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A Human Environmentalist Approach to Diffusion in ICT Policies: A Case Study of the FOSS Policy of the South African Government

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Abstract

Purpose - Through an evaluation of the Information Technology adoption and diffusion models and the Free and/or Open Source policy of the South African Government, the underlying assumption is that the developmental divide between those with and those without access to technology is purely technical. This paper illustrates that if Free and/or Open Source Software (FOSS) is to be used as a building block to bridge the 'digital divide' a more social and environmental perspective, which embraces the philosophy behind the software, needs to complement the technical perspective. The human environmental model is presented as a useful alternative which, if embraced, can inform more holistic ICT policies.

Design/methodology/approach - Through a review of diffusion of innovations models an alternative diffusion framework is described and applied to an interpretive open source case study in South Africa.

Findings - Contemporary diffusion and innovation models are narrowly focused on Information Technology as a purely technological linear phenomenon. This perspective also underlies many ICT policies. A more socio-technical adoption model can assist in providing a more holistic approach to ICT policy development.

Originality/value - The application of a new innovation model, the human environmental model, to ICT policy provides a holistic framework in which the complexity of the innovation process can be reflected in policy. Such an approach to ICT policy formulation will assist with broadening the perspective of policy makers from IT as a technical solution to IT as part of a socio-technical solution and recognise the duality of the innovation process.

Keywords: ICT Policy; ICT for socio-economic development; ICT adoption and diffusion; ICT implementation context; human environmental model; Free and/or Open Source Software

1. Introduction

Developing countries are well aware of the potential benefits of Information and Communication Technology for development: “There was at one time some debate as to whether information and communication technologies (ICTs) were relevant to developing countries, but this debate has been resolved with a clear yes answer. The question has become not whether, but how ICTs can be beneficial” (Walsham and Sahay, 2006). Many policies promoting the use of ICT have resulted in large investments in ICT infrastructure and launching of e-governance initiatives. Many purport to support both economic and social development. However, when these policies are examined more closely the question of adoption and diffusion is often not, or at best simplistically, addressed. A rather linear trajectory from installation and training to adoption and diffusion is implicit.

This paper explores the existing linear and universalistic models of ICT adoption and diffusion which are based on an underlying assumption of a globalised “flat” world (a term popularised by Friedman (2006)). This simplistic view of globalisation ignores the structural process of diffusion and adoption. In Section 2 of this paper we discuss the classical diffusion theories and suggest an alternative model which addresses their shortcomings. The example of the *Policy on Free/Open Source Software Use by the South African Government* (DPSA, 2006) is used to illustrate that a more holistic multi-dimensional model of adoption of ICT – the human environmental model – is needed to explore not just the various dimensions of the socio-economic context, but also the process by which these dimensions interact. Greater awareness of all dimensions of the context in which ICTs are proposed to be implemented are acknowledged in the policy, but the process of adoption and diffusion is largely ignored.

Thus, this paper addresses the question: *Can a holistic model to ICT adoption and diffusion improve FOSS policy formulation?* This question is answered by illustrating that in a globalised economy the existing models of ICT adoption are inadequate in explaining the process of adoption and diffusion, and that a human-environmental model can address this gap by explaining the duality of this process.

2. Diffusion and innovation models

A one-dimensional view of ICT, inherent assumptions of the “goodness” of ICT, and an assumed linear trajectory from installation and training to

adoption and diffusion, is apparent in many ICT policies. However, this assumes a “flat” world and ignores the structural conditions of diffusion and adoption. To take the latter into account implies having more holistic ICT policies based on contextual and socio-economic models of innovation diffusion. General trends, such as total quality management, business process reengineering, and the discourse on globalisation, support the rationale that there are standard ways in which ICTs should be used, and there are specific organisational features which ICTs should aim at supporting (Avgerou, 2001). Avgerou (*op. cit.*) calls this approach to the exploitation of ICTs “a-contextual” and warns that it involves high risks of misleading and frustrating local efforts to make sense of and appropriate new technologies. Later in this section we illustrate a model of ICT adoption and diffusion which can be used instead of these a-contextual models and assist in providing the context needed for a more human-environmental approach to ICT.

