still only used by a minority, and since non-profit organisations are likely to be understaffed, it is reasoned that most non-profit organisations will not have access to anyone familiar with OSS, and able to install it on the organisation's computers. Of course this will happen from time to time, but it is likely to be by chance -- a volunteer for the organisation coincidentally being on OSS user. It is felt that the perception of OSS as 'difficult', and just a general lack of

knowledge, will result in non-profit organisations not having the confidence to switch to OSS. This kind of attitude is confirmed by a reading of the NOSI Primer. This hypothesis relates closely to H11. Since non-profit organisations get a significant discount on software licences, the perceived benefit of switching to OSS is reduced.

4.3.2 Awareness of OSS among OSS non-users

H2.Most OSS non-users are not aware of the nature of OSS.

This hypothesis can in fact be taken as several distinct hypotheses, depending on which 'nature' is being considered. For instance, some people who are not OSS users may not be aware that it is free of charge, on the other hand they may know it is free but think that is evidence enough of low quality. Views have been expressed such as "If it's free it can't be any good" - attitudes such as this are described in a number of research papers on the open source phenomenon. The author of this research has also heard opinions like this expressed in conversation. On the other hand, other OSS non-users may be unaware of the kind of people who are involved in the development of open source software, and unaware of the scale of Internet collaboration involved in OSS. In general terms, however, this hypothesis is based on the idea that, particularly at an early stage, opinions on an innovation will vary between people and this will depend on their sources of information. Indeed, the phase of the innovation-decision to be considered here is what Rogers (1995) refers to as the 'information' phase. That is, people gathering information about an innovation but not yet ready to make a decision on its use.

4.3.3 Likelihood of OSS users continuing with OSS

H3 Most OSS users are likely to continue using it.

This hypothesis is based on the initial investigation: it was observed that users of OSS were typically strong supporters of the OSS concept. While these people did often admit that Linux was not yet “ready for the desktop”, for example, they said they would continue to use it. Their motivation s they explained it is to support the OSS development effort by telling other people about OSS, showing it to them, and encouraging its use as well as from time to time posting bug reports on software packages. One of the Linux users who were asked about OSS in non-profits had provided installation media for Linux and Openoffice to libraries and other local organisatons, free of charge. This certainly shows personal commitment and is the kind of attitude which indicates that OSS users are not likely to stop using it. Others pointed out that they were not will to pay for software licences, and if any open source program they use does not meet their requirements, they will look for a different program, but still open source.

4.3.4 Influence of Internet use on OSS adoption

H4. OSS users are more likely to rate Internet information as important, compared with personal contact. OSS non-users are more likely to prefer personal contact to information obtained from the Internet.

This hypothesis comes from ideas of Rogers on communication through the media in relation to innovation. Specifically, users of the mass media are more likely to innovate. The Internet is of course a prime example of a mass medium and OSS owes its existence to the Internet, as well as using the Internet for the distribution of the software.

H6 and H7 are also based on ideas fro Rogers on the role of communication media in decisions to adopt innovative technology. Specifically, Rogers claims that users of mass media are more likely to adopt innovations than individuals who rely on personal contacts for information.

4.3.5 Influence of Organisational Decision-Making

H5. According to Rogers (1995, p.379) “Centralization [the degree to which control is in the hands of a few individuals] has usually been fond to be negatively associated with innovativeness; that is, the more that power is concentrated in an organization, the less innovative the organization tends to be”. Rogers explains that in a centralised organisation, “top leaders are poorly positioned to identify operational-level problems” (loc.cit.). it seems likely then that an organisation where IT procurement decisions are made by a management group such as a committee is less likely to adopt OSS than an organisation where IT staff have more independence and can make their own decisions.

4.3.6 Influence of Software Usability on OSS adoption

H8. Ease of use is expected to be a major factor influencing OSS adoption because many OSS non-users (and some OSS users) said that open source software is not easy to install and configure. Frequently non-users compared Linux with Windows, explaining that Windows has better hardware support and in general has a more consistent user interface. They pointed out that programs available for Linux were written by different teams of people with different ideas about user interfaces, or they are based on different support libraries. For example there two major competing desktop environments, KDE and GNOME, and these do not do things the same way. This was in fact the main complaint, that it was sometimes necessary to learn how to use the interface provided by different software packages, rather than all programs having a similar style as happens with Windows.

4.3.7 Influence of Software Compatibility on OSS adoption

H9. The hypothesis that compatibility is not a major factor influencing OSS adoption comes from the results of the NOSI forum analysis – compatibility is mentioned in under 2% of forum postings.

4.3.8 Influence of Ideology on OSS adoption

H10. Based on, e.g. Bruce Perens (1999) and the literature on creation of Open Source (rather than just free software) – Perens (19999) doesn't care about ideology, just what works well. This led to the rapid growth of OSS, so can expect ideology is ignored by many people.

4.3.9 Influence of Cost on OSS adoption

H11. This comes from the NOSI forum analysis – low frequency of total cost of ownership, licence cost etc.

Summary

This chapter has introduced all of the research hypotheses, and explanations have been given for their origins, based on either consideration of the literature or on the results of the initial investigation, including analysis of content from the NOSI forum.

Now that the hypotheses have been explained, it is time to consider the empirical aspect of the research. It is necessary to have a research method able to determine whether the hypotheses are true or false. As well as deciding on the general research approach, there has to be decision on the specific tools used to testy the hypotheses. The next chapter will set out the research philosophy and methods, while the one after that will describe the actual fieldwork.

Chapter 5. Research Philosophy and Methodology

The purpose of this chapter is to give an overview of the approach to be used in investigating the research questions identified earlier. The software environment is complex and rapidly changing, so it is necessary to have a flexible approach while investigating it. First a review of a number of different philosophies:

5.1 Determinism

Technological determinism is the view that a society's technology determines its development and history, its structure and values. Technological determinism is a reductionist theory – explanations are all reduced to the effects of technology. It is the "belief that social progress is driven by technological innovation, which in turn follows an 'inevitable' course" (Smith 1994, p.38), or expressed as briefly as possible, "Technology determines history" (Williams 1994, p.128).

Technological determinism can be viewed in two forms – a 'strong' and a 'weak' version. The strong version considers technological innovation as the only factor influencing social change. The weak version does not go as far as this but says that technological innovation is a key factor influencing social change.

Adoption of technology, therefore, is considered in technological determinism as a result of the natural growth of technology itself, which 'follows its own rules':

- The development of technology follows a trajectory which is not influenced by social factors
- Technology has effects on society which are determined by the technology itself, rather than socially influenced.

Technological determinism is no longer accepted as a theory of the relationship between technology and society. Science and technology studies (Pinch & Bijker 1984, Bijker, Hughes & Pinch 1987) have shown that the relationship between technology and society is not as simple as presented in technological determinism. The main limitation of technological determinism is of course that it ignores social influences on technology development. Technology development is a social activity and the aims of technology developers are influenced by the social environment: values, methodologies and so on. This is not reflected in technological determinism.

However, technological determinism is a view which has had a large influence on thinking about technology and especially in the media, presentation of stories about technology often display aspects of determinism. This most often takes the form of presenting technology as a solution to a problem – for instance a newspaper story may introduce news about technological change as though a new technology will solve all or many of the existing problems. Also, the way government policies are expressed or reported often have a deterministic 'feel' – for instance introduction of a new computer system may be described as if the technology will automatically result in significant improvement. This ignores the complex relationship between technology and the environment in which it exists, and overlooks the fact that any new system will have to be 'debugged'.

So although technological determinism is no longer considered a realistic theory, it is still necessary to be careful when discussing technology and introduction of new technology, to avoid falling into the trap of deterministic thinking.

5.2 Interpretive Approach

Orlikowski and Baroudi (1991) identify three major research philosophies: positivist, interpretivist and critical.

The basis of positivism is the idea that “the world exhibits objective cause-effect relationships which can be discovered, at least partially, by structured observation” (Walsham, 1993, p.4). Positivism is a theory which has been influential in the philosophy of science: the ideas of positivism come from thinking about science. Positivists argue for the use of the ‘scientific method’, based on a cycle of theorising and experimenting. Critical to positivism is the development of suitable experiments aimed to ‘discover reality’ and in the case of studies of ICT use this means having suitable tools to make measurements. Statistical tools and tools for different types of network analysis may be used. Typically, positivist researchers do not enquire about the ‘meaning’ of technology in context since this is not an ‘objective’ phenomenon.

On the other hand, the interpretive approach places emphasis on ‘subjective meanings’ and the importance individuals give to elements of the technology they use (for instance use of a more efficient database system might ‘mean’ being able to access client data more quickly when someone makes a telephone enquiry). The interpretivist approach is based on the idea that the social world is constructed through shared meanings and the reasoning and intentions of individuals. Interpretive studies are not based on quantitative measurement, they are based on understanding phenomena on the basis of the meanings that people give to them. Interpretivists aim to understand a process by ‘getting inside’ and finding out about motivations, preconceptions, the influence of personal links and organisational structure, and so on. Clearly the interpretivist view takes account of the influence of social factors (and possibly also psychological factors) on choices regarding technology use. However, this may not be the ‘whole picture’. The way ‘meaning’ is understood is also important for an understanding of the interpretivist approach. Meaning is not just an ‘individual’ phenomenon, it is something which comes within a social context. As expressed by Walsham, “In an organizational context, the enactment of meaning is a collective activity, at least in a partial sense, and thus cultural ‘structures’ or structures of shared meaning are created within the organization” (Walsham, 1993, p.34).

The critical philosophy of Information Systems research emphasises the idea of ‘unfulfilled potential’ and it proceeds by trying to identify ‘barriers’ to positive change, concentrating on a historical perspective on how conditions have developed. The role of the researcher is to “bring to consciousness the restrictive conditions of the status quo in order to help eliminate the bases of alienation and domination” (Walsham, 1993, p.246).

The view here is that a positivist approach is not sufficient for an understanding of factors influencing the adoption of open source software. At the same time, the usefulness of measurement tools producing data for statistical analysis is acknowledged. Such tools need to be used in this kind of research alongside an investigation of social factors through methods such as interviewing. There are many views on open source software, and some people in organisations which are potential adopters simply do not know much about it. With a lack of information, opinions and personal influence are such a significant element in determining what happens when decisions are made that they can not be ignored.

5.3 Social Constructivism

A response to technological determinism came in the form of Social Constructivism, which is the view that technology is constructed entirely according to social context. The dependence of technological development and technological choices on social context is recognised by authors like Walsham, who says “Technology does not determine social direction, but rather social stability and change arise from a myriad of personal choices. Individuals make such choices within perceived social contexts which constrain and enable various alternative actions” (Walsham, 1993, p.242). As Walsham explains, use of computerised systems may be linked with significant social change as well as reinforcing existing social structures. Walsham advocates an approach to research on ICT use which focuses on questions about why certain transformations have or have not occurred, and what social choices exist.

The view of social constructivism is that technology is entirely structured by its social context. Examples are given in Bijker, Hughes & Pinch (1987) of the ways in which technological innovations can be adapted for use in unexpected situations and how this gives rise to different ideas about their meaning.

Bullen and Bennett (1991) discuss work productivity in ICT environments and note that the link between computerisation and productivity is not direct: more computerisation does not necessarily lead to increased productivity. These authors argue that successes in increasing productivity come from managers and group members working to create environments with clear goals of improvement – environments where hard work and commitment is encouraged and rewarded. This is a recognition that the technology is only a tool, and it has to be deployed properly with properly motivated staff, so that the organisation can take advantage of what it offers.

5.4 Social Informatics

Although social constructivism may be able to give some explanation of how technology is shaped through social processes, it does not extend naturally to explaining what happens after a technological innovation has been adopted. As McLoughlin says, '… innovation cannot be adequately occurring up to but not beyond the point of first successful adoption' (McLoughlin 1999, p.148). This criticism of social constructivism suggests that what happens in the post-adoption phase is the key influence on the mutual shaping of technology and organisations. New technological ideas and new types of organisation are developed and these depend closely on each other.

The SI approach utilises aspects of SCOT (Social Construction of Technology), ANT (Actor Network Theory) and Systems Theory. However, unlike these approaches, SI is very much concerned with the context in which a technology appears. As it is expressed by Kling, "One key idea of social informatics research is that the social context of information technology

development and use plays a significant role in influencing the ways in which people use information and technologies, and thus affects the consequences of the technology for work, organisations and other social relationships" (Kling, 2000, p.225). Kling makes the observation that social context is not an "abstract cloud", it is a "specific matrix of social relationships" (loc.cit.).

Building on the ideas of Social Constructivism, Social Informatics (SI) is an approach to investigate the use of ICT which emphasises social context. It is "the interdisciplinary study of the design, uses and consequences of ICTs that takes into account their interaction with institutional and cultural context" (Kling 2000). Social Informatics is built as a combination of different approaches, therefore. Technology is investigated in its own terms, but this is not the only aspect considered. Conditions in organisations using ICT are viewed 'organically', with close observation of social interaction as well. It is felt in the SI approach that no one description is adequate and it is necessary to approach the topic from several different lines of enquiry, at least partly because the situation is in fact very complex, with many interactions at many levels – technical, social, individual and organisational. This is one of the major insights of Kling and it has been described as a 'multi-view' approach (Horton, Davenport & Wood-Harper, 2005).

It could be said that social constructivism focuses on the 'micro-level' rather than taking an overall view, but SI considers both the macro-level and the micro-level. SI is concerned with ideas such as context, identify, role and power, which may be considered as basic ideas coming from sociology. It is also concerned with the dynamics of social interactions and the historical development of ideas about technology. It acknowledges conflict arising because of disagreements about goals and recognises that there are negotiated solutions among individual actors, each with their own interests.

While social constructivism has a 'historical' viewpoint, SI researchers are interested in technological development 'from the beginning'. Social informatics is also an approach which emphasises what happens to technological artefacts once they are already in use. It does not assume that

an artefact is somehow ‘fixed’ at that stage. So IS researchers are interested in investigating how users interact with technology over the medium and long term, and how this can have an impact on the emergence of new technologies.

It is also a significant aspect of the SI approach that it tends to be ‘problem driven’ rather than ‘theory driven’, and this goes back to Kling’s idea that the complexity of the subject is such that no one theory is adequate. Social informatics, because of this, is multi-disciplinary in nature as researchers investigate problems that interest them and apply whatever theories seem applicable and suitable.

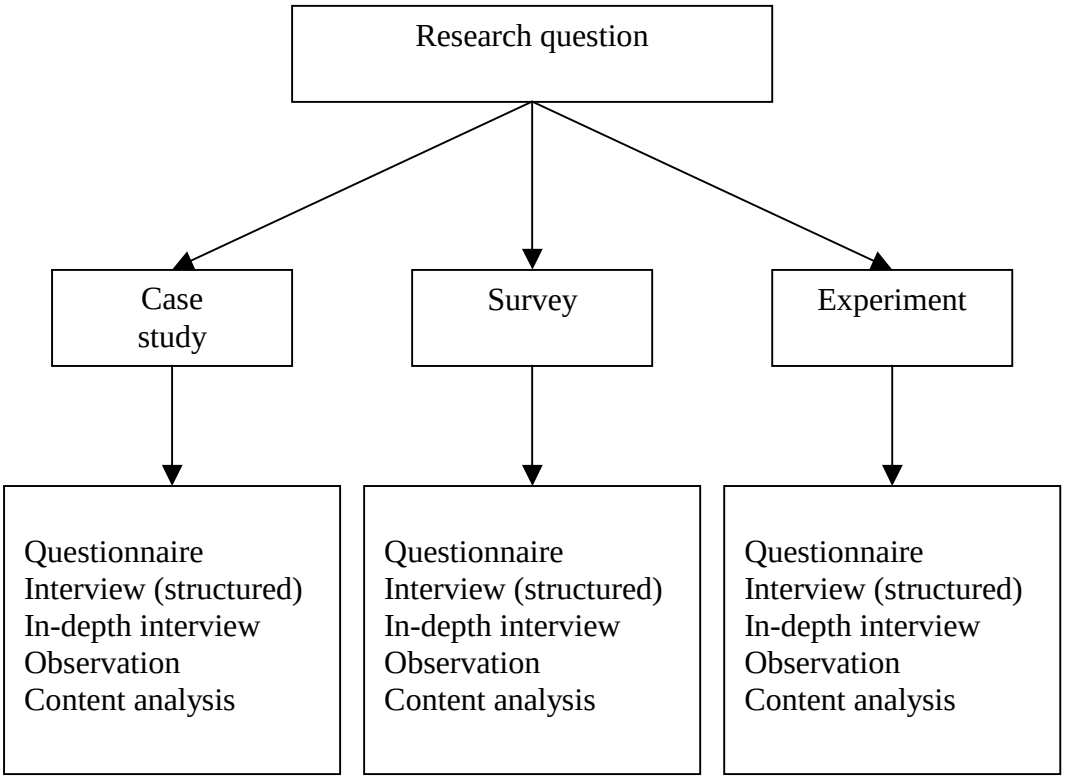
5.5 Research Approach: Choice and Instruments

In line with the Social Informatics approach outlined above, being problem driven rather than theory driven, we need to clarify what kind of research approach is appropriate.

5.5.1 Survey as a Research Approach

There are various approaches to data collection and analysis in social research: there are case studies for example, as well as surveys and experiments. In contrast to a survey, the case study method involves collection of data in one specific case, while an experimental approach collects data over a range of cases where an experimenter can control the values of some variables by experimental intervention. Each approach is used in a different research situation, for instance where it is not appropriate to control variables by experimental intervention, the case study or survey approach is preferred. Fundamentally, all the methods begin with a research question, then apply their own method of data collection (see Figure 5.1), after which analysis of the data can be done.