In the next section we describe some of the existing a-contextual and contemporary diffusion and adoption models, but before describing the various models it is important to achieve clarity on what we mean by diffusion, adoption and innovation. Innovation in relation to ICTs is used when technology is used in an Information Systems context, where “... even if the technologies implemented in an IS project are already common elsewhere and widespread, the local experience of technology implementation and socio-organizational change constitutes an innovation for the organization concerned and may well constitute innovation for its socio-economic context” (Avgerou, 2009). Diffusion is the implementation of the innovation across the organisation, whereas adoption is when the innovation is accepted and embedded in every day work practice.

In the late 1980’s and early 1990’s a lot of research in the field of information systems (IS) was done on IS implementation problems (Moore and Benbasat, 1991). IS implementation research was mainly based on the theories of innovation diffusion, focusing on how the perceptions of the potential users of the information technology (IT) innovation influenced the adoption thereof. One of the most cited innovation-diffusion theories is that of Rogers (in: Prescott and Conger, 1995). Rogers’ innovation-diffusion model shows that factors which influence the diffusion of an innovation are the characteristics of the innovation, communication channels, and the social system, all interacting over time. The five characteristics of an innovation which affect the rate of diffusion of that innovation, are: relevant advantage (the degree to which the potential adopter perceives the innovation to be better than its forerunner); compatibility (the degree to which the potential adopter perceives the innovation as being in line with his/her existing values, needs and past experiences); complexity (the degree to which the potential adopter experiences the innovation as being difficult to use); observability (the degree to which an innovation’s results are evident to others); and

“trialability” (the degree to which the potential adopter will try-out the innovation before adoption).

Moore & Benbasat (1991) added two more innovation characteristics to the model of Rogers, namely: image (the degree to which a potential adopter's image or status is perceived to be enhanced in his/her social system because of him/her using the innovation) and voluntariness of use (the degree to which the potential adopter is perceived to willingly make use of the innovation). They furthermore split observability into result demonstrability (the degree to which the potential adopter's results of using the innovation are observable and communicable to others) and visibility (the degree to which information technology is apparent to the sense of sight). Moore and Benbasat (1991) also pointed out that the key to whether or not an innovation diffuses is not really a result of the potential adopter's perceptions of the technology itself, but rather his/her perceptions of using the technology. They therefore rephrased Rogers' five innovation characteristics to reflect that it is the perceptions about using the innovation rather than the perceptions about the innovation itself which are of concern, and in addition labelled it “the Perceived Characteristics of Innovation (PCI)”.

The social system's characteristics referred to in Rogers' model include those of the individuals, groups, the organisation, decision makers, and specific role players such as champions and senior managers, while the communication channels referred to could be internal or external to the organisation and could transfer either formal or informal communication (Prescott and Conger, 1995).

According to Rogers (Prescott and Conger, 1995; Rogers, 1995) the diffusion process consists of two stages: adoption and implementation. The adoption stage comprises of three sub-stages: knowledge acquisition, persuasion and learning, and the decision to adopt or reject the innovation. Implementation occurs when the individual starts to use the innovation. Kwon & Zmud (1987) extended this model to also include post-implementation phases, such as confirmation, which occurs when the individual seeks the reinforcement of the innovation-decision already made.

Kwon & Zmud (1987) combined the diffusion of innovation theory with application implementation research and as a result ended up with an enlarged model, which apart from Rogers' model, also includes task (uncertainty, autonomy, and variety) and environmental (heterogeneity, uncertainty, competition, concentration/dispersion, and inter-organisation interdependence) characteristics.

This model can be critiqued in a number of ways. For example, terminology in IT research seems to differ from that used in classic diffusion research, as for the former the adoption of technology is often a decision taken by a higher

authority and the IS department then gets tasked to diffuse the technology through the rest of the organisation. The decision to adopt the technology is therefore made without consulting all the individuals in the organisation (Bayer and Melone, 1989). Adoption is therefore seen as the decision to use the technology, while diffusion is the process of implementing the decision.