Figure 5.1 A range of methods of research and techniques of data collection (source: de Vaus 1991, p.6)



According to de Vaus (de Vaus, 1991, p.3), a survey may use several different methods of data collection: "questionnaires are widely used but other techniques such as structured and in-depth interviews, observation, content analysis and so forth are also appropriate". A survey is characterised by de Vaus as having a structured set of data which is a data matrix. The result of data collection is a data matrix because "we collect information about the same variables or characteristics from at least two (normally far more) cases and end up with a data matrix". The technique for obtaining the data need not be highly structured, the only requirement is that for each case we obtain a measurement of the value of each variable. However, as observed by de Vaus (op. cit. p.5), "Because questionnaires are the easiest way of ensuring this structured data matrix they are the most common technique used in survey research.

One distinguishing feature of the survey, then, is the data matrix of variable values obtained by the use of a research instrument (e.g. a questionnaire).

This allows the values of variables to be compared in different cases, and the method of data analysis is another characteristic of the survey approach. What survey research seeks is some systematic linking of variables. According to de Vaus, "it aims to draw causal inferences by a careful comparison of the various characteristics of cases" (loc. cit.). At the same time, as de Vaus does recognise, it is necessary to be careful to avoid mistaken ideas about causal links, since simply showing two things occur together does not prove that they are causally linked.

This type of research approach may be described as the correlational survey, a term used by Punch (Punch, 2005, p.75). Punch explains that such a survey stresses the study of relationships between variables. He also explains that "Those relationships are often studied using conceptual frameworks similar to those used in experimental design", though a survey is a non-experimental approach to research. The reason for this, as outlined by Punch, is that research methodologists have developed non-experimental research designs for situations where variables are to be studied but it is not possible to control them. Because of that, it is important for researchers to understand the basic principles of experimental design.

Certainly in the case of the design of a survey, care must be taken to ensure first of all that there is a good choice of variables to measure. Also, there must be decisions made on what type of response to allow to each question (Yes/No, 1-10, Agree/Neutral/Disagree etc.).

As noted by de Vaus (de Vaus, 1991, p.47). “To be useful, concepts must have empirical indicators”. As the author points out (loc. cit.). “The difficulty is in developing good indicators for concepts”, going on to suggest a three-step method, which was utilised for the survey undertaken here, as follows:

1. clarifying the concepts;
2. developing initial indicators;
3. evaluating the indicators.

Starting with the research questions then, it was necessary to refine the concepts involved and create a conceptual framework in which the variables employed were able to characterise relevant aspects of OSS. Data was then collected and an analysis was undertaken. For example, one of the elements in the conceptual framework is expressed in the question ‘How do potential adopters obtain information about IT’ and this was developed into a concept of information flow through an organisation, or in person, or through the media, including the Internet. This allowed the definition of indicators to make measurements within a sample population. Those indicators included measurements of the perceived importance of various sources of information: the Internet in general, online discussion forums, mailing lists, software vendor websites, Internet news sites, personal contacts and IT consultants. Similarly, another fundamental concept in the conceptual framework is network effects. This was investigated with other indicators through questions in the online questionnaire, for instance measuring frequency of contact with other non-profit organisations in relation to IT problems, IT latest news and IT events/meetings.

However, clarifying the concepts and indicators was not all that was required. As noted by Gomm (Gomm, 2008, p.129), “Only insofar as a sample is statistically representative can it be claimed with confidence that what was true for the sample will also be true for the population from which it was drawn”. Attention was therefore given to ensuring that an appropriate sample population was constructed to help ensure that the findings were statistically significant. The sampling approach is discussed later in this chapter.

In order to assist with enhancing confidence in the outcomes of the survey, the author gave consideration to reported advantages and disadvantages of the survey approach, derived from several sources (de Vaus 1991, Sapsford 2007, Gillham 2008). First, a survey (for instance done with a questionnaire) is widely reported as an efficient way of collecting a large amount of data. It can also be a low cost approach, depending on the data collection method. An online survey in particular is acknowledged to be a low cost method since there is no need to send out mail or make telephone calls and in addition to

that, data collection can be automated. As well as these advantages, the data format of a survey (the data matrix referred to earlier) is suitable for statistical analysis using standard techniques such as correlation coefficients, chi square test, regression and so on.

However, a number of criticisms of surveys were also noted by the author. Some of these are as follows (after de Vaus, p.7 ff):

1. Surveys cannot establish causal relationships between variables. They can establish a statistical link, but that does not necessarily mean there is a causal link.

2. Surveys cannot get at the meaning behind social activity. This involves the beliefs and attitudes of individuals, their memories and goals and so on,

3. Surveys consider particular aspects of people's beliefs without considering their context. Taken out of context beliefs and behaviours are easily misinterpreted.

4. Surveys are based only on rigid ideas of hypothesis testing and produce statistics from a mass of facts, but this proves nothing of theoretical value.

5. Surveys are incapable of measuring some things, for example they cannot be used to measure how much influence a particular political party has, because that is something which really cannot be quantified.

Possible responses to these criticisms were considered in developing the use of a survey for the research reported here. In particular the author ensured that the following issues were addressed in the development, execution, and analysis of the survey.

1. The construction of the conceptual framework included elements derived from consideration of causal links, for instance it was hypothesised that use of Open Source Software would be more likely in an organisation where

decisions on IT are made by an IT manager, rather than by a general manager or a head office. The reasoning for this was that an IT manager would be more likely to have wide knowledge of IT, would be more likely to communicate with others on specific IT issues, and would be more likely to want to experiment with OSS. In this way, the conceptual framework was built up from specific hypotheses about causal links, and the survey was used to test the hypotheses of the framework, so it was possible to make inferences about those causal links.

2. As noted by de Vaus (op. cit. p.7) “survey research can go a long way towards arriving at such ‘meaningful’ explanations” (with theory construction followed by empirical research). In this research, the questionnaire included a number of questions on attitudes, so not just questions on ‘factual’ information. In addition, since the conceptual framework included elements based on the reasons behind behaviours, the questionnaire allowed inferences to be made in the research about the significance of those reasons. As well as that, further confirmation of results was obtained from carrying out interviews with selected respondents, during which certain points were clarified.

3. Survey research in fact can gather information on context. Bearing in mind the previous two points, regarding the problems of using a survey to gain information about causal links and about the reasons behind behaviours, care was taken to include additional context questions. For instance, in considering what factors are important in decisions on whether to adopt OSS, there were questions not only on attitudes towards OSS, but also questions on organisational software needs. This context information was needed because an effect thought to come from a respondent’s attitudes might in fact simply be a result of availability of software satisfying a particular organisational requirement, and it was necessary to be clear what the main influence was. The penalty for gathering context information is, of course, an increased number of questions. The decision on what kind of information to collect about context to avoid misunderstanding is a concern of the theoretical construction stage of the research, so while lack of context information may be a difficulty,

as de Vaus puts it (op. cit. p.8), “with care survey research need not lead to contextless pieces of information and the consequent misunderstanding of that information”.

4. It is not the case that surveys produce nothing of theoretical value, but again this depends on the conceptual framework worked out beforehand for the research. The development of the conceptual framework, reported in the previous chapter, was used to inform the construction of the survey to address this particular concern. In other words, the questionnaire grew out of theory – it came from a collection of hypotheses derived from thinking about the realities behind decision-making and social interaction. It was this earlier stage which decided whether the results from the survey were of some theoretical value, since the survey results shed light on the theories (for example by showing certain hypotheses to be false). The results of theoretical value from a survey are only as good as the theories motivating the survey questions, so care was taken to develop a suitable set of theories and hypotheses.

5. Consideration was given to the possibility, and sometimes voiced concern, that some subjects are simply not suitable for a survey. In this research careful consideration was therefore given to the choice of approach, and a survey was deemed to be an appropriate research method.

In conclusion, while the survey approach may be reported to have a number of potential weaknesses, these were considered and addressed for the research reported here. In particular, very careful thought was given to the development of the conceptual framework described in the previous chapter, and this informed the development of the survey, also the analysis of the results. It was decided that with careful choice of questions to gather some context and with an awareness of the limitations of surveys, it would indeed be possible, and useful, to use the survey approach for the research reported in this thesis.

There are various different types of research instruments associated with a survey based approach and each has its own advantages and disadvantages. The following discussion is an indication of how it was decided to use an online questionnaire and follow-up interviews. The discussion will proceed with first a description of several research instruments that were used, second a summary of the criteria for selecting the research instruments for this research.

First, then, a review of the different types of research instrument used to undertake this survey:

Questionnaire
Interview
Document Analysis

5.5.2 Questionnaire

A questionnaire is conducted by using a standardised set of questions delivered to respondents. Delivery can be face-to-face, over the telephone, on paper or online. A questionnaire can include both open-ended and closed-ended questions. A closed-ended question is one with only certain fixed responses available (such as Strongly agree/Agree/Neutral/Disagree/Strongly disagree) while an open-ended question gives the respondent the chance to give any answer, by saying whatever they want (or writing free text to say what they want). Open-ended and closed-ended questions will take a different form depending on whether the questionnaire is done face-to-face or by some other method. Face-to-face or on the telephone, the researcher simply waits for an answer without saying anything. In the case of a closed-ended question, the researcher will read out the options for the answer and wait for the respondent to choose one of these.

A questionnaire can be a good way to obtain data, and use of closed-ended questions makes it easy to carry out a statistical analysis. All closed-ended

questions have pre-defined responses and that is what makes the analysis simple. A closed-ended question may be asked to find out how much a respondent agrees with a statement, for example, and then the response will be on a scale. That can be represented numerically and is suitable for statistical analysis - for instance correlation coefficients can be used to find out to what extent this response is linked to others responses in the survey. Also, for questions where the response is not on a scale (e.g. asking who in an organisation makes IT procurement decisions), it is still possible to use statistical tests to find links with other responses (for example a t-test to discover differences between groups of respondents. In addition, there are special purpose software packages which can be used to carry out statistical data stored electronically, as a spreadsheet or as a comma separated variables (CSV) file. One such software package is SPSS and this was used throughout the analysis of the survey results in this research. A clear advantage of using software like SPSS is of course that results can be obtained rapidly. However, a balance has to be struck: if open-ended questions are not used, it is quite possible that some important views from the respondent will be missed.

5.5.3 Interview

Interviews may be conducted in person or over the telephone. At one time face-to-face interview was the only method used, but telephone surveys became popular for market research in particular. Once the majority of households had a telephone, telephone interview became a cost-effective method of conducting opinion polls, whether for business use (market evaluation) or for government. Interviews may be structured, unstructured or semi-structured, representing different levels of pre-planning from the interviewer. In a structured interview, the interviewer controls the flow of the questioning fully and there is no deviation from the plan written beforehand. In an unstructured interview, the interviewer treats the interview as a conversation. The aim of conducting an unstructured interview is to make the conversation as natural as possible but this is difficult to achieve since it relies

on the skill of the interviewer in guiding the flow of conversation without having a plan at the outset. This needs at least skill in improvising (so reacting to what the respondent says and steering the discussion to a topic of interest). These are two extremes: full planning of the interview beforehand in one case and no advance planning at all in the other. As an alternative to these two extremes, an interviewer may decide on a semi-structured interview. Typically this will involve the interviewer having a 'topic list' decided in advance but trying to keep the conversation as natural as possible. When the respondent says something related to an item on the topic list, the interviewer can guide the conversation onto that topic quite naturally. However, it is done, in person or over the telephone, structured, unstructured or semi-structured, interviews can be a good way to obtain certain types of information (in particular to get someone's opinions on a subject), but it represents a lot of work and analysis of the results can be very time consuming. After the literature review and initial investigation, it became clear that it would be necessary to obtain good qualitative data for research into factors influencing OSS adoption in non-profit organisations. Since it became obvious that social factors have a large influence on views of open source software (e.g. many Linux users are strong supporters of the operating systems and give their own time to help others with it), it was apparent that just a questionnaire would not be sufficient. It was evident that there had to be some person-to-person discussion to clarify the origins of opinions, and individual concerns and motivations. Although there is a very obvious time penalty in conducting and analysing interviews, there is a real opportunity to find out about the personal and social factors behind the statistics from a survey.

5.5.4 Document Analysis

Textual analysis of an organisation's documents can give an insight into the functioning of an organisation. This can be extended to any group of people who communicate in text. The analysis can be on more than one level -- for instance there can be an analysis purely of content, but there can also be analysis of the time relationship between communications (to study speed of

response from different groups for example). The usual meaning is analysis of the actual text, but this research will use the extended definition, both content and time relationships. Content can be analysed for the occurrence of key words or phrases. Frequency can be measured and context can be determined from reading the text. This can be a useful tool but only has limited application. Obviously it requires access to the documents and this may be difficult to obtain in many cases. However, it can if used carefully give an indication of a direction for research, by giving some indication of perceived importance of an issue by frequency of mention. This is the simplest application of document analysis but more advanced uses require sophisticated statistical analysis and computer-aided text analysis.

5.5.5 Criteria for Choice of Research Instrument

Criteria for choice of research instruments fall into two categories - criteria relating to the research problem itself, and practical concerns. First, consider the nature of the research problem.

The research problem involves determination of the influence of certain factors which are quantitative. For instance it is expected that size of organisation, number of IT staff and budget will all have an influence, and these are quantitative data. The most time efficient method of collecting such data is through a survey.

Many factors influencing OSS adoption are expected to fall into a limited range of responses, for instance who makes IT procurement decisions in an organisation, or factors may be rated for importance by respondents, for instance the importance of Internet use, the importance of software support, etc. this makes closed-ended multiple choice questions suitable, so a survey is appropriate.

Data can be collected and analysed easily. With a survey, respondents are asked a standardised set of questions, so it is easy to compare responses. This gives an objective measure, compared with interview.

Potentially, information can be collected from a large proportion of a population. Since the questions are standardised there is no restriction on who can take part. In reality, of course, the response rate may not be high, but it can be maximised by re-contact reminders. Questionnaires are a familiar way of getting information, so respondents may feel more comfortable with a questionnaire than with an interview.

A questionnaire can be completed at a time chosen by the respondent, so it may be easier to collect questionnaire answers than arrange and conduct an interview.

The researchers opinions cannot influence the answers given by a respondent, which is a possibility in an interview. Even if an interviewer is careful about this, some “cues” given unintentionally may influence the responses in the interview.

5.6 Sampling Strategy

It is necessary to explain the sampling strategy and give a critical evaluation of the degree to which this influences the empirical results. After the decision was made to conduct the research using a combination of questionnaire and interview, there was a need to consider how a sample would be obtained to give a representative cross-section of opinion. This is of course always a concern in any research of this kind. Considering the sample selection has to cover several stages -- obtaining a list of contacts, selection of organisations from that list, and also recontact strategy. The last of these was considered important since often surveys are said to have a 'self-selecting' sample: survey data comes from people who are *willing* to do surveys. As a result, it was decided that there should be two or three rounds of recontact for organisations which had not responded to the initial invitation. In that way, it

was expected that there would be some responses from people who would be usually less likely to do surveys.

First, an attempt was made to contact organisations in the city of Edinburgh. That was expected to include the region as well as the city, and approaches were made through personal contacts. However, it became clear after some weeks that although there were willing participants in the area, there was not a large number of non-profit organisations, certainly not enough to obtain a large enough sample for purposes of the research.

The research was therefore widened and it was decided that a UK national survey would be carried out. Since in the local area there was only a relatively small number of non-profit organisations, it was also a problem in obtaining a representative sample of organisations, since there was a limited choice of organisations to approach. For any research of this type, it is necessary to have a representative sample, which in some way gives a good enough idea of the whole population. Given the wider choice in a national survey to select organisations of different sizes, in different sectors and so on, a national survey would clearly give a better chance of obtaining a representative sample.

For research of this type it is necessary to have as representative a sample as possible. The sample is a subset of the entire population and for it to be representative of the whole population it has to share its main features. The population considered here is the set of all non-profit organisations in the UK. The features considered for the purpose of obtaining a representative sample are:

+ Region
+ Sector (e.g. Health, Science)
+Size

As observed earlier, more than three quarters of UK general charities are in England with one eighth in London. In order to have a representative sample

of organisations across the UK, there should be a selection of organisations from different regions. UK regions were taken as follows:

+ Scotland
+ North East
+ North West
+ Yorkshire and Humberside
+ East Midlands
+ West Midlands
+ East Anglia
+ South East (excluding London)
+ London
+ South West
+ Wales

and in the sample there should be organisations from each of these regions, in approximately the right proportions (matching the regional breakdown of the whole population). This was done by selecting organisations from an online directory of non-profit organisations in the UK (DirectGov) (see Table 5.1).

Table 5.1 Cities and Contacts

Cities	Contacts
Aberdeen	37
Aldershot	42
Basildon	18
Bedford	19
Belfast	63
Birkenhead	54
Birmingham	381
Blackburn	24
Blackpool	50
Bournemouth	73
Brighton	88
Bristol	97
Burnley	29
Cambridge	28
Cardiff	53
Cheltenham	19
Chesterfield	18

Colchester	19
Coventry	60
Crawley	32
Barnsley	35
Derby	45
Doncaster	20
Dundee	29
Eastbourne	19
Edinburgh	84
Exeter	19
Glasgow	116
Gloucester	22
Grimsby	22
Hastings	24
High Wycombe	21
Ipswich	25
Kingston upon Hull	51
Leeds	290
Leicester	85
Lincoln	19
Liverpool	153
London	846
Luton	38
Manchester	413
Mansfield	26
Margate	20
Middlesbrough	65
Milton Keynes	33
Newcastle upon Tyne	153
Newport	25
Northampton	32
Norwich	33
Nottingham	118
Nuneaton	25
Oxford	26
Peterborough	25
Plymouth	46
Portsmouth	78
Preston	48
Reading	63
Sheffield	110
Slough	25
Southampton	62
Southend on Sea	46
Southport	19
St Albans	21
Stoke on Trent	64
Sunderland	30

Swansea	45
Swindon	25
Telford	24
Torquay	20
Warrington	29
Wigan	31
York	22
Aberdeen	37
Aldershot	42
Basildon	18
Bedford	19
Belfast	63
Birkenhead	54
Birmingham	381
Blackburn	24
Total Contacts: 4969	

An online directory of non-profit organisations was used to obtain a list of organisations and almost all of these gave contact email addresses. In addition, the directory included some information on the organisations, so it was possible to select organisations in different locations, and organisations operating in different sectors. However, there was no information on the size of organisation. One of the factors influencing OSS adoption was expected to be the size of the organisation, so a sample was required with small, medium and large organisations, but it turned out to be difficult to get this information in advance. Therefore it was decided to carry out the survey with organisations found from the directory without knowing their size, then consider the data collected.

In order to ensure a representative sample in this situation, it is necessary to consider the matter carefully. What might cause the sample not to be representative? It can be the result of under-representation or over-representation of specific groups, that is if the breakdown into groups of the sample is different from the breakdown of the whole population. Because of this it was decided to operate a quota system. Specifically, since the main concern was having a representative sample in terms of size of organisation, the organisations were divided into three size categories and there were limits

placed on the minimum and maximum number of each allowed in the final results. These limits were not limits placed on the sample itself, the limits related to the breakdown of organisations in the sample contributed to the final results.

However, what this does require is some basic evidence on the actual breakdown into different sizes of non-profit organisations. This research will follow the definitions used but the Office for National Statistics -- a small enterprise is one with fewer than 50 employees, medium size is 50 or more but under 250, large is 250 or more. It is not easy, however, to obtain statistical information on sizes of non-profit organisations. The Office for National Statistics, for instance, explicitly excludes government organisations and non-profits from its figures. However, from the information available it seems that the breakdown is approximately as follows in Table 5.2:

Table 5.2 Classification of Organisation Size

Organisation Size	%
<50	50
50-249	10
250+	40

It was decided to allow variation from these percentages and still admit the results, as long as the percentages were not too far from these. Maximum and minimum acceptable values were chosen - this was based on consideration of average response values in multiple-choice questions.

Now consider the effect of having over-representation or under-representation in a sample. This discussion is purely by example, with numerical calculations to show how much of an influence there is on final (average) statistics. If two groups have similar views, if either is under-represented or over-represented, the difference in the statistics will not be large. A large difference in their views (given by answers to multiple-choice questions) will of course have a greater effect on the final measurement. The example calculations below are used just to quantify this effect.

Suppose there are two groups in a population, Group A and Group B, and suppose they each represent 50% of the population. Now imagine the responses of the two groups to a multiple-choice question with five possible responses, 0-4. This could correspond to, for instance, "Strongly Agree / Agree / Neutral / Disagree / Strongly Disagree. Now suppose (to consider the worst case scenario) that the responses from Group A are all 0, the responses from Group B are all 4. Then Average = ((50*0)+(50*4))/100 = 2,
but suppose in a sample we have 65% Group A and 35% Group B. Then Average = ((65*0)+(35*4))/100 = 1.4, which represents a change of 30% in the average value. This is of course the most extreme case, where the two groups give responses at opposite ends of the scale. More realistically, consider the following scenarios -

Scenario 1

In the population

Group A: 50%, response value 1
Group B: 50%, response value 3

Average = ((50*1))+(50*3))/100 = 2

and in the sample

Group A: 65%, response value 1
Group B: 35%, response value 3

Average = ((65*1)+(35*3))/100 = 1.7

so a 15% difference from the population value.

Scenario 2

In the population

Group A: 50%, average response value 1.5
Group B: 50%, average response value 2.5

Average = ((50*1.5)+(50*2.5))/100 = 2

and in the sample

Group A: 65%, average response value 1.5
Group B: 35%, average response value 2.5

Average = ((65*1.5)+(35*2.5))/100 = 1.85

which is a 7.5% difference from the population value.

Obviously it can be seen that if the responses of the two groups are similar, there will be less of an influence on the final result. Also, with this kind of range in the split between groups, 65/35 rather than 50/50, with only five responses in multiple-choice questions, the level of error is acceptable.

Maximum and minimum percentages for each group were chosen as follows in Table 5.3:

Table 5.3 Size Breakdown

Organisation Size	Maximum %	Minimum %
<50	25	75
50-249	5	15
250+	20	60

where in each case the minimum is half the percentage given above in Table5.3. Classification of Organisation Size and the maximum is one and a half times.

In the data actually collected the breakdown is as given in Table 5.4:

Table 5.4 Collected Organisation Size Breakdown

Organisation Size	%
<50	65
50-249	10
250+	25

So larger organisations are under-represented while small organisations are over-represented. This is not totally surprising since large organisations are less likely to respond to speculative requests to take part in surveys. However, even given the under-representation of the larger organisations, the breakdown of sizes is within an acceptable range according to the sampling strategy decided earlier.

Discussion of Sample Bias

The sample was obtained as a list of email addresses taken from an online directory. The organisations were selected in towns and cities across the UK, so in different regions. One possible source of bias in the selection is that the larger cities are over-represented. The reasons for this are not clear, but only a certain number of organisations could be identified in the smaller cities. It might be expected that the number of organisations based in a given city would be proportional to its population, but consider one example – the population of Preston is around 264,601, while the population of Liverpool is around 816,216, so a ratio of 3.0847. However, 48 organisations were contacted in Preston and 153 in Liverpool, so a ratio of 3.1875.

This is not felt to be a major source of bias because sector and size are expected to be much more likely to have an influence on OSS adoption than

geographical region. Size in particular is expected to have more influence because larger organisations are expected to be less innovative so less likely to adopt open source software.

5.7 Conclusion

The first stage of the fieldwork consisted of informal discussions with acquaintances involved either with IT or with non-profit organisations. This was felt to be a useful exercise to obtain an initial idea of attitudes towards software in general and open source software in particular. As Gilbert notes, “Many studies begin with ‘pilot interviews’, to gather basic information about the field before imposing more precise and inflexible methods: this is why interviews are the most often used research method.” (Gilbert 2001, p125).

The second stage of the fieldwork consisted of a questionnaire, made available on a website. Invitations were sent to people identified from a national directory of non-profit organisations. One advantage of using a questionnaire is that results can be rapidly obtained and statistical analysis of the results is relatively straightforward. The data collected is already in a quantitative form and so there is no need for any kind of conversion. A second advantage is that the process can be automated – data can be collected by a web server and this does not require human intervention. Gilbert observes that sociologists value data from surveys and they allow collection of information on “attitudes, values, personal experiences and behaviour” from a specified target population. (Gilbert 2001, p85). On the other hand, it is expected that the response rate will be quite low, perhaps 5% of people invited to take part. It is felt, however, that this disadvantage is outweighed by the advantage of automatic data collection and ease of analysis.

Part of the methodology includes pre-testing of the questionnaire instrument, and a pilot study. It should be noted that the initial group must be similar in its characteristics to the population to be studied (it must be a representative sample), and “from the pilot, the researcher will be able to assess whether the

line of questioning is appropriate and whether the document is understandable and simple to use." (Gilbert 2001, p103).

The pre-testing involved presenting the questionnaire to a small number of colleagues and friends to determine what aspects of the survey could be improved. This resulted in a number of small changes to the wording to make it clearer. Following on from that, the website was finalised and around 200 invitation emails were sent out. There were 11 who took part. This demonstrated there were no problems with the functioning of the questionnaire, and all the responses were correctly recorded on the server. No email responses were received indicating that the questionnaire design should be changed.

After the pilot study a large batch of email invitations was sent out (approximately 5000). The questionnaire was available online until the specified closing date and the results from the pilot study and main study were aggregated.

The research is within the tradition of Social Informatics. In particular, where necessary ideas from other areas are used, such as theories on technology adoption in general. For example, concepts coming from Rogers on diffusion of innovations are applied. Socio-Technical Interaction Networks are employed in the model and so are concepts like connectivity and centrality taken from Social Network Analysis.

The research was undertaken using a combination of questionnaire and interview. This is a good approach because it allowed quantitative data to be collected and analysed, but it also allowed for interpretation of the data based on further information obtained through interview.

Chapter 6. Fieldwork: Questionnaire and Interviews

Fieldwork was conducted in several phases – first, the fieldwork was divided into i) questionnaire and ii) interview. Each of these was divided into three phases: design and implementation, data collection and data analysis.

For the questionnaire, the design and implementation required, first, choice of questions, and second, setting up a website. The questions were chosen based on consideration of the research aims and hypotheses. The questions were divided into sections suitable for different respondents – open source users and non-users, users who have considered giving up OSS, users who have not considered giving up OSS, non-users who have considered using OSS and non-users who have not considered using OSS. It was decided that respondents should be 'routed' through the questionnaire according to their answers (e.g. open source user/non-user). In terms of the implementation, this was achieved with CGI programming. The design and implementation phase included pre-testing of the questionnaire, presenting it to colleagues to find any unclear wording and so on. Once the pre-testing was completed and the questions finalised, the website was made available online and the data collection phase began. The first step towards data collection was to send out invitation emails to non-profit organisations in different regions of the UK.

Since the questionnaire was to be delivered on a website, it was easy to collect data automatically. For each respondent completing the questionnaire, a 'response file' was saved on the webserver (in a location separate from the website). The response files consist of name=value pairs, one per line. The variable names and values from the HTML forms were read by CGI program and stored at each page as hidden HTML fields. The CGI program run on final submit saved the data in a response file.

For analysis of the data from the questionnaire, SPSS was used. Because of the use of SPSS, it was easiest to have the data in the form of a spreadsheet.

The server was checked on a daily basis and data from any new response files was added to the spreadsheet manually. This allowed for ‘cleaning’ of the data – for instance 20k (budget) was converted to 20,000, ‘2 staff + 5 volunteers’ (number of staff) was converted to 7, and so on. Answers from the respondents were entered one per line, all fields filled in, with nulls where necessary when no answer was given.

The analysis by SPSS included use of a number of tools. First, SPSS can be used to ‘explore’ the data, and this was done at an early stage to find out if there were obvious areas of interest. For instance the breakdown into OSS users/non-users was checked. Also, the proportion of non-users who had considered using OSS, and the proportion of users who had considered giving it up, were both checked. At this stage it was also possible to get an idea of the general nature of the responses. The more advanced SPSS tools used for the data analysis included automatic creation of graphs and pie charts, cross-tabulation, calculation of correlation coefficients, t-test, chi-square test and principal component analysis.

After the analysis of the questionnaire data, preliminary conclusions were drawn. This allowed decisions to be made on most of the research hypotheses, deciding true/false. For the remaining hypotheses, results were needed from interviews, so this led into the interview phase of the fieldwork.

The design phase for the interviews involved first of all looking through the answers given in the questionnaire by respondents who had agreed to be interviewed. This was necessary because interview questions has to be chosen from individual respondents, to seek clarification where required. Interviews were recorded for later transcription and all respondents were asked their permission to make the recordings. It was also explained clearly that the data was to be used for research only and that it would not be possible to identify anyone from the final results.

After each interview, the recording was transcribed and the text was gone over, to identify significant statements and mark key terms. This intermediate

stage was useful because once it was done, it meant that the most relevant content from the interview could be picked out.

Fieldwork consists of the following elements –

- Setting up a website to host a survey questionnaire on software use
- Contact emails to invite respondents to take part in the online survey
- Automatic data collection on the web server
- Conversion of questionnaire data to spreadsheet form
- Analysis of questionnaire results
- Preliminary conclusions
- Interview design
- Follow up telephone calls to respondents who agreed to be interviewed
- Creation of interview transcripts including annotation of key terms
- Interpretation of interview results
- Final conclusions

6.1 Questionnaire Web Site

It was decided to carry out a survey by using an online questionnaire, since this was felt to be more efficient than face-to-face interview or telephone interview. Data collection would be easier: in the case of interviews done in person, either face-to-face or by telephone, it would be necessary to create an interview transcript and that is time-consuming. Also, it was felt that it was easier to control the type of response by this method: most of the questions being multiple choice, very few open-ended questions. Further, it was felt that analysis of the data would be significantly easier because initial data would be in a more convenient format, and already stored electronically.

From a technical point of view, the web site was kept as simple as possible, but still an effort was made to make it look attractive. The setup involves having HTML files on the server for a number of pages, but routeing the

respondent to different pages depending on previous responses. That is achieved by using CGI (Common Gateway Interface) programs on the server. Those were written in Perl since it has a very convenient CGI module which makes it easy. All of the CGI programs have a similar function – they obtain the responses to the questions from one page, then decide which page to show next based on one of the variables. This first happens when the respondent provides a Yes/No answer to whether they use open source software.

6.2 Development of Interview Themes

After the 250 responses to the questionnaire were received, it was possible to consider how the themes should be further developed. Development of the themes is intended to refine the questions asked to get better information. This covers several aspects:

- Reasons for answers. The aim of asking about this is to discover the factors which influenced the respondent to give a particular answer, and interpret this in terms of the theoretical background of STINs. How did the respondent get information? Were other people involved in influencing the respondent's views?
- Asking questions to get more detailed information. For example, in the case of software use, I would like to ask the respondent some more details about use of specific software packages and their experience of them, so that is like asking the respondent to present a small 'case study'. Questions asked will include
    - How did you find out about the software?
    - Did you get expert advice on using the software?
    - Did you use online resources to learn about setting up the software?
    - Are there other organisations you have links with which use the same software?
    - What problems have you had with the software?
    - What did you do to resolve the problems you had?

These questions are aimed at finding out about how users experience software in a real situation, as they learned about it from the beginning, to the time they were familiar with it and had adapted it for what they wanted.

- Asking questions to get information where the respondent did not provide an answer. In these cases the questions should be asked in a different style to try to get a response.

Interview Theme Summary

Specifically, topics covered in the interviews are

- Experiences of using OSS. This covers both negative and positive experiences and general perceptions of OSS.
- Communication patterns related to obtaining information on IT.
- Factors influencing choice of software.

A number of links have been found from analysis of the data from the pilot study. Some are strong links, others are not so strong. The interviews should be conducted to confirm the existence of a real link, or to get more details about why the link exists. Again, this must all be related to the theoretical framework. The interview questions will concentrate on establishing the social factors which caused the respondent to give the answers they did – interactions with other organisations, the influence of policy, use of various media, and so on. Provisionally, topics to discuss are

- What is the respondent's general view of OSS compared with commercial software, and how did they get that view.
- How much involvement does the respondent have with other users of the same software, or with users of software doing the same job. This will include questions about links with the open source community, or with commercial software vendors, to find out what influences the

respondents ideas about the relative advantages and disadvantages of OSS.

- Discussion of the relative importance of different sources of information (e.g. “Why do you think discussion forums are very important, but Internet news sites are not very important?”).
- Discussion of the influence of various people or organisations. For example, from the pilot study responses so far, it seems that respondents who think Linus Torvalds has a large influence are less likely to give up OSS, and more likely to think OSS is higher quality than commercial software, more likely to think that OSS saves money in the long term, and so on. Here, the questions are, for example, “What do you think the main influence is of Linus Torvalds?” or “Have you been influenced by the ideals of the Free Software Foundation?”
- Discussion of ideology. Here, the respondents are asked first how much they agree with the ideals of open source, then they are asked whether these ideals are something that their organisation would like to follow. These questions should be asked without referring to open source to get an unbiased reply.
- Discussion of financial considerations. This will include asking about current costs of software used by the organisation and finding out what the main costs are. It will also include questions about the cost concerns of migrating to open source, to identify what cost factors are most likely to prevent migration.
- Discussion of licence concerns. This will include questions about the organisation’s current software licensing arrangements, and questions about what they think about OSS licences. Do they think OSS licences are likely to cause legal trouble in future? Do they believe licences such as the GPL will last, or do they think that they may disappear some time and the IT market will go back to being fully commercialised.

Chapter 7. Data Analysis

An online survey was conducted in 2007 on software use and use of open source software, based in the UK, and responses were obtained from around 250 non-profit organisations. Questions asked covered matters such as number of staff, budget, perceived importance of various information sources, organisational decision-making and so on.

This following will highlight some of the basic findings from the study, giving summary statistics where appropriate.

The Sample

Responses are assigned to groups for analysis purposes, and this is done at two levels. The first division is between open source users (Group1) and non-users (Group0). Within the open source users group, there is a further division – have not considered giving up open source (Group10), have considered giving up open source (Group11). Within the non-users group, there is a similar division – have not considered using open source (Group00), have considered using open source (Group 01). Respondents were asked to say whether they use any open source software. Open source non-users are recorded as ossyesno=0 and open source users are recorded as ossyesno=1.

Numbers of respondents in each group:

Group1: Open source users: 112
Group0: Open source non-users: 135

Open source users –

- Group10: Not considered giving up open source: 65
- Group11: Considered giving up open source: 47

Open source non-users –

Group00: Not considered using open source: 95

Group01: Considered using open source: 40

From this it can be seen that 42% of open source users have considered giving it up, while only 30% of non-users have considered using open source.