Furthermore, in the IT field, voluntary decisions to adopt an innovation are not very common and Rogers' model does not address the resentment which is often caused by the enforcement of IT from a higher authority. Bayer & Melone (1989) also argue that the characteristics of "non-diffusion" are of major importance to the IT field, due to the high incidence of IS failure, and that the classic diffusion theory does not explain why innovations are discarded in the same depth as why it is adopted.

The classic diffusion theory also fails to "consider interactions between various social systems" (Bayer and Melone, 1989). Information technologists tend to be more loyal to their discipline than to the organisations that employ them. It is therefore seldom the needs of their organisation that alerts them of a new technology, but rather their contact with other technologists. Aspects such as information politics and power bases seems to be important adoption factors and should therefore also be included in the innovation adoption theory.

According to Du Plooy (1998) the classic diffusion theory disappoints as it makes no explicit mention of the social context or human environment of information systems adoption and use. Information technology is socially constructed and to cultivate and nurture a human environment in which the IS is to be implemented, one has to understand how people view technology and how they understand the meaning of technology. Innovation theory and the enhanced models of information technology diffusion/adoption not only fail in their lack of consideration of social interaction, but also because they are overly simplistic (even deterministic) in their view of the innovation process (or, in terms of information technology, of the process of implementation). According to Du Plooy (1998):

"they fail to consider the type of social characteristics and dual interaction between information technology and the organisation, specifically with regard to factors and characteristics such as the different world views of the agent of change and the organisation within which the change is implemented; the duality of technology; the technological frames of reference of the agent of change and the organisation; organisational culture; organisational learning and emergence; the power bases of individuals and groups; empowerment/disempowerment of workers through information technology; resistance to change; the non-deterministic aspects of information technology; the determining capability of this technology; the

influence of this technology on the values and judgement of an organisation; the influence of this technology on business processes, organisational learning and internal communication; the application of technology in different work situations, e.g. managerial, individual office work, group work; the influence of organisations on information technology; the adaptation of the organisation to the technology; organisational norms and values; etc.”

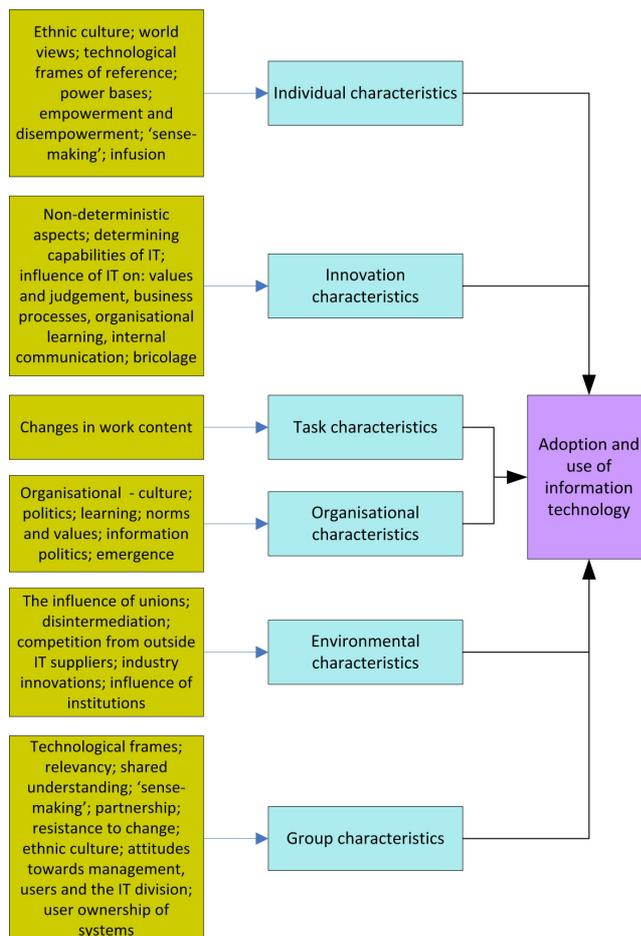


Figure 1: Du Plooy's enhancement of Kwon & Zmud's diffusion/implementation model (Du Plooy, 1998)