Awareness of Open Source

A number of respondents who said they do not use any open source software actually do, indicating that they are not aware these programs are open source. In the group of open source non-users, 4.5% use Mozilla, 12.6% use Firefox, 1.5% use Apache, 0.75% use sendmail, 3.7% use MySQL.

Question Categories

Respondents were asked questions covering a number of different areas:

- Number of staff
- Budget
- Required ICT functions
- Importance of various ICT information sources
- Frequency of information exchange with other non-profit organisations
- Influence on attitudes to software of various people and groups
- Documentation made freely available by the organisation
- Aspects of software influencing software choices
- Ideological views on software
- Views on open source software
- Importance of interacting with the open source community
- Use of different types of software support
- Reasons for considering using open source software
- Reasons for considering giving up open source software
- Social factors influencing technology adoption

Many of the questions in the questionnaire ask the respondents to rank their answers. Two scales are used, 1-4 (e.g. Not important, Not very important, Quite important, Very important) and 1-5 (e.g. Strongly disagree, Disagree, Neutral, Agree, Strongly agree).

7.1 Basic Observations

ICT Budget and Software Budget

There are significant correlations between an organisation's total ICT budget, its software budget, the total number of staff it has and the number of technical staff (see Table 7.1):

Table 7.1 Correlations between ICT Budget, Software Budget, Total Number of Staff and Number of Technical Staff

Correlations

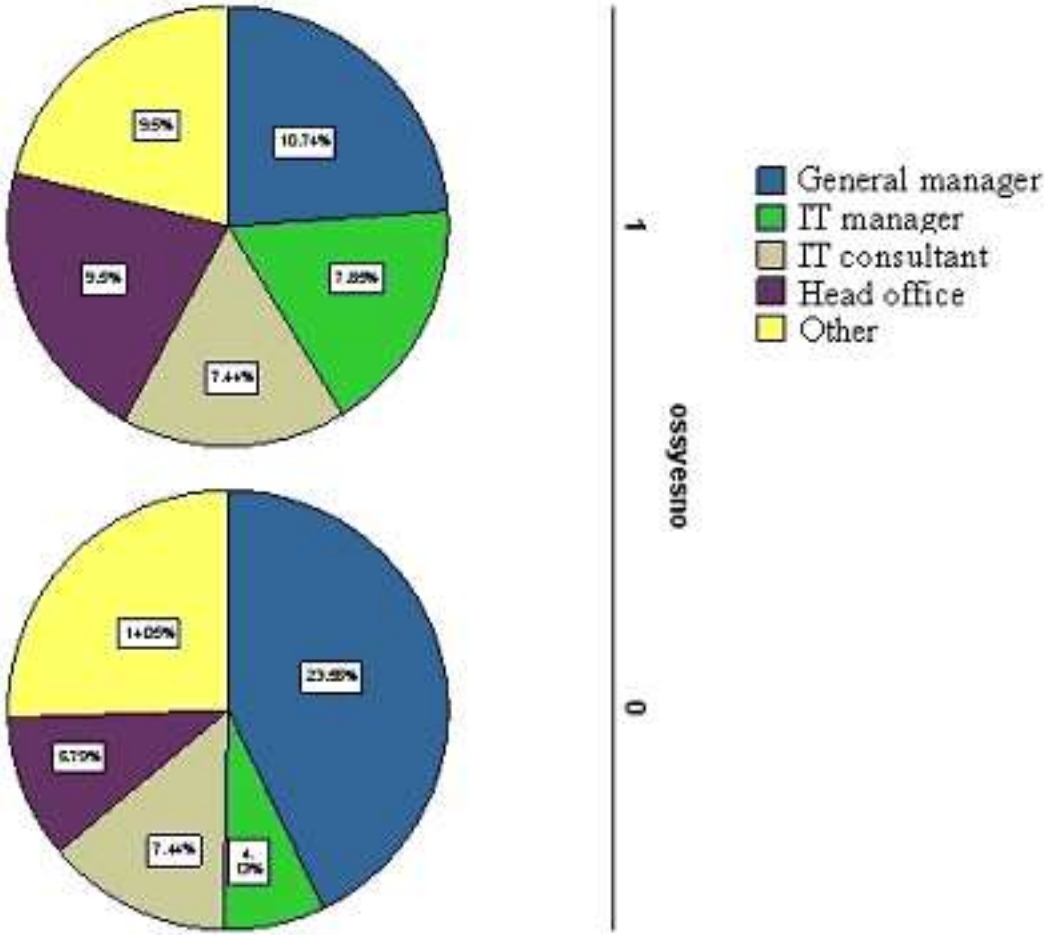
		stafftotal	techstaff	ictbudget	softwarebudget
stafftotal	Pearson Correlation	1	.219**	.279**	.319**
	Sig. (2-tailed)		.001	.000	.000
	N	242	241	153	149
techstaff	Pearson Correlation	.219**	1	-.040	-.019
	Sig. (2-tailed)	.001		.623	.817
	N	241	241	152	148
ictbudget	Pearson Correlation	.279**	-.040	1	.980**
	Sig. (2-tailed)	.000	.623		.000
	N	153	152	155	151
softwarebudget	Pearson Correlation	.319**	-.019	.980**	1
	Sig. (2-tailed)	.000	.817	.000	
	N	149	148	151	151

**. Correlation is significant at the 0.01 level (2-tailed).

but note that only the total ICT budget and software budget are strongly linked, with a correlation of 98%.

Respondents were asked to state who usually makes decisions for their organisation on software acquisitions. The following pie chart shows the difference between the open source users and non-users (see Figure 7.1).

Figure 7.1 Decision-maker Profile in OSS and non-OSS Groups



Information Sources

Respondents were asked to rate the level of importance of various sources of information on ICT:

info1: the Internet in general
info2: online discussion forums
info3: mailing lists
info4: software vendor websites
info5: Internet news sites
info6: personal contacts
info7: IT consultants

Both open source non-users and open source users rated the Internet in general as important: around 75% of respondents in each case recorded info1=4 (Very important).

Most open source non-users rate online discussion forums as not very important, while most open source users rate online discussion forums as quite important. This is shown to be a significant difference by applying the chi-squared test (see Table 7.2):

Table 7.2 Chi-Square Test Comparing Use of Online Discussion Forums by OSS users and non-users

ossyesno * info2 Crosstabulation

			info2				Total
			1	2	3	4	
ossyesno	0	Count	32	69	13	11	125
		% within ossyesno	25.6%	55.2%	10.4%	8.8%	100.0%
	1	Count	27	15	51	8	101
		% within ossyesno	26.7%	14.9%	50.5%	7.9%	100.0%
Total		Count	59	84	64	19	226
		% within ossyesno	26.1%	37.2%	28.3%	8.4%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	56.260(a)	3	.000
Likelihood Ratio	60.087	3	.000
Linear-by-Linear Association	9.117	1	.003
N of Valid Cases	226		

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.49.

Two-thirds of both the open source non-users and open source users rate mailing lists as either quite important or very important. However, almost one third of open source users rate mailing lists as not important, so the

responses from the open source users are more polarised than the responses of the non-users.

Most open source non-users rate software vendor websites as either not important or not very important as sources of information on ICT, while most open source users rate software vendor websites as either quite important or very important.

There is no significant difference between the group of open source non-users and the group of open source users in rating the importance of Internet news sites as sources of information on ICT.

Two-thirds of open source users rate personal contacts as very important sources of information on ICT, while only one third of non-users rate personal contacts as this important. The difference between the groups is shown to be significant using the chi-squared test (see Table 7.3):

Table 7.3 Chi-Square Test Comparing Importance of Personal Contacts for OSS users and non-users

ossyesno * info6 Crosstabulation

			info6				
			1	2	3	4	Total
ossyesno	0	Count	8	8	69	44	129
		% within ossyesno	6.2%	6.2%	53.5%	34.1%	100.0%
	1	Count	16	3	16	68	103
		% within ossyesno	15.5%	2.9%	15.5%	66.0%	100.0%
Total		Count	24	11	85	112	232
		% within ossyesno	10.3%	4.7%	36.6%	48.3%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	40.727(a)	3	.000
Likelihood Ratio	42.954	3	.000
Linear-by-Linear Association	1.748	1	.186
N of Valid Cases	232		

a 1 cells (12.5%) have expected count less than 5. The minimum expected count is 4.88.

There is no significant difference between the open source users and non-users in rating the importance of IT consultants (info6) as sources of information on ICT.

Information Exchange

Respondents were asked how frequently they exchange information with other non-profit organisations on a number of topics:

infofreq1: IT problems
infofreq2: IT latest news
infofreq3: IT events

Responses can be 1 = Never, 2 = Yearly or less, 3 = Every few months, 4 = At least monthly

No significant difference was found between open source users and non-users in the frequency of information exchange on IT problems. More than 70% of respondents in each group exchange information on IT problems either never or yearly or less.

Around 97% of open source non-users exchange information on IT latest news never or yearly or less, while around 78% of open source users exchange information on IT latest news never or yearly or less. Among the

open source users, almost 20% exchange information on IT latest news every few months.

A significant difference was found between open source users and non-users in the frequency of information exchange on IT events and meetings (infofreq3) (see Table 7.4):

Table 7.4 Chi-Square Test Comparing Importance of IT Events for OSS users and non-users

ossyesno * infofreq3 Crosstabulation

			infofreq3				
			1	2	3	4	Total
ossyesno	0	Count	74	29	8	2	113
		% within ossyesno	65.5%	25.7%	7.1%	1.8%	100.0%
	1	Count	55	24	13	10	102
		% within ossyesno	53.9%	23.5%	12.7%	9.8%	100.0%
Total		Count	129	53	21	12	215
		% within ossyesno	60.0%	24.7%	9.8%	5.6%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.255(a)	3	.026
Likelihood Ratio	9.742	3	.021
Linear-by-Linear Association	7.701	1	.006
N of Valid Cases	215		

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.69.

Software Choice Factors

Respondents were asked to rate the importance of several aspects of software products in choosing software, on the scale

1 = Not important
2 = Not very important
3 = Quite important
4 = Very important

Factors considered are

softwarefactor1: ease of installation
softwarefactor2: ease of use
softwarefactor3: ease of customisation
softwarefactor4: full documentation
softwarefactor5: good support

For both open source users and non-users, principal component analysis shows that ease of installation, ease of customisation, full documentation and good support are the main factors influencing software choices. In the case of open source users, however, only 37% of respondents rate good support as very important, compared with 64% in the case of open source non-users. 34% of open source non-users rate ease of customisation as very important, compared with 48% of open source users.

Ideological Views on Software

Respondents were asked how strongly they agreed with certain ideological views on software, on the scale
1: strongly disagree
2: disagree
3: no opinion
4: agree
5: strongly agree

The views considered are

swview1: IT plays a crucial role in positive social change
swview2: everyone should have access to a computer
swview3: everyone should be able to access the Internet easily
swview4: software companies should release full documentation on their products

Around 75% of both open source users and non-users agree that IT plays a crucial role in positive social change.

More than 85% of both open source users and non-users agree that everyone should have access to a computer, and that everyone should be able to access the Internet easily. More than 75% of both open source users and non-users agree that software companies should release full documentation on their products, however, more than 10% of open source users agree strongly with this, compared with less than 5% of open source non-users.

Required ICT Functions

Respondents were asked to specify what types of ICT functions they have a need for. Functions considered are document editing, spreadsheet, database storage, graphics (image editing), web authoring (creating websites), presentation software, content management, client relationship management, finance, web browsing, email, firewall.

For both open source users and non-users, 96% require email, 85% require document editing, 90% require spreadsheet. A difference between the two groups is seen in several requirements. 50% of open source non-users require image editing and web authoring, compared with 80% of open source users. 24% of open source non-users require content management, compared with 63% of open source users.

Documents Made Available

Respondents were asked which documents their organisation makes freely available: annual report, program help/manuals, software development documents, FAQs, software installation guides, policy documents. More than 90% of both open source users and non-users make their annual report available. 47% of non-users make policy documents available, compared with 62% of users. Almost 10% of open source users make software development documents available, but no non-users.

Influence of Groups and People

Questions were asked about the amount of influence of various groups and people on attitudes about how software should be developed, licensed and distributed, on the scale

1 = none
2 = not very much
3 = some
4 = quite a lot
5 = a great deal

and cases considered are Richard Stallman, Linus Torvalds, Free Software Foundation/GNU, Open Source Initiative and the Microsoft shared source initiative.

In the group of open source non-users, more than 70% say that Richard Stallman and Linus Torvalds have no influence or not very much. 47% of open source users say that Stallman has either quite a lot of influence or a great deal. 73% of open source users say that Torvalds has either quite a lot of influence or a great deal. More than 45% of open source users believe that the OSI has had quite a lot of influence or a great deal, and in fact approximately 25% of non-users have the same opinion. Slightly less than one quarter of open source non-users believe the Microsoft shared source

initiative has had significant influence, and this rises to a little more than 45% for open source users.

7.2 Links between Responses

This report will now highlight some of the links found between answers in the various categories. First, it was found that there are clear links between answers given in the different question categories. For instance respondents who agree that everyone should have access to a computer also tend to agree that everyone should be able to access the Internet easily; respondents who believe that Linus Torvalds has had a significant influence on attitudes to software also tend to agree that the Free Software Foundation has had a similar influence.

Open Source non-users who have not considered using open source:

There is a strong link between perceived importance of Internet news sites (info5) and influence from other non-profit organisations on software procurement decisions (procurenontech2) (see Table 7.5). If an organisation is influenced less by other non-profit organisations then it is likely to rate the importance of Internet news sites more highly.

Table 7.5 Correlation Between Use of Internet News Sites and Software Procurement Decisions

			info5	procureno ntech2
Spearman's rho	info5	Correlation Coefficient	1.000	-.675(**)
		Sig. (2-tailed)	.	.000
		N	81	54
	procurenontech2	Correlation Coefficient	-.675(**)	1.000
		Sig. (2-tailed)	.000	.
		N	54	61

** Correlation is significant at the 0.01 level (2-tailed).

Open Source non-users who have considered using open source:

There is a strong link between the view that open data standards are important (procuretech1) and the likelihood of not having adopted open source because of a lack of organised support (ossno1) (see Table 7.6).

Table 7.6 Correlation Between Open Data Standards and Lack of Organised Support

			procuretech1	ossno1
Spearman's rho	procuretech1	Correlation Coefficient	1.000	.842(**)
		Sig. (2-tailed)	.	.000
		N	79	23
	ossno1	Correlation Coefficient	.842(**)	1.000
		Sig. (2-tailed)	.000	.
		N	23	31

** Correlation is significant at the 0.01 level (2-tailed).

There is a strong link between the view that security is important (procuretech6) and the likelihood of not having adopted open source because no staff know how to use open source (ossno3) (see Table 7.7).

Table 7.7 Correlation Between Security and Lack of Staff Knowledge of OSS

			procuretech6	ossno3
Spearman's rho	procuretech6	Correlation Coefficient	1.000	.974(**)
		Sig. (2-tailed)	.	.000
		N	107	29
	ossno3	Correlation Coefficient	.974(**)	1.000
		Sig. (2-tailed)	.000	.
		N	29	39

** Correlation is significant at the 0.01 level (2-tailed).

Open Source users who have not considered giving up open source:

There is a significant relationship between whether or not an organisation is a subsidiary of a larger organisation and whether they would consider giving up open source because Microsoft started giving free support for owned software (ossrevert2) (see Table 7.8).

Table 7.8 Comparison of Procurement Decisions in Head Offices and Subsidiary Offices

			subsidiary	ossrevert2
Spearman's rho	subsidiary	Correlation Coefficient	1.000	.756(**)
		Sig. (2-tailed)	.	.000
		N	65	55
	ossrevert2	Correlation Coefficient	.756(**)	1.000
		Sig. (2-tailed)	.000	.
		N	55	55

** Correlation is significant at the 0.01 level (2-tailed).

Open Source users who have considered giving up open source:

There is a strong link between frequency of using commercial IT support (swsupport4) and considering giving up open source because of licensing concerns (stoposs5) (see Table 7.9). An organisation using commercial support more frequently is more likely to give up open source because of licensing concerns.

Table 7.9 Link Between Licensing Concerns and Use of Commercial IT Support

			swsupport4	stoposs5
Spearman's rho	swsupport4	Correlation Coefficient	1.000	.929(**)
		Sig. (2-tailed)	.	.000
		N	44	42
	stoposs5	Correlation Coefficient	.929(**)	1.000
		Sig. (2-tailed)	.000	.
		N	42	45

** Correlation is significant at the 0.01 level (2-tailed).

7.3 Summary Observations from Questionnaire

From the statistical results of the survey, the following observations were made –

- Contrary to the hypotheses, OSS users rate personal contact as more important for exchanging information than non-users do.
- The two groups, OSS users and non-users, rate the importance of the Internet in general equally.
- The OSS users are more likely to exchange information on IT frequently, and arrange meetings about it.
- There are some significant differences according to software requirements. 50% of OSS non-users require image editing and web authoring software, but it is 80% of OSS users. 24% of OSS non-users require content management software, while 63% of OSS users do.
- From the statistics, it appears that ease of installation, ease of customisation, full documentation and good support are the main factors influencing software choice.

Chapter 8. Interview Analysis

Now it is time to consider the second phase of fieldwork, the interviews. The online questionnaire included on the final page an invitation to take part in a follow-up interview. There, the respondent was able to fill in the required contact details and those details were recorded in the response file on the web server.