Du Plooy (1998) therefore argues that the social context within which the adoption and diffusion of IT takes place is much 'deeper' than the pure demographic characteristics described by the characteristics of Rogers' model. Furthermore, Du Plooy argues that making sense of IT also means

understanding the changes in structure, culture, work processes, and power bases that the adoption and use of IT bring to the organisation. Du Plooy extended the enhanced diffusion/ implementation model of Kwon & Zmud by adding a sixth dimension to the innovation-diffusion process, namely group characteristics. He also added “forces” and “elements” to the other five characteristics which he regarded as of importance to the human environment of IT adoption and use (see figure 1).

Du Plooy’s (1998) enhancement of Kwon & Zmud’s diffusion/implementation model is still a deterministic model as it seems to indicate that adoption and use will be successful if one takes the stipulated social factors into consideration when implementing an innovation. Du Plooy (1998), however, believes the mechanistic causal interpretation suggested by the model to be incorrect and inappropriate since information technology is socially constructed and has non-deterministic characteristics. One cannot predict outcomes or determine cause and effect during information technology adoption and use that readily, because of these characteristics.

For more successful adoption and use, one needs to understand the social context of IT diffusion and implementation in its totality. This does however not mean that cultivating all six characteristics will guarantee success, while omitting one of these characteristics will also not necessarily lead to the adoption not being successful. According to Du Plooy (1998) “such determinism cannot be superimposed on a process with so many non-deterministic characteristics.” The six characteristics of Du Plooy’s human environment of adoption and use framework (see figure 2) should be viewed as an integrated totality which is not divisible into parts (Du Plooy, 1998):

“The six characteristics do not deterministically decide adoption and use. As a whole they are adoption and use in the sense that they constitute the full social context for adoption and use. Taken together they are the very substance of information technology adoption and use.”

The “binding factor” between the various characteristics of the framework is their social contexts. Although each side of the cube points to a different dimension of the social context of information technology adoption and use, these dimensions cannot be isolated and considered on their own. The human environment only makes sense when considered in its totality, as a single environment which interacts recursively with information technology during its implementation and during its use (Du Plooy, 1998).

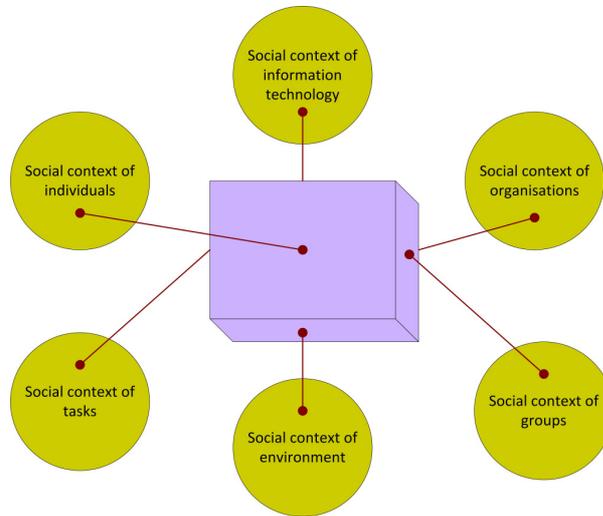


Figure 2: The human environment of IT adoption and use (Du Plooy, 1998).

Giddens' structuration theory (Orlikowski, 2000) can be applied to describe the processes through which ICT's are themselves shaped, while they at the same time contribute to the shaping of the social relations of organisations within which they are implemented (the duality of technology) (figure 3).

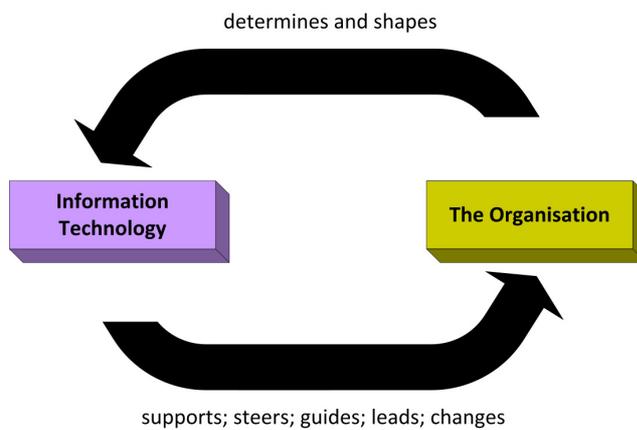


Figure 3: The recursive relationship between information technology and the organisation during the process of adoption and use (Du Plooy, 1998).