Altogether there were twelve respondents to the questionnaire who agreed to be interviewed. From a group of 250 that is roughly one out of twenty, so a 5% rate for the follow-up interviews. In order to present their statements anonymously, they will be referred to by letters of the alphabet, so “Respondent A” to “Respondent K”.

It should be noted that conducting interviews on the telephone can be a difficult experience, and there has to be a balance between the interviewer controlling the discussion and the interviewee controlling the discussion. If the interviewer controls the discussion too closely, the respondent may not express their views freely enough. On the other hand if the respondent controls the interview, it is possible that the interviewer will not obtain answers to questions. At least it will make the process less efficient from the point of view of data collection and will result in interviews taking a longer time. Since transcription is such a time-consuming task, this should be avoided if possible.

8.1 Design of Interviews

It was decided that an interview should take between 15 and 20 minutes. Then it was necessary to decide how many questions there should be and what the interview format should be.

Regarding the number of questions then, the decision was to aim for around twenty questions. Some would be prioritised and would be asked first, others would be left for later or left out if the respondent did not have time. Interviews were to be semi-structured, that is there would be certain fixed questions, but mixed with free discussion. As well as that, each interview was individually planned and a topic list and question list was written beforehand. This was based on study of the responses given to the questionnaire. For instance, a respondent who currently used open source software would be asked about their experiences; a respondent who said they were not an open source user would be asked about well-known open source products like Mozilla and Linux, and would be asked about their more general experiences with software.

In fact, in the end ideas about the time taken for interviews had to be revised. This was simply because a small number of respondents talked willingly for a long time. One talked for 25 minutes on the telephone and there was a second follow-up call taking another 15 minutes. Understandably this resulted in a large amount of data being collected. All respondents were reminded of data confidentiality at the beginning of the interview and were asked if recording would be permitted. All of them agreed and it was clearly explained to them the recordings would only be used for transcription and all data would be deleted after the fieldwork, and that any quotations used would be anonymous.

Now to consider the interviews themselves –

Extracts from interviews will all be presented in the same style: each quotation will be marked at the start with **G** or **A**. The **G** (my initial) indicates a question or an introduction by me the interviewer, and the **A** indicates an answer or other comment from the respondent. Also included is a brief description of the type of organisation.

For the purpose of giving a representative view, the interviews were considered very carefully. Some contained more useful information than

others. Four were selected as giving a reasonable cross-section of opinion. These four spoke well and touched on almost all the points raised by the others, so the selection is representative in the sense of covering the major issues. It is also representative in terms of software usage pattern – as follows:

- Respondent A. Uses OSS at work but not at home, medium budget organisation. Mixed opinions on OSS.
- Respondent B. Uses OSS at home as well as at work, small budget organisation. Positive opinions on OSS.
- Respondent C. Uses OSS at work but not to a significant level. Low budget organisation. Negative opinions on OSS.
- Respondent D. Does not use OSS. Medium budget organisation. No clear opinion on OSS.

Summary observations from the interviews are as follows:

Respondent A

Several things stand out from this interview – the respondent

- is a member of the technical staff
- uses OSS and is well-informed about OSS
- believes in the advantages of regular communication
- thinks that trialability of software is significant
- finds online information resources useful in solving software problems
- believes IT has an important role in education

and the organisation

- is involved in science education and has relatively high-level needs
- has a medium budget

Respondent B

Some points to note from this are – the respondent

- uses OSS and is well-informed about OSS
- believes in the advantages of regular communication
- thinks that trialability of software is significant
- believes IT has an important role in education
- has no definite ideology on OSS although a strong supporter of OSS

and the organisation

- has a small budget
- has minimal IT needs
- has only informal IT support
- IT decisions are effectively made by one person, a lead-user.

Respondent C

Points to note from this – the respondent

- makes limited use of OSS
- uses software in paid work and voluntary work
- expresses views from one extreme to another
- makes much more use of personal contact than mass media
- has a very low opinion of OSS
- is sceptical regarding the educational value of IT
- is concerned about compatibility much more than trialability

and the organisation

- has a small budget
- makes decisions by committee

Respondent D

Points to note from this – the respondent

- makes no use of OSS
- has no real opinion of OSS because of lack of exposure to it
- regarding IT, is more concerned about compatibility than anything else
- does not get information from the Internet frequently

and the organisation

- has a medium-size budget
- has a small number of IT staff
- there is no in-depth discussion of IT with the IT staff

8.2 Overall Conclusions from Interviews

The interview material supports the following conclusions:

- Computer users with IT awareness are more likely to use OSS.
- Computer users with IT awareness are more likely to believe that IT has more general, educational benefits.
- Preference for personal contact over mass media makes OSS use less likely (such users are less likely to be innovative).
- Different styles of organisational decision-making can influence the likelihood of OSS adoption: non-technical decision-makers are less likely to choose OSS; organisations with committee decisions are in general les likely to use OSS; some individual ‘lead-users’ may have enough influence to bring OSS to an organisation.

Chapter 9. Conclusion

After completion of the interviews and interview analysis, the following Table 9.1 shows which hypotheses were accepted and rejected:

Table 9.1 Accepted, Rejected Hypotheses

H	Hypothesis	Accepted/ Rejected	Reasons for Acceptance or Rejection
H1	Most OSS non-users have not considered using OSS.	Accepted	Out of 135 OSS non-users, 95 had not considered using OSS, according to the basic questionnaire results. That is 70%.
H2	Most OSS non-users are not aware of the nature of OSS	Accepted	There is a link between concern about security and not using OSS because no-one knows enough about it. This indicates non-profit workers are not familiar with OSS. Also, a fairly high number of computer users are not aware that software they are using (e.g. the Firefox browser) is open source.
H3	Most OSS users are likely to continue using it.	Accepted	Out of 112 OSS users, 65 had not considered giving it up. That is 58%.
H4	OSS users are more likely to rate Internet information as important, compared with personal contact. OSS non-users are more likely to prefer personal contact to information obtained from the Internet	Accepted	The statistical results for this do not present a clear division. OSS users and non-users rate the Internet with roughly the same level of importance. However, from the interviews, it appears that some users who rely on getting information from personal contacts have negative views of OSS. This, it seems, is likely to be linked with a lack of awareness of the nature of OSS.
H5	OSS use is less likely in an organisation where decisions are made by a committee or other management group, rather than by one person or a	Accepted	From the questionnaire statistics, the main decision-maker is an IT manager in only X% of organisations which do not use OSS. However, in the case of organisations using OSS, the main decision-maker is an IT manager in Y% of cases. Also, in

	small group with IT knowledge		organisations not using OSS, decisions are made by a general manger in Z% of cases, while in organisations using OSS, the figure is U%.
H6	Greater use of the Internet is linked with a higher probability of using OSS	Accepted	Evidence for this is from the questionnaire results. There is no significant difference between OSS users and non-users on how important they rate Internet news sites or mailing lists. OSS users, however, rate online discussion forums as significantly more important than non-users do. Acceptance of the hypothesis has to be qualified though: it is specifically greater use of online forums which is linked with OSS use.
H7	Organisations where workers rely mostly on personal contact for information on IT are less likely to use OSS	Rejected	Evidence here from the questionnaire is not conclusive, but from the interviews there is evidence that people who mostly use personal contacts for information on IT are less confident with IT in general. This makes them less likely to try new software, especially if it is 'experimental'. These individuals fit in with the pattern described in Rogers (1995): lower use of mass media, lower innovativeness.
H8	Ease of use is a major factor considered in software choice	Rejected	This comes from principal component analysis which shows the main factors are ease of installation, ease of customisation, full documentation and good support.
H9	Compatibility is not considered a major factor	Accepted	The evidence for this is the same as for H8. principal component analysis does not show compatibility as a major factor.
H10	OSS ideology has little influence on OSS adoption	Accepted	This comes from the questionnaire results. Respondents were asked how strongly they agreed with certain items

			of ideology – “everyone should have access to a computer” etc. there was no significant difference between OSS users and non-users.
H11	Cost is not a major concern in non-profit organisations	Accepted	Evidence for this comes from the analysis of the NOSI forum content. Terms such as ‘licence cost’, ‘total cost of ownership’ etc. occur infrequently. As well as that, initial structured interviews revealed that many non-profit organisations do not spend regularly on computers, either hardware or software. Also, when they do, software licences are available at a low cost because of price reductions from vendors.

The STFN model has its origins in the concept of STINs, and it adds feedback to this idea. Although feedback is a feature which has been noted in diffusion of innovations (Rogers, 1995), it has not been included in any previous work on STINs, so that is the major contribution of this research.

The model provides a scheme to describe decision-making in terms of probability (probability of OSS adoption), with feedback effects influencing the behaviour of decision-making nodes. This effect is conceptualised as changing probabilities – probability of adoption will increase under some influences, decrease under others. Because the model is based on nodes and probabilities, it gives a way of operationalising the decision-making process: operationalisation is a way of taking a qualitative concept and clarifying it by introducing a number of quantitative parameters. As an example of this, consider how a researcher might determine different levels of interest in a topic among a group of individuals. The level of interest is a group of individuals. The level of interest is clearly qualitative – how can this be operationalised?

One suggestion might be to consider how often those individuals access certain websites relating to the topic, for instance counting the number of visits an individual makes to each website in one week. This gives numerical

data, and that numerical data can be formally analysed. The model has the potential for future application in any context where decisions are made in the presence of network feedback effects. For operationalisation, it is necessary to obtain numerical values for the decision probabilities, and for the changes in those probabilities cased by network influences. This, of course, may require further operationalisation – it is not possible to measure those probabilities directly, so it is necessary to measure other parameters to estimate the probabilities. That could include, for example, gathering data on individual attitudes to adoption measured on a scale (e.g. 0-10) and aggregating the results to obtain an estimate of adoption probability for a specific group.

In conclusion, the model could be applied in other contexts, but care is needed in choice of parameters to measure so that probabilities can be estimated.

Some further observations:
Specific software requirements are linked to OSS use, as is shown by strong statistical correlations. In particular, requirements for image editing, web authoring and content management are linked to open source use. Note that even respondent C, who has strongly negative views on OSS, points out that the OSS content management system is better than any alternative.

From the interview results it seems that technical staff are likely to rate trialability as important in software choice, while non-technical staff are likely to rate compatibility important. This is possibly because the technical staff are aware of technical solutions to compatibility problems, but non-technical staff are not aware that solutions exist.

How should the model be evaluated in light of the empirical evidence and the statistical results? Certainly, since the model is expected to be the basis for a computer simulation, the amount of data is small compared with the data that would be generated during a simulation. To be sure of a link between network topology and adoption behaviour, it would be necessary to have the results

from many simulations so that patterns could be identified. However, some candidates are as follows:

- *Most OSS non-users have not considered using OSS.*

OSS non-users have a small number of network links with sources of influence encouraging use of OSS, compared with the typically large number of such links OSS users have. As a result, the 'normalised influence' **E** introduced in 3.9 is negative, so the probability of OSS adoption will not increase.

- *Most OSS users are likely to continue using it.*

Many OSS users are committed to open source software. As explained in the interviews, OSS can allow a user to use software which only exists in expensive versions of commercial products (video editing for instance). OSS groups (like Linux User Groups) are active and do a great deal to promote OSS, so this creates feedback where the user base increases in size and the software itself is better supported and more likely to survive. The feedback exists between OSS users and groups and the OSS non-users they come into contact with.

- *OSS use is less likely in an organisation where decisions are made by a committee or other management group, rather than by one person or a small group with IT knowledge.*

This can be related to the 'importance index' **I** introduced in 3.9. In this situation, the decision is an organisational decision and the value of **I** is low, because the importance of influences on the decision (from many decision-makers) is high. The most extreme example of this phenomenon would be a subsidiary office receiving direct instruction from a head office, so that **I** = 0.

The essential style of the model can be kept, but there has to be some refinement in terms of what factors are actually modelled. Factors which were brought in at the stage of the hypotheses are not all significant it seems. The result is a model which incorporates network effects and feedback, but which is made up of fewer elements than expected.

- Simplify STFN model, remove unnecessary elements in the model. In particular, since it was found that membership of mailing lists and online discussion forums were not significant factors influencing OSS adoption, those items are to be removed.

- Rank priorities of the key elements in the simplified model. Communication patterns were found to be significant, with users of mass media more likely to use OSS than those who rely on personal contact. Also, software compatibility was found to be a more significant factor than ease of use.

Certainly there is more empirical work that can be done. A further questionnaire could be used but it would have to focus on narrow areas or be considerably longer than the current questionnaire.

From the statistical analysis of the questionnaire results it has become clear that certain factors are important in determining open source adoption patterns. First, organisations are more or less likely to use open source software depending on who makes decisions on software procurement. It was confirmed through the interviews that management may not have much knowledge of open source, so depend on advice from an IT consultant (who may well be a volunteer). This is again linked with the questionnaire results, which showed that one of the things most likely to make an organisation consider using open source software is having someone show them how to use it.

This highlights the issue of communication between management and other staff and management use of media to obtain information as areas for further investigation. In particular it is hypothesised that general manager do not usually view specialist IT web sites or open source websites and their choice of websites to view is likely to reinforce their existing attitudes. On the other hand it is hypothesised that IT managers are likely to use these specialist websites and are likely to be more in favour of open source. As open source websites attract users and become more popular, even more IT managers are likely to access them and the result is increasing influence and increased probability of an organisation adopting open source, as the IT manager can present more material to the general manager while arguing for open source adoption.

Another concern which only became clear from the interviews is that negative experiences with open source can have a significant effect on attitudes towards open source adoption. This mainly affects open source ‘on the desktop’. Many users are dissatisfied with the user-friendliness of desktop software such as OpenOffice for example. Staff resistance to specific open source products may have long-term effects on management decisions, and the paths of communication and influence in this context are worth investigating.

While it seemed at the time best to have different sets of questions for different groups of users, with questions routeing decided by the questionnaire software, now it seems that there should be as many questions as possible in common, for easier comparison. However, the basic routeing of the questions (e.g. for OSS users and OSS non-users) would remain the same.

The questionnaire did not consider factors like the sector an organisation operates in, or which region it is in. the region may not have much influence, but the sector may have a significant effect. For instance, it was observed that organisations with some scientific basis were more likely to be OSS users.

Bibliography

Baldi, S., Heier, H., & Mehler-Bicher, A. (2003). Open Courseware and Open Source Software. *Communications of the ACM*, 46(9), 107.

Bergquist, M., & Ljungberg, J. (2001). The power of gifts: organizing social relationships in open source communities. *Information Systems Journal*, 11, 305-320.

Berry, D.M. (2004). Internet research: privacy, ethics and alienation: an open source approach. *Internet Research*, 14(4), 323-332.

Bijker, W.E., Hughes, T.P. & Pinch, T.J. eds. *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*. MIT Press, 1987.

Bloom, P.N. & Gundlach, G. (2000). *Handbook of Marketing and Society*. Sage Publications.

Brooks, J. (2004). KDE, GNOME Both Needed. Retrieved March 03, 2006 from http://www.eweek.com/article2/0,1759,1449828,00.asp.

Cusumano. M. (2004). Reflections on Free and Open Software. *Communications of the ACM*, 47(10), 25-27.

Davenport, E. & Horton, K. (2006), *Rethinking e-Government Research: The 'ideology-artefact complex'*. IFIP (International Federation for Information Processing), Volume 226, Project E-Society: Bulding Bricks, eds. Suomi, R., Cabral, R., Hampe, J. F., Heikkilä, A., Järveläinen, J., Koskivaara, E. (Eloston Springer), 380-391.

de Vaus, D.A. (1991). *Surveys in Social Research*. Third Edition. Allen & Unwin Pty Ltd, Australia.

DiBona, C., Ockman, S. & Stone, M. (Eds.) (1999). *Open Sources: Voices from the Open Source Revolution*. London: O'Reilly.

DiMaggio, P., Hargittai, E., Neuman, W.R., & Robinson, J.P. (2001). "Social Implications of the Internet". *Annual Review of Sociology* vol. 27, 307-336.
DirectGov. Retrieved September 16, 2009 from http://www.direct.gov.uk

Ekbia, H.R., & Gasser, L. (2005). Discourses of Reliability in The F/OSS Movement: Cultural Frames and Mobilizing Structures. Retrieved December 10, 2005 from www.crito.uci.edu/si/resources/ekbiaGasser.pdf.

Elliott, M.S., & Scacchi, W. (2004). Mobilization of Software Developers: The Free Software Movement. Revised version to appear in *Information, Technology, and People.*

Elliott, M.S., & Scacchi, W. (2004). Free Software Development: Cooperation and Conflict in A Virtual Organizational Culture. In S. Koch (Ed.), *Free/Open Source Software Development*, IDEA Publishing.

Feller, J., & Fitzgerald, B. (2002). *Understanding Open Source Software Development*. London: Addison-Wesley.

Fine, A. (2003) "Evaluating the Impact of Information Technology". *Innovation Network* (March).

Fischer, G., Giaccardi, E., Eden, L., Sugimoto, M., & Ye, Y. (2005). Beyond binary choices: Integrating individual and social creativity. *International Journal of Human-Computer Studies*, 63, 482–512.

Free Software definition. Retrieved October 20, 2005 from www.gnu.org/philosophy/free-sw.html.

George, J.F., Iacono, S., & Kling. R. (1995). Learning in context: extensively computerized work groups as communities-of-practice. *Accting. Mgmt. & Info. Tech*., 5(¾), 185-202.

Gilbert, N. (2001). *Researching Social Life*. Sage Publications, London.