The use of Du Plooy's (1998) framework to understand the full social context of information technology adoption and use is best understood when the recursive relationship between information technology and the organisation during the process of adoption and use (as illustrated in figure 3) is integrated with the human environment framework (figure 2) to show how the human environment actually encapsulates the process of information technology adoption and use (figure 4).

If we therefore understand the interaction between the human environment and the process of IT adoption and use as shown in figure 4, we are able to make sense of this human environment. Only if we understand the human environment and its interaction with the adoption and use processes will we be able to cultivate and nurture such an environment to facilitate the adoption and use of this technology (Du Plooy, 1998).

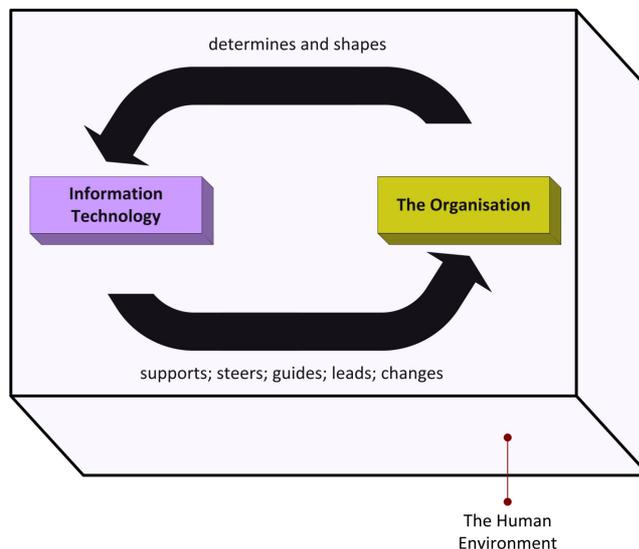


Figure 4: The human environment encapsulating information technology adoption and use (Du Plooy, 1998).

According to Du Plooy (1998), it is also important to note that the two dimensions of the adoption and use process shown here are “two sides of the same coin”. They are not divisible into two distinct dimensions that can be considered separately because they are both contained and embedded in a human environment. The upper arrow of figure 4 shows that information technology is socially constructed, but this model even goes beyond that. Social construction is a term applied to the study of the meanings of technology and how those meanings affect the implementation (the adoption and use) of technology within the organisation (Sahay et al., 1994). This

model includes that notion, but also shows that the human environment comprises of various integrated social contexts which transcend the study of meanings to include a large number of non-deterministic aspects that should be considered during information technology adoption and use. The lower arrow shows that information technology may also determine what an organisation is or may become. It does not do so deterministically, but it takes place within a particular human environment. It is the “other side” of the adoption and use “coin” (Du Plooy, 1998).

This duality, however, is not a separation into two things that differ widely from or contradict each other, but it could rather be described as a concept expressed in a different way. Information technology, due to its close interaction with human actors in organisations, has in fact become the relic of modern society. We cannot perform our work in the modern organisation without this technology, but at the same time our organisations and we are changed when we adopt and use this technology (Orlikowski, 2000; Postman, 1992). These two dimensions are impossible to disentangle or undo. We cannot understand the one dimension unless we also understand the other, and as Du Plooy explains “we can no longer even conceptualise information technology without thinking about its implementation”, (Du Plooy, 1998). Thus, an ICT policy which aims to address socio-economic development should have this duality embedded in its policy if it is to address the process of innovation adoption and diffusion of ICTs in its country. The *South African Policy on Free/Open Source Software Use by the South African Government* is used as an example of a policy which aims to address socio-economic development, but in a rather linear manner, and inadequately deals with the process of innovation adoption and diffusion.