Gillham, B. (2008). *Small-scale Social Survey Methods*. Continuum, London.
Glass, R. (2003). Practical Programmer. *Communications of the ACM*, 46(11), 25-27.

Gomm, R. (2008). Social Research Methodology. Second Edition. Palgrave Macmillan, New York.

Grobman, G. (2008). *The Nonprofit Handbook: Everything You Need to Know to Start and Run Your Nonprofit Organization.* White Hat Communications.

Hertel, G., Niedner, S., & Herrmann, S. (2003). Motivation of software developers in Open Source projects: an Internet-based survey of contributors to the Linux Kernel. *Research policy*, 32, 1159-1177.

Horton, K., Davenport, E. & Wood-Harper, T. (2005). Exploring sociotechnical interaction with Rob Kling: five “big” ideas. Information Technology & People, Volume 18, Issue 1, 50-67.

Hubbard, J. (2004). Open Source to the Core. *Queue*, (May), 25-31.

Hussain, Z., Taylor, A., & Flynn, D. (2004). A case study of the process of achieving legitimation in information systems development. *Journal of Information Science*, 30(5), 408-417.

Johnson, R. (2004). Open Source vs. Capitalism and Communism. *Communications of the ACM*. 47(4), 11-12.

Keskinen, A. (2003). “MIDEM. Models for Interactive Decision Making”. *Electronic Journal of e-Government* Vol. 2, no.1, 55-64.

Klein, H.K. & Myers, M.D. (1999). “A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems”. *MIS Quarterly,* vol.23, no.1, 67-94.

Kling, R., Kim, G., & King, R. (2003). “A Bit More to IT: Scholarly Communication Forums as Socio-Technical Interaction Networks”. *Journal of the American Society for Information Science and Technology*. Vol.54, no.1, 47-67.

Kollock, P. (1998). The economies of online cooperation. In *Communities in Cyberspace* (Smith M and Kollock P, Eds). London: Routledge.

Lakhani, K.R., & von Hippel, E. (2003). How open source software works: “free” user-to-user assistance. *Research Policy*, 32, 923-943.

Lee, S., Moisa, N. & Weiss, M. (2003). “Open source signalling device – an economic analysis”. Retrieved April 6, 2006 from http://opensource.mit.edu/online_papers.php

Lehman, M.H. (1996). Feedback in the software evolution process. *Information and Software Technology*, Volume 38, Issue 11, pp. 681-686. Elsevier Science

Lerner, J. & Tirole, J. (2001). “The open source movement: Key research questions”. *European Economic Review* vol.45, 819-826.

Lessig, L. (1999). *Code and Other Laws of Cyberspace*. New York: Basic Books.

Ljungberg, L. (2000). Open source movements as a model for organising. *European Journal of Information Systems*. 9, 208-216.

Locke, J. (2004). *Open Source Solutions for Small Business Problems*. Hingham, Massachusetts: Charles River Media.

Mannaert, H., & Ven, K. (2005). The Use of Open Source Software Platforms by Independent Software Vendors: Issues and Opportunities. *Open Source Application Spaces: Fifth Workshop on Open Source Software Engineering (5-WOSSE),* St Louis, MO, USA.

McLoughlin, I. (1999). *Creative Technological Change*. London: Routledge.

Meyer, E.T. & Kling, R. (2002). Leveling the playing field, or expanding the bleachers? Socio-Technical Interaction Networks and arXiv.org. Retrieved February 16, 2006 from http://rkcsi.indiana.edu/archive/CSI/WP/WP02-10B.html

Millar, C., Choi, C.J., Russell, E.T., & Kim, J.B. (2005). Open source communities: an integrally informed approach. *Journal of Organizational Change Management*, 18(3), 259-268.

Moody, G. (2001). *Rebel Code*. Cambridge: Perseus Publishing.

NOSI Primer. 2007. Retrieved November 10, 2007 from http://www.nosi.net

Office for National Statistics. Retrived October, 25, 2009 from http://www.statistics.gov.uk/default.asp

Orlikowski, W. and Baroudin, J. (1991). “Studying Information Technology in Organizations: Research Approaches and Assumptions”. *Information Systems Research*, vol.2, no.1, 1-28.

Otte, E., & Rousseau, R. (2002). Social network analysis: a powerful strategy, also for the information sciences. *Journal of Information Science*, 28(6), 441-453.

Peizer, J. (2003). Realizing The Promise of Open Source in the Non-Profit Sector. Open Society Institute, New York.

Perens, B. (1999). “The Open Source Definition”, in DiBona, C., Ockman, S., & Stone, M. (eds.), *Open Sources: Voices from the Open Source Revolution*, O’Reilly, Sebastapol, CA.

Pinch, T.J. & Bijker, W.E. *The Social Construction of Facts and Artefacts: Or How the Sociology of Science and Sociology of Technology Might Benefit Each Other*. Social Studies of Science **14** (August 1984), 399-441.

Punch, K. F. (2005). *Introduction to Social Research*. Second Edition. Sage Publications, London.

Raymond, E.S. (1998). *The Cathedral and the Bazaar.* O'Reilly.

Redmond, William H. (2002). *Interconnectivity in diffusion of innovations and market competition*. Journal of Business Research, Volume 57, Issue 11 1295-1302.

Reverberi, P. & Talamo, M. (1999). A probabilistic model for interactive decision-making. *Decision Support Systems.* Volume 25, Issue 4, 289-308.

Rogers, E.M. (1995). *Diffusion of Innovations.* Forth Edition. New York: The Free Press.

Ronald, C., & Blair, J. (2005). *Designing Surveys A Guide to Decisions and Procedures*. Sage Publications.

Sapsford, R. J. (2007). *Survey Research*. Second Edition. Sage Publications, London.

Scacchi, W. (2005). Socio-Technical Interaction Networks in Free/Open Source Software Development Processes. In S.T. Acuña and N. Juristo (eds.), *Software Process Modeling*, pp. 1-27. Springer Science+Business Media Inc., New York.

Scacchi, W. (2002). Open acquisition: combining open source software development with system acquisition. Retrieved January 18, 2006 from http://www.ics.uci.edu/~wscacchi/Papers/DAU/OpenAcquisition.pdf.

Scacchi, W. (2002). Understanding the Social, Technological, and Public Policy Implications of Open Source Software Development. Retrieved January 6, 2006 from http://www.ics.uci.edu/~wscacchi/Papers/NSF-Workshop-Jan02/Scacchi-Position-Paper-Jan2002a-hold.pdf.

Scacchi, W. (2004). Free and Open Source Development Practices in the Game Community *IEEE Software*, 21(1), 59-67.

Sharma, S., Sugumaran, V., & Rajagopalan, B. (2002). A framework for creating hybrid-open source software communities. *Information Systems Journal*,12, 7-25.

Stallman, R. (2002). *Free Software, Free Society: Selected Essays of Richard M. Stallman*. GNU Press, Boston, MA USA.

Tarter, C.J., & Hoy, W.K. (1998). Toward a contingency theory of decision making. *Journal of Educational Administration*. Volume 36, Number 3. pp. 212-228.

Ulhoi, J.P. (2004). Open source development: a hybrid in innovation and management theory. *Management Decision*. 42(9), 1095-1114.

Välimäki, M., Oksanen, V., & Laine,J. (2005). An Empirical Look at the Problems of Open Source Adoption in Finnish Municipalities. *Seventh International Conference on Electronic Commerce,* China, 514-520.

Vernis, A.; Iglesias M; Sanz B & Saz-Carranza, A. (2006). *Nonprofit Organizations: Challenges and Collaboration*. Londres, UK: Palgrave MacMillan.

Vixie, P. (1999). Software Engineering. In: DiBona, C., Ockman, S., & Stone, M. (Eds.), *Open Sources: Voices from the Open Source Revolution*. O'Reilly, Sebastapol, CA.

von Hippel, E. (2005). *Democratizing Innovation*. The MIT Press, London.

von Hippel, E. (1988). *The sources of innovation*. Oxford: Oxford University Press.

von Hippel, E., von Krogh, G., (2003). Open source software and the private-collective innovation model: issues for organization science. *Organization Science,* 14(2), 209–233.

von Krogh, G., & von Hippel, E. (2003). Special issue on open source software development. *Research Policy*, 32, 1149-1157.

Walsham, G. (1993). *Interpreting Information Systems in Organizations*. Wiley, Chichester.

West,J. (2003). How open is open enough? Melding proprietary and open source platform strategies. *Research Policy*, 32, 1259-1285.

Wheeler, D.A. (2005). "Why Open Source Software / Free Software (OSS/FS, FLOSS, or FOSS)? Look at the Numbers!" Retrieved April 10, 2006 from http://www.dwheeler.com/oss_fs_why.html

Worldwide Email Usage 2005-2009 Forecast: Email's Future Depends on Keeping Its Value High and Its Cost Low: Pub ID: IDC1265282

Wusteman, F. (2004). About XML Patently ridiculous. *Library Hi Tech*, 22(2), 231-237.

Yu, Q., & Terzopoulos, D. (2007). A decision network framework for the behavioral animation of virtual humans. In *Proceedings of the 2007 ACM Siggraph/Eurographics Symposium on Computer Animation.* Eurographics Association, Switzerland, 119-128.

Zeitlyn, D. (2003). Gift economies in the development of open source software: anthropological reflections, *Research Policy*, 32,1287-1291.

Appendix – A (Questionnaire)

Questionnaire - IT/Software Use in non-profit Organisations

This online survey is being conducted for research at Napier University in Edinburgh. The aim of the survey is to investigate the factors influencing the adoption of open source software in non-profit organisations. Open source software is free software which can be downloaded from the Internet, often written by volunteers. It is made available with the source code (the original text form of the program) so that anyone can modify it for their own purposes. Examples include the Linux operating system and the Apache web server. In some areas open source software dominates – Apache has around 80% of the web server market for example. In other areas open source software has had less impact and commercial products still dominate, for instance word processing.

You do not need to be a user of open source software to take part in this survey – there are general questions on software use and views on software issues. Your views are valuable whether or not you use open source software: this will give a balanced view of the factors affecting decisions on whether or not to use open source software.

Your answers will be treated confidentially and will not be passed on to anyone else, and the name of your organisation will not appear in the results. Data will only be used for research purposes. Any questions you cannot answer, leave. This is not a test, the aim is to get your opinions, just answer as many questions as you can.

If you have any queries about this survey, please contact Guoli Zhang (*Email:* guoli_email@yahoo.co.uk)

Please complete the questionnaire by Friday 22nd June 2007.

Start Questionnaire

General Information – (Questions for Open Source users and Open Source non-users)

What is the name of your organisation? (optional)

How many staff are there in your organisation?

How many computer/IT (Information Technology) staff are there?

Is your organisation a subsidiary of a larger organisation?

- Yes
- No

Who is mainly responsible for choosing the software you use?

- General manager
- IT manager
- IT consultant
- Head office
- Higher level organisation
- Other, please specify:

What is your average annual spending on IT? £

(hardware and software)

(optional)

What is your average annual spending on software alone? £

Which of the following IT functions do you require? (select all that apply)

- Document editing
- Spreadsheet
- Database storage
- Graphics (image editing)
- Web authoring (creating websites)
- Presentation software
- Content management
- Client relationship management
- Finance/Payroll
- Web browsing
- Reading/sending email
- Firewall

Please specify any other IT functions you require:

Please rate the level of importance to you of these sources of information on IT

	Very important	Quite important	Not very important	Not important
The Internet in general				
Online discussion forums				
Mailing lists				

Software vendor websites	•	▯	▯	▯
Internet news sites	▯	▯	▯	▨
Personal contacts	–	•	▯	▯
IT consultants	▯	▯	▯	▯

How much influence do you feel the following people or groups have had on attitudes about how software should be developed, licensed or distributed?

	A great deal	Quite a lot	Some	Not very much	None
Richard Stallman (founder of the FSF)	▯	▯	▯	▯	▯
Linus Torvalds (creator of Linux)	•	▯	•	▯	▯
Free Software Foundation/GNU	▯	▯	▯	▯	▯
OSI (Open Source Initiative)	▯	▯	▯	▯	▯
Microsoft shared source initiative	–	▯	▯	▯	▯

(The Microsoft shared source initiative is a scheme allowing some universities and a limited number of technology companies access to Microsoft source code)

Which of the following documentation do you make freely available? (select all that apply)

▯ Annual report

- Program help/manuals
- Software development documents
- FAQs (Frequently Asked Questions)
- Software install/configure procedures
- Policy documents
- Other, please specify

How frequently do you communicate with other non-profit organisations on the following topics?

	At least monthly	Every few months	Yearly or less	Never
IT problems				
IT latest news				
IT events/meetings				

How do you rate the importance of the following in choosing software?

	Very important	Quite important	Not very important	Not important
Easy to install				
Easy to use				

Easy to customise	☐	☐	▨	☐
Full documentation	▨	☐	☐	•
Good support	☐	☐	☐	☐

Which of the following do you use in your organisation? (select all that spply)

☐ Microsoft Windows	☐ Linux	☐ Apache web server	☐ Microsoft IIS web server
☐ Zeus web server	☐ Mozilla	☐ Firefox	▨ Microsoft Exchange
☐ sendmail mailserver	☐ Postfix mailserver	☐ mailman	☐ KDE
☐ OpenOffice	☐ StarOffice	☐ Microsoft Office	☐ MySQL
☐ Oracle	☐ Microsoft SQL Server	☐ Zope	☐ Plone

How much do you agree or disagree with the following views?

	Strongly disagree	Disagree	No opinion	Agree	Strongly agree
IT plays a crucial role in positive social change	☐	☐	☐	☐	☐
Everyone should have access to a computer	☐	☐	☐	☐	☐
Everyone should be able to access the Internet easily	☐	☐	☐	☐	☐

Software companies should release full information on their products					

Do you use any open source software?

- **Yes**
- **No**

Open Source Software – **(Questions for Open Source Users)**

How long has your organisation been using open source software?

- Less than one year
- 1-2 years
- 2-5 years
- More than five years

How much do you agree with the following statements?

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Open source software is higher quality than proprietary software (more reliable, more secure etc.)					
Open source software encourages sharing					
Open source is an efficient way of developing software					
Open standards can prevent lock-in to proprietary products					
Having multiple software vendors gives users more flexibility					
Using open source software can save money in the long term					

Please rate the amount of influence of information from the following sources on your software choices

	A great deal	Quite a lot	Not very much	None
Dedicated open source sites				
Our own employees				
Other non-profits				
The open source community				

Which of the following open source groups/mailing lists have you joined? (select all that apply)

- [ ] sourceforge
- [ ] freshmeat
- [ ] NOSI (Non-profit Open Source Initiative)
- [ ] Circuit Riders
- [ ] Open Source Hub
- [ ] Other, please specify: _____

How many times have you used the following for software support?

	Never	1-5 times	6-10 times	More than 10 times
Contracted open source support	☐	☐	☐	☐
Open source community	☐	☐	☐	☐
Online help resources	☐	☐	☐	☐
Commercial IT support	☐	☐	☐	☐

How important do you think each of these is to you?

	Very important	Quite important	Not very important	Not important
Reading open source websites	☐	☐	☐	☐
Joining open source mailing lists	☐	☐	☐	☐
Joining open source events	☐	☐	☐	☐
Contributing to open source projects	☐	☐	☐	☐

How likely are you to recommend open source software to other organisations?

- ☐ Very likely
- ☐ Quite likely
- ☐ Not very likely
- ☐ Not likely

Have you considered stopping using open source software?

- ☐ Yes
- ☐ No

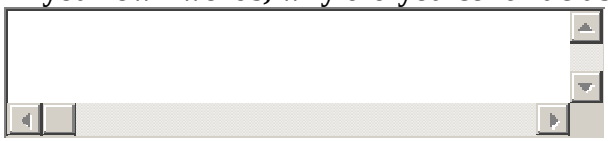
Your Concerns – (Questions for Open Source Users who have considered stop using OSS)

How significant were the following in your considerations?

	Very significant	Quite significant	Not very significant	Not at all significant
Frequency of updates too high	○	○	○	○
Lack of software features	○	○	○	○
Incompatibility	○	○	○	○
Lack of formal support	○	○	○	○
Licensing concerns	○	○	○	○

(incompatibility: systems cannot be used together)

In your own words, why did you continue using open source software?



That is the end of the questionnaire:
please submit your answers - many thanks!

Reconsidering Open Source Software - (Questions for Open Source Users who have not considered stop using OSS)

How likely are the following to make you stop using open source software?

	Very likely	Quite likely	Not very likely	Not at all likely
Microsoft products becoming significantly cheaper	○	○	○	○
Microsoft giving free support for owned software	○	○	○	○
Slow development of open source products	○	○	○	○

That is the end of the questionnaire:
please submit your answers - many thanks!

Software Choice – **(Questions for Open Source non-users)**

How many times have you used the following for software support?

	Never	1-5 times	6-10 times	More than 10 times
Software vendor	☐	☐	☐	☐
Other commercial support	☐	☐	☐	☐
Online user group	☐	☐	☐	☐
Employee in organisation	☐	☐	☐	☐

Volunteer support	☐	☐	☐	☐

How important are these technical factors to you in decisions about choosing software?

	Very important	Quite important	Not very important	Not important
Open data standards	☐	☐	☐	☐
Compatibility/interoperability	☐	☐	☐	☐
Usability	☐	☐	☐	☐
Customisability	☐	☐	☐	☐
Reliability	☐	☐	☐	☐
Security	☐	☐	☐	☐

How important do you think the following factors are in technology adoption?

	Essential	Very important	Quite important	Not very important
Publicly available information	☐	☐	☐	☐
Technology leaders who set an example	☐	☐	☐	☐
Government guidelines	☐	☐	☐	☐

Cooperation between organisations	☐	☐	☐	☐
Simple licensing	☐	☐	☐	☐

How important are these non-technical factors to you in decisions about software procurement?

	Very important	Quite important	Not very important	Not important
TCO (Total Cost of Ownership)	☐	☐	☐	☐
Influence from other non-profits	☐	☐	☐	☐
Policy	☐	☐	☐	☐
Staff knowledge of IT	☐	☐	☐	☐

Have you considered using open source software?

☐ Yes

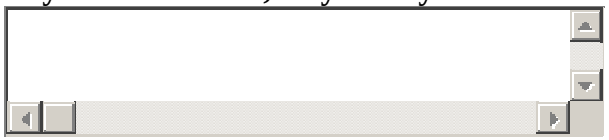
☐ No

Your Concerns – (Questions for Open Source non-users who have considered using OSS)

How significant were the following in deciding not to use open source software?

	Very significant	Quite significant	Not very significant	Not at all significant
Lack of organised support	☐	☐	☐	☐
Poor software consistency	☐	☐	☐	☐
No staff knew how to use open source software	☐	☐	☐	☐

In your own words, why were you considering open source software?



That is the end of the questionnaire:
please submit your answers - many thanks!

Considering Open Source Software – (Questions for Open Source non-users who have not considered using OSS

How likely are the following to make you try open source software?

	Very likely	Quite likely	Not very likely	Not at all likely
Someone to show us how to use open source software	☐	☐	☐	☐
Headquarters advise us to	☐	☐	☐	☐
Microsoft licences increased in price	☐	☐	☐	☐

That is the end of the questionnaire:
please submit your answers - many thanks!

Appendix - B (Interview Transcripts)

Respondent A

This respondent is an IT consultant to a non-profit organisation involved in coordinating scientific research. The respondent uses open source software at work but not at home.

G: I would like to know about the software you use and what influenced the decision making about what software to use.

A: Our organisation runs a website and I have worked there for four years. I am a website developer and a general IT consultant. The amount of time I spent on the society has varied and that is related to the changes in software used. In the first two years I worked 3-4 hours a week, but in the third year we decided to redevelop the website with a content management system. That was a big investment in information technology, and because it's a content management system the updates are a lot easier to perform so after this I would say that I spent roughly about 2 or 3 hours a week but a longer amount of time whenever we have a meeting. We have one big spring meeting and an autumn meeting, and we also have special interest group meetings. We only have two staff, and myself as a consultant. We have a committee as well. They are volunteers. We have an honorary treasurer, a chairman, we've got the heads of special interest groups and we have local representatives.

G: So you decided to start using a content management system, how was the final decision made to do that? Who was involved?

A: On a day-to-day basis the administrators will make the decisions but for anything else they will have to justify their decisions to the committee. The

responsibility lies with the committee and committee chair. A decision will be made by the administrator, or more likely by myself, as a sort of IT consultant. I'll tell them what they need.

G: Ok. So you give suggestions to the chairman or to the administrators and tell them the best thing or some benefits and then they will take your advice.

A: Yes.

G: However, the final decision will be made by the general manager.

A: Yes.

G: Ok. Thanks. How much would you say the organisation is influenced in its software choices by other organisations it has links with?

A: I'd say to quite an extent. There are similar organisations all of a similar size. There's quite a lot of dialogue. We try to maintain quite a lot of dialogue with other similar size charities and societies with the same kind of agenda basically because we don't have the resources inside the organisation to make these decisions. I mean the committee, these are all academics who do it. They do the job on a voluntary basis so they don't tend to be very well versed in managing organisations like these. They do it for a couple years then someone else gets voted in. So yeah, the contacts are very important, to see what they're doing.

G: Yes, so you believe this contact is very important. What benefits to you get?

A: Not just selecting IT software, but things like organising meetings.

G: I see your organisation's website talks about the benefits of making information available. Do you believe similar principles apply to fields like engineering, and in particular to software design and development?

A: This is a very controversial area. It's still a controversial area at the moment because a lot people would say if a work is funded academically, then it's funded by the government, that's where all our funding comes from, and it *should* be made publicly available. Yes, that's one argument. I mean there's a lot of argument about who actually owns the work, whoever it's beneficial to.

G: In your questionnaire answers you rated online forums as not very important. Could you say a little more about why you said that please?

A: I use online discussion forums if I can't get something to work. If something doesn't work, first I will look for online documentation, then I will maybe look for a tutorial. And if things are still going wrong, I think maybe someone else has had the same experience so generally I'll reach an online discussion forum through a web search. Actually I have never asked a question on a forum or answered one, so that’s not very generous (laughs).

G: I see, but you can get useful information from online forums sometimes.

A: Yes, but I try to get information from other sources first and that is usually enough.

G: Ok. You have been using open source software for 1-2 years. What was the reason you started using it?

A: Yes, I use things like MySQL and PHP. MySQL implements standard SQL so it can be used just like any other database system, but it is free isn’t it?

G: Actually MySQL has a commercial version and an open source version.

A: Oh yes, I have used the open source version. Open source packages are easily available. They are free and can be downloaded from the Internet. They allow me to try them and I don’t need to get permission, or buy a licence.

G: So it is important being able to try the software.

A: Yes that is good. We can try it without buying it so we don’t waste money. That allows us to find out whether the software does what we want.

G: I see, could you tell me about one of the packages you have found this way?

A: We are using a package which allows you to do things in HTML, like it lets you make a bit of text bold or italic, or add a table. I used that because it provided the functionality that I needed. I wanted to integrate it into my own piece of software which was a content management system. And I wanted to be able to adapt the software to do some specific things for our content management system. So for example, I wanted to restrict the access to some of the functions. You see I wanted the administrators to be able to update the websites but I didn't want them to upload loads of massive files or do things with the format that didn't coincide with the style of the website. And also I wanted to extend it do things that would be specifically appropriate to the content management system that we were building so I wanted them to be able to upload documents and have them presented in a particular style. Another major factor was that with the software being open source there was a community using the software and they were adding functionality onto the software.

G: I see, they were adding functionality.

A: Yes so the software would be getting better over time. I mean people generally wouldn't change the core code of the thing, because it's very hard to debug a piece of software that you haven't developed. What we had, they made it so you could add modules in and you could keep your code separate from the original code.

G: So that is an efficient way of doing things.

A: Yes.

G: Also you mentioned in your answer, you agreed open source is an efficient way of developing software. That is the community cooperation. All right. Now have you found that slow product development is an issue in any of the open source software you have used?

A: Quite often whenever you look for a piece of open source software you find a fit to your requirements to different degrees. And you'll also find there's a lot of variety in the amount the software has been developed and the amount that the project has taken off. Because the developers of open source software have no obligation to yourself to develop the software... If it's a project that hasn't taken off, if it hasn't built up a community, if it hasn't got this critical mass, the certain amount of people you need to keep the project going… If it's just one or two people… Quite often you'll look at a piece of open source software and you read the documentation, maybe go to SourceForge and see the program's going to do this, it's going to do that, then you look to see when the software was last updated. Often you find it was about five years ago or something. And then you'll click onto the outside of SourceForge onto the person's website, and they'll say, oh, I have a job, I can't do this. Someone else can pick up this project but no-one's going to do that. It's for all sorts of different reasons. Open source works well whenever you have a generic problem, so a lot of people want this problem solved, a lot of people want the software to go. If it's very specific to one person's

needs then there isn't that motivation for a large number of people to build up a community to develop the software, so these projects generally don't take off, so yes, slow, it is a concern. I can't use a piece of open source software unless it's almost complete and workable, unless there's a core there you can actually use. And I can't go to my manager and say oh we're going to use this piece of software and I am going to put in time developing this software if I'm going to rely on people who don't have any contractual obligations, so yes that's probably quite a big issue, but if the core of the software is already there, and you can already use it then it ceases to be an issue.

G: So, that means in the software development process, if people stop at an early stage, then it's difficult for others to continue and if they do something well at the beginning and then others can pick it up and continue.

A: Yes. I think if they get it either to a certain stage, maybe not perfect, doesn't do everything but it does the core task and it can be used, then I would use that piece of software, or if there appear to be a large community of people working on the software you can tell that if there's a large number of people it's more likely to continue, if it's a small number of people they can lose interest and projects are stopped.

G: Yes that can certainly happen. Do you think that software licences have any influence on that?

A: That’s an interesting question. I can say something about the particular case of integrating open source software into our content management system. Anyway, You'll know the GPL license. The GPL means that you have to…if you develop a piece of software and it uses a piece of GPL software, then your software has to become GPL. That's the situation we're finding with the project I'm working on now. Someone else wants to use it but for someone else to use it I have to make it GPL.

G: Yes, if an organisation uses open source software and they add something to it, then they have to keep the licence as GPL if they release their work to others. Otherwise they have to keep as their own.

A: Well I had to look up the GPL. It's to do with the project we're getting funding for next. There were interesting things about the GPL. I was reading about the open source business model. With GPL, you can reuse the software, but it's only if you release the software again that you have to make the software you release GPL. What you can do as well, and this is what MySQL do, is have a dual licence. There is a free licence for users and a commercial licence for developers who want to include the code in their own commercial software.

G: Yes, that is the same with Qt, the toolkit used by the KDE desktop.

A: Yes, I thought that was quite interesting. So it has big ramifications if you want to commercialise.

G: Now you said in your answers to the questionnaire that IT has a crucial role in positive social change. Can you say a little more about that and say how open source software fits in?

A: I think the more and the better access people have to information, the more people become well informed about everything in general. You can get just so much information. I believe a well-informed person is going to be a better functioning member of society. As well as that, people, they can go online and talk to someone. Say someone has a problem. Even if it's only one other person in the country has had a problem with that, or maybe a few other people in the world, they can go online and go and find out who that person is and the solution that they found. Yes, a very positive effect on society. And positive social change

as well, because things do change whenever people are able to have their voice heard.

G: Ok, and where does open source fit in to that?

A: Open source can make a difference, but only in so far as it gives access to free software, so there is more availability.

G: So open source can help, but the main issue is availability of information.

A: Yes that's right.

G: Well thank you for your time, it has been very interesting.

A: Thank you.

Respondent B

This respondent gives time as a volunteer to a health charity and is a home user of OSS and a member of a Linux User Group.

G: Could you say a little about how the organisation is run and about how choices are made on software to use?

A: In the society they originally had two computers. I was a volunteer there. There was one administrator for the whole centre. Generally he made decisions about what had to be done, but he was always very busy, so it was whoever was willing to do the work that would do it. There was a committee but they only met once a month and they didn't really participate in anything. The decision-making and technical support is just sort of ongoing.

G: Could you say more about the ICT cost and software cost and how your organisation keeps running?

A: Well usually if they were going to get new equipment they would be given it. For instance a photocopier was donated by a local company and I gave them another three computers so that more than doubled the number of computers they had. As a charity, in theory they should get software free or at a very low price. They did have software but they didn't have the original licences because they had just had the equipment donated. The software they were using was old anyway.

G: OK. Now I see from your questionnaire answers that you have a positive attitude towards open source software. Could you tell me about your experiences using it, how the decision was made to use it in the organisation and whether you communicate with other non-profit organisations, for instance information sharing, technical help and personal communication.

A: With respect to the centre, what open source gave us – what I did was put in several computers which would allow visitors to access the Internet. A lot of people who visit don't necessarily have the ability to access the Internet. There is quite a large proportion have difficulty with eyesight or with movement. There are so many physical problems. They can meet other people in the centre who find it easier to use the Internet and they can get information from them. The needs were quite simple, really just a web browser. They didn't have any servers, but they could easily have had a mail server. We also used open source software to set up a WIKI which is used to gather together information from people locally and share the information on the Internet.

G: So you can use the software to collect information which isn't easily available.

A: Yes, the situation is we had a lot of people who couldn't afford broadband access and were just beginning to learn how to use the Internet, whereas before they didn't have access to the information.

G: So all these people can communicate to share the information they have. Now, you rate IT consultants as quite important as sources of information. How does the organisation make use of consultants and what sort of information do you get from them?

A: They don't have any money to pay consultants, they are all volunteers, and the specific software needs are really very small. They need someone with the expertise to help them set up the infrastructure because they just don't have the real knowledge of what needs to be done.

G: You say that Richard Stallman, Linus Torvalds and the Free Software Foundation have quite a lot of influence on attitudes about software. What would you say has been their main influence?

A: Both Richard Stallman and Linus Torvalds have made a huge contribution, not only in the area of creating software. They also have two fairly distinct messages. The Free Software Foundation and Richard Stallman promote the message that it's important that everybody should be able to learn from past mistakes and the only way you can do that is by allowing everything freely to be seen. So there are no secrets, there is only passing information from one generation to another. It's a long process but it has to be done, whereas Linus Torvalds agrees with the Free Software Foundation but he also emphasises the fact that you've got to have very practical and sensible solutions. So there would be a disagreement over, for example, Digital Rights Management. Richard Stallman might say that is against freedom of speech, but Linus Torvalds would say it's just a piece of software, and there are good reasons for it to be made because it's just a type of encryption software. They have different views but both are valid.

G: And how much personal involvement do you have with open source software? Do you use open source software at home and do you do work for the organisation at home?

A: I use a great deal of open source software all the time. I think that the OpenOffice suite with word processor and spreadsheet packages is very very important. There is also software for two-dimensional vector drawing, photograph manipulation or three-dimensional drawing with programs such as Splendor, and there are programs to allow me to change and update websites. There are database programs, WIKI programs… If I didn't have them, if I had to buy them, I wouldn't be able to get anything like the functionality that I have. The thing is, people can try it – if they like it they can use it. If they don't like it, they can buy software if they want. The professional video editing software is ahead of the free software stuff, but it's not actually that important because even the best software that you can get out there would only be about five years ahead of the free software. So as free software becomes more mature it will eventually catch up with the commercial software.

G: Also, you say that good support is not very important in choosing software, why is that?

A: Well the organisation doesn't need much software. If their needs were greater then technical support would be more important. For 90% of the users that are out there, their needs are really small – email and Internet and word processing, and that's about 80% of everybody that's out there, maybe a little bit of photograph imaging. Once a machine is set up you really don't need much technical support. What would be important would be to have a decent backup and restore facility, but in the organisation they have so little data they can back it all up onto a thumb drive, so they really don't need very much.

G: You say that information from dedicated open source software sites has a great deal of influence. Which sites do you visit most frequently and what do you get from them?

A: Generally for open source I would go to linux.com or OS News. For more general stuff I would go to slashdot.org. For KDE news, they have a very good site they keep up to date. As far as open source goes, there's never really a big news story, it's just a gradual evolution of how things go on. For instance, I am using open source CD burning software. There is the original site and there are community sites which have grown up around that with detailed information about it. OpenOffice has a huge community. Firefox has a huge community around it. So I would go to linux.com or OS News or slashdot, but for more specific things I would go to other sites. But there is a lot.

G: Have you joined NOSI the Non-Profit Open Source Initiative mailing list?

A: Yes I have.

G: And how relevant do you find the information from NOSI?

A: Well I think like very many mailing lists, not just on open source, you get a large amount of information that isn't important to yourself. But then each person has their own specific things that they are interested in. But every so often you get something that you *are* interested in. I think the mailing list are useful because it's bringing people who *are* interested in the same things together. Generally the ones I know, people are more interested in doing positive things than doing negative things, so they are useful.

G: You say have used online resources and open source communities to get support. What sort of support have you found? Have you directly contacted OSS developers?

A: Oh yes, that's consistently going on all the time. There's so much information and so much support out there. The easiest way to talk about that is to talk about Wikipedia, where people are volunteering their time to help others, and that's the same thing that's happening with more complex technical stuff.

G: So you found they were helpful and even though some things were not relevant to you it was useful to give you a wider view.

A: Yes.

G: You say you have been using the sendmail server. It has sometimes been criticised for being insecure. Do you think those problems have been fixed?

A: Well what you will find is that all software is insecure – whatever you use. The question is, how often is it updated to become more secure. If sendmail is absolutely flawed then nobody would use it, and the community would dry up and go and use something else. If there is a problem then you can go to the community and see if they can fix it, or you can try to fix it yourself if you have the ability. Actually there is a lot of talk around software, but only about five percent actually do anything. It is my responsibility to look after my email but I would research it. And an email server is only one small part of security, and there are many layers of security.

G: How would rate the security in general of open source software compared with commercial software?

A: I think the most secure software can be open source software, for instance if you look at OpenBSD, it is vastly superior to anything else that's out there. It's much more secure than anything Windows or Linux has got. There is also some BSD and Linux software out there which is hugely insecure. Any software can be

made more secure or less secure. The only thing about security with open source software is that on Linux for example there is the kernel but there is all the other software around that and it is all being updated at the same time, which just doesn't happen with a Windows system. So talking about which one is more secure… They've been talking about that for a very long time and there isn't really an answer.

G: So it depends on what you are using and various factors.

A: Yes.

G: You say that IT has a crucial role in positive social change. Can you tell me in what ways you think IT has that influence?

A: The most important thing for social change is education. That is where it's important, to get information to people. There's no point giving out books or leaflets if people can't read. There need to be teachers and the teachers need to be trained. In developing countries it can be very basic. People can maybe have access to one shared computer – for a whole village. One computer could do it, then they can start using it as a sort of portable learning centre, library, all sorts of things.

G: Well thank you very much for all your answers.

A: You're welcome.

Respondent C

This respondent is a volunteer in a sports club and does administration work and web design. Other volunteers there are mainly responsible for setting up the IT systems. The respondent also works for a local council doing web development.

G: Hello, we can begin. If anything is unclear just ask me OK?

A: Right.

G: Could you tell me about your organisation, like the organisational structure?

A: It is a club which is run by the members for the members, so there's a committee, but there are no paid employees.

G: So you mean all the members are volunteers.

A: Yes and the committee is made up of members and it works on behalf of the members.

G: How about decision-making in the organisation?

A: That's done by the committee. The committee is elected by the members. They have monthly meetings and any big decisions will be made at the annual general meeting where all the members are present.

G: I see. Now in your questionnaire answers you give the figure of £10 as the average annual spending on IT.

A: Yes, that was just buying the web address!

G: Oh really!

A: Yes you see I had developed an entire website in my own time and it was just available internally, but then we decided to buy the web address. So what happened was I met with the committee and asked if they like the website, and if they do why not buy a web address it's only £10 a year, and they said yes, go on, do it. So I paid for the domain and got the receipt and paid for it out of petty cash. You see everything I use IT-wise I've got at home.

G: So you do some work at home and then that is used in the organisation.

A: I don't sit down in the office to do it while we are all there, I do it while I am at home. It's a voluntary thing so I'm not paid for it.

G: OK, so what kind of information do you get about IT from the Internet?

A: Not a lot, because whatever I use at work I go home and use as well. Somebody at work might suggest something and I may download some software. For example I downloaded the Safari web browser to see what our web pages looked like in Safari.

G: Do you get information from specific websites or do you get information by searching usually?

A: It's usually what someone's recommended to me. I either go straight to the website or I google it, I'm not just browsing.
G: OK, so like you said, the personal contact is the most important. So if someone suggests something you are likely to go and look then try it, rather than searching around for some information.

A; Yes. It's like that, and it can come through work too. You see I do the web pages at work. So maybe somebody at work can tell me about Firefox for example and I'll use it. That's how I found out about Safari, through work. Then I'll use the same things at home.

G: Are there types of information you find it difficult to get from the Internet, and if so what are they.

A: I have more of a problem with things being accessible, because I'm dyslexic. To be able to read websites properly I need to be able to set the text blue and the background white. I need to use Firefox as well. Now some sites don't work in Firefox, full stop. And sometimes if you change the colour the website just falls to pieces. So that's a problem I have, not being able to make the website actually accessible to me, and that's because of my specific needs.

G: So do you ask any others about this problem to help you to solve it?

A: If I can't read a website I contact the web designer. I ask them, what about the disability discrimination act etc. can you please make your website accessible? Sometimes I have success, other times I am completely ignored.

G: So you contact the person directly, not through some forum.

A: No I don't bother with things like that. A good friend of mine is really into IT and I asked him about a virus and how it can be removed, so he went onto the forums and just couldn't find anything there, and he had to do it himself. Forums tend to talk about less specific things and they don't have the full story, so I am very very wary of getting information and advice from them, because you just can't trust it – it's just one person's opinion.

G: Yes, people in online forums can say anything they want and it may take time to search through it and find what you want.

A: Yes, and there's usually someone I can just ask.

G: Yes, you have mentioned that personal contacts are very important sources of information for you. What sort of information do you get from these contacts?

A: Well there is the IT guy at work. If I've got a virus or anything like that I just say "Help!" and I can count on him to solve technical problems. There are other people I can ask – maybe I want to do something with style sheets and I don't have a clue so I can ask them and they can give me a basic start then maybe suggest I look at some websites to get more information, and tell me maybe you can teach yourself from there. So I'm quite good at getting people, and I want to start looking at Java, so I said to one of the guys at work "You know you wrote that in Java: can you email it to me?" They have been really helpful. They can point me to useful websites and that sort of thing. So I can get that sort of information at work then I can make use of it at home for the voluntary work.

G: So what open source software do you use?

A: Firefox is the only open source software I use at home, but at work we have a bit more, but I'm really not happy with it.

G: Oh, why is that?

A: You see, we use OpenOffice at work. For a dyslexic it's diabolical. The characters don't look good and the paragraphs don't format properly for me. So I can't actually read it properly.

G: I see. Is this your main experience of open source software?

A: Yes it is, and it just isn't as good as Word. I can't get the colouring right and the layout's wrong. There are compatibility problems as well. One of my colleagues had it installed and it wiped out her webcam. The only open source software I really really love is Firefox, the web browser. It's fantastic, and it's got the toolbar and everything. It's so well written. Firefox is stunning. But the other open source software I've seen just isn't very good. It's because it's written by volunteers, so they don't appreciate the problems that others have and don't get right into it, because it works for them.

G: I understand what you're saying, yes, but how does that compare with commercial software?

A: Something that's done commercially, though it *can* have issues, is actually a lot better for those of us that have disabilities, especially vision difficulties. If it's a commercial thing, they make sure it's going to work, because they want to sell it!

G: So not all the open source products are attractive, or perfected, not like Firefox or Apache. Those two are mature, because they were used by a lot of people. Then people find they are technically very good and they can solve some of their problems, so they use them. These are very popular open source products, but you are saying that others are not acceptable, and didn't fit their specific requirements.

A: Exactly. Firefox is fantastic. I love it.

G: OK. Now you just mentioned some difficulties you had when you used open source software, with accessibility. I see in your questionnaire answers you say ease of customisability is very important to you in choosing software. Do you customise the software or does someone else in the organisation customise it?

A: It depends what you mean by customisation. If it's just changing a few settings then I just go and do it. It's very rare I just use a package off the shelf. Usually I go in and change something in it.

G: How do you think commercial software open source software compares with open source software for ease of customisability?

A: Generally the commercially developed software is a lot better. The one exception to that is Firefox which far outstrips Internet Explorer. Every other bit of open source software I have found has problems with it somewhere.

G: Also I see in your answers you give low importance to software support and full documentation in choosing software. Is that because you think it is generally not important, or is it because you have enough support from other IT staff?

A: Partly because I have enough support and partly because I know enough so that if I have a problem I can usually find a way around it. I can work out how to use a package myself usually.

G: Whose idea was it to start using open source software in your organisation?

A: It was me, because I do all the IT stuff. The only thing open source we use there is Firefox anyway. In my day job there are some other things we use, but that is just handed down from on high.

G: What were the main reasons at work? Cost, customisability or security?

A: That's a difficult one. When we changed to OpenOffice it was purely cost. But that is such a mess because of all the stuff it doesn't work with. With the Aplaws content management system it was because it was so much better than what we

had already got. That was a national project we bought into, so that was for a completely different reason.

G: Do you think open source software has a good image for quality?

A: No it hasn't, it has a terrible image for quality. Unfortunately most of the people I work with, their only experience with open source is OpenOffice and everybody hates it so much it's just turning people off.

G: Oh really. What do they say about it?

A: They say if that's the standard of open source then forget it. Often open source software is so poor and doesn't work with so much else. I don't like OpenOffice for my own reasons, but I don't know a single person at work who prefers it.

G: Is there any other open source software you think is good?

A: Linux is good as a server, but most people would never play with servers. Most people are just using software on their own machines. At work we run Aplaws on a Red Hat Linux server, but most people would just say "What's a Linux server?" Most people using software don't know a lot. These people have seen open source software coming in at work – it's lousy, so they don't want to know anything about it at home.

G: And what about Firefox?
A: Well when people see that they ask why it is free. When they find out it is open source they assume it's going to have bugs in it, and they can't get it into their heads anyway that someone is going to do something like that for free. Anyway, yes Linux servers are great, but most people don't operate at server level.

G: You didn't say if you use Windows or Linux yourself, which do you use?

A: I use Windows.

G: What do you think are the main advantages?

A: Software runs better in Windows because it has been written to run on Windows. Things are more compatible on Windows. If people are going to write software commercially then they need to do it for Windows, so that's what they do.

G: What would you say to someone who was thinking of starting to use open source software?

A: Be very very careful. Firefox is superb but OpenOffice is ****.

G: Now I would like to change the topic and ask what you think of standards, like standards for document formats or web design standards.

A: The thing that really affects me is the standard for web design. When the Internet was let loose on the world there were absolutely no standards, but now the W3C suggests standards, and I create web pages that conform to those guidelines. I think the standards are a very good thing.

G: What aspects of the standard are most important?

A: To me the most important thing is accessibility. If someone has a website which is not accessible, I can say "Look, there are the W3C guidelines and that is an industry standard, and what you should be writing to", and people should take more notice of that rather than just saying "I can't make your site work".

G: Have you heard of the Open Source Initiative?

A: No I hadn't heard of it before doing your questionnaire, then I looked it up, and if they can make it, then good. I just don't have a lot of faith in open source stuff.

G: What do you think is the main positive social influence of information technology?

A: Well for example with the organisation I do voluntary work for, since we put the website up the membership has gone through the roof. Also it gives an easier way to keep in touch with the members. The website is so well used by the members, it's brilliant. Just in general, I have my ISP's web page as my own home page, so I will go there and read the news before I do anything else. As long as you are on a reputable site, it's fantastic.

G: What about any problems?
A: Well there is just so much junk out there. But in general it is fast and convenient, as long as you know what you are doing and can avoid the junk.

G: What advantages do you think there are in IT in general?

A: Well I am dyslexic, so if I type something I don't know if I'm spelling things correctly, but there is a spell-checker in Word, so from my disability point of view it has made my life a lot easier.

G: How about things like government plans to increase the proportion of families with a computer?

A: Well it would be good if everyone who wants one can have one.

G: What about things like the freedom of information on the Internet?

A: With things like a google search, you have to be careful about the quality of what you are getting.

G: What is the best way to deal with that? You say you don't really trust the content of online forums – what can be done?

A: Well when someone like the forum moderator gives an answer, you can usually trust that, but when it's just people putting forward their opinions you can't really trust them. For example my fourteen year old son visits websites and treats everything he reads as the truth, because he doesn't have the same scepticism as me, that's the main worry.

G: What do you think of Wikipedia?

A: That has been really slated recently. Because anyone can contribute, it's sort of open source itself. There was a well-publicised case of a person with absolutely no qualifications being one of the editors, and putting up stuff that was actually contradictory to the truth. And he had thousands of entries! It's brought the whole thing into disrepute.

G: So if you can summarise your views on open source, what would you say?

A: I think there are a small number of open source programs that are really really good, like Firefox or like Linux as a server, but a lot of it is very very bad. It is low quality and isn't written to a professional standard. It has a very bad reputation, and I don't trust it, and I don't know anyone who does.

G: OK. Well thank you for your time, it has been interesting.

A: Thank you.

Respondent D

This respondent is a volunteer in a non-profit organisation giving advice to the public. The respondent does not use OSS and is not informed about it.

G: Can you tell me a little bit about your organisation?

A: It is a non-profit organisation giving advice. People can come in or make appointments and we try to help them.

G: And what sort of use do you make of computers there?

A: Just some basic admin really, you know, things like recording appointment times and booking rooms for meetings, sometimes setting reminders to arrange transport, that kind of thing.

G: I see, do you use email within the organisation?

A: Yes to some extent. We all work in the same office, so it isn't as if we can't just go and speak to each other if something comes up. But sometimes, since we have several branches in different locations, we send emails to colleagues in another office to ask a question maybe. To get a specific bit of information, that sort of thing.

G: How about using the Internet?

A: Certainly the advisors use the Internet, because there are some useful sources of information there. Government websites, websites of other charities and non-profits giving useful information. Sometimes a bit of legislation comes

out that relates to what we do so everyone tends to read about that on the Internet when they are in the office, maybe during a break.

G: So who set up your Internet access for you?

A: That was done by one of the guys who knows about computers. He has worked here for years and years! (laughs). He set up our computers when all we had was two Amstrad WPCs I think they were called, things that had a built in word-processor.

G: So you were working here then too – what did you think of the introduction of IT?

A: (Laughs again). Well they didn't call it IT then, they just called it 'computers' and everyone was sort of afraid of them, maybe because they hadn't used them, or they heard they were unreliable, like the person who got a million pound electricity bill because of a computer error. And we all heard stories that computers were for boffins so we weren't sure we would be able to use them. Actually when we got them it wasn't too bad, it was just like a typewriter with a screen really when you used it as a word processor.

G: Maybe you could tell me some more then about how your IT systems started off and who decided how to do it and how it changed over the years.

A: Of course. As I said one guy we had was interested in computers. He had a Commodore and some other computers at home and he talked about it but nobody really knew what it was about. Some time we were offered a couple of old computers for the office and he said he would set them up. He showed people enough to get them started and we could all look at the manuals, and he would help us out if we got stuck. It was years later we got onto the Internet though. By that time we had PCs with Windows on them.

G: Oh yes, what version of Windows was that?

A: First we had Windows 3.1 then we had Windows for Workgroups which was pretty similar. Then we went through all the later versions of Windows, so we upgraded from time to time.

G: How frequently did that happen?

A: Every few years, but we did always leave it as long as possible, because of the inconvenience, things like not having access to files while the changeover was being done, that sort of thing, you know. Anyway we had to spend some money obviously when we upgraded. Every once in a while we would get newer faster computers, or a few times computers just stopped working suddenly. They weren't as reliable as they are now.

G: What kind of licensing agreement did you need for the software?

A: What do you mean exactly? Do you mean did we have any sort of special agreement to get software?

G: I mean what about the cost of buying new CDs or whatever you needed to install software? Where did you buy it from? Could you install the software on all the computers or could you just install it on one?
A: Oh I see what you mean. Yes, well at first we installed everything from floppy disks I think. We could do that on as many computers as we wanted. It carried on like that for a while. Eventually things changed and everyone talked about needing proper permission to have software, especially if it was on all the computers. Actually that worked out well since we get a special licensing arrangement because of what we do. We only pay a small amount of money to get it.

G: Right, so that wouldn't be a big concern then. What difference did it make when you got Internet access?

A: It didn't make a *big* difference to the way we did things. We had better computers of course, and we had up to date software by then, but we more or less did the same as before with them. A bit of email and a bit of web browsing for information I suppose, that was the main thing. Well actually, I am forgetting one thing. You know there is all the talk about viruses and so on. One of the other offices got a virus somehow and all their computers were affected and they had to set them all up again afterwards. You have to be more careful these days and it made us aware we have to be careful not to lose information, or let people get it from our computers illegally.

G: So who made the decisions about how to set the system up, what software to use, how to keep everything secure and so on?

A: By the time we had the Internet set up, there were several people involved. There was one person who was in charge overall, but after a while, and after several people left over the years as well, we ended up with three IT guys who could do all we need. But they are just volunteers as well. Two of them work in IT anyway, the other one has been doing it for years, that's the one who started it all off years ago. Pretty much we can tell them about any problems we have and they can generally sort it out, or the problem is fixed when we do an upgrade, so it's fairly settled.

G: Do you use any open source software?

A: No we don't. I don't even know much about it, which is one of the reasons I decided to talk to you. It all sounds interesting but I'm not sure what to make of it.

You mean people just giving software away? I hadn't really heard about that, but maybe I read about it somewhere in a newspaper, I can't remember.

G: So it's all Windows is it? How about your Internet connection, does that go through a firewall?

A: Oh yes actually, it does. One of the IT guys set that up when we realised we had to be more careful about security. It seems to work well, and what it means is all our computers are connected to it, then they can connect to other computers outside, and to the Internet, yes. I don't really know about the firewall but I know it's Windows. Sometimes I see someone checking it. They go over and turn on the monitor and I can see it's the same kind of Windows screen as what's on my computer too. But it's away from all the other computers, just somewhere near where the cable comes in and nobody touches it apart from the IT guys.

G: Do you think IT has benefits for general society?
A: Yes I do. Now that I have gotten used to it. I can see that people can get a lot of online information if they want to, and I search for things myself from time to time, like maps or timetables, maybe sometimes if I can't remember something, like an actor's name, and I can look it up somewhere. Just by doing a search.

G: Do you think computers and software themselves benefit society, or is it just the information.

A: Well they go together really. I don't suppose you could have all that information floating about without the computers and the network. They kind of grew up together I suppose. You can't have one without the other.

G: Do you know about websites where you can get information about IT?

A: Not really, no. We leave that to the tech guys. I did look for some advice on Word a few times, and actually I did get some useful tips, but often I couldn't follow it or it didn't seem to work. So I don't go out of my way to look that stuff up.

G: So what is your first reaction to the idea of open source software? Maybe I should just say free software. There are different ideas about why software should be made free, and not everyone agrees. Open source is just one interpretation of what free software should be.

A: I am a little surprised really. I guess those computers buffs just like to tinker around and make something up and get it working and that's about it.

G: Well at the moment, some of the software is quite advanced. In some areas it is used a lot. Web servers for example, and a lot of people are using the Firefox web browser, that's open source.

A: Oh right. Yes well some of us are using Firefox, I have to say. I know about that. Actually I'm still using Internet Explorer. I haven't given it much thought to be honest, I'm happy enough to stick with that. I'm used to it.

G: Ok, I'll just finish off with a final question. If you had to say what is the most important thing about choosing software, what would you say that is?

A: I would say, just my first reaction, what really matters is it doesn't mess anything up. I mean if you upgrade or if you install something different or new, everything should still work, ideally. We are just volunteers after all and we have limited time anyway, so it's very frustrating if we can't use the system or access some files when we want to. So that would have to be it. Software should all be compatible and it shouldn't cause any problems when you add new things.