3. The South African Policy on Free/Open Source Software Use by the South African Government

Since 2002, two accepted policy submissions have been made to the South African Cabinet on Open Source Software (OSS) (DPSA, 2006), of which the first one, done by The National Advisory Council on Innovation (NACI) in its study on Open Software and Open Standards (Cabinet Memorandum No. 13 of 2002), was titled *Open Software and Open Standards in South Africa: A Critical Issue for Addressing the Digital Divide*. NACI formulated the use of Open Standards to be an enforced base for ICT in the public sector as, according to their study, OSS would promote interoperability and universal access to the South African government’s online services without exorbitant costs, restrictions because of licensing, or other related obstacles; it would also reduce the risk of being ‘locked-in’ by specific vendors of ICT commodities and services, and this would in turn drop the entry barriers for local software developers who are able to offer ICT solutions to the public sector.

According to Byrne & Jolliffe (2007) the cost of proprietary software licences is a clear motivation behind the pro-FOSS proposals contained in the NACI document, but they also identify a number of important broader developmental and societal aspects to the arguments presented. Apart from arguing that FOSS provides a “useful tool to allow developing countries to leapfrog into the information age”, it also indicates how the “arrival” in this information age is not only more viably achieved using FOSS (a cost argument), but also that the use of FOSS fundamentally effects the nature of this information age.

The arguments made in the NACI document, which are habitually ignored or downplayed in the policy and strategy documents to follow the NACI document, according to Byrne and Jolliffe (2007) are:

1. the threat propound by broad software patents to the development of FOSS, and how to fight this threat;
2. relating the right to free software usage and development to freedom of expression and the free exchange of ideas, and;
3. the acknowledgement that individuals, academia, businesses and NGOs already make use of FOSS, not because they are forced to do so by means of a policy, but because they have the freedom to do so.

It is significant to note that the NACI document uses the terminology ‘Open Software’, in stead of ‘Open Source’ or ‘Free Software’. This was done as they considered the use of the term ‘source’ to be too technical and they wanted to emphasise the importance of the non-technical arguments put forward in their document (Byrne and Jolliffe, 2007).

In January 2003, the then Department of Arts and Culture, Science and Technology, made a second OSS policy submission to Cabinet. This submission, which encouraged the utilisation of OSS in government, was a proposed OSS policy for Government (Cabinet Memorandum No. 29 of 2003) and was compiled by the OSS working group of the Government IT Officers (GITO) Council. This document borrowed extensively from the NACI document, but did not include all the richness of the original reasoning and mainly concentrated on arguments of OSS efficiency en effectiveness, as reflected in the title which talks explicitly of Open Source Software (Byrne and Jolliffe, 2007).

On the 22nd of February 2007 the South African Cabinet approved a FOSS policy and strategy and agreed that all future software to be developed for Government would be based upon open standards and that Government would migrate its current software to FOSS (GCIS, n.d.). According to this policy all government departments were to include FOSS in their planning and a project office were to be established by the State Information Technology Agency (SITA), with the Council for Scientific and Industrial

Research (CSIR) and SITA tasked to ensure the smooth implementation of this policy throughout South Africa.

The revised FOSS policy is as follows (DPSA, 2006):

1. "The South African Government will implement FOSS unless proprietary software is demonstrated to be significantly superior. Whenever the advantages of FOSS and proprietary software are comparable, FOSS will be implemented when choosing a software solution for a new project. Whenever FOSS is not implemented, then reasons must be provided in order to justify the implementation of proprietary software.
2. The South African Government will migrate current proprietary software to FOSS whenever comparable software exists.
3. All new software developed for or by the South African Government will be based on open standards, adherent to FOSS principles, and licensed using a FOSS license where possible.
4. The South African Government will ensure all Government content and content developed using Government resources is made Open Content, unless analysis on specific content shows that proprietary licensing or confidentiality is substantially beneficial.
5. The South African Government will encourage the use of Open Content and Open Standards within South Africa."

Important to note from this policy is that South Africa has adopted a preferred OSS strategy, as points 10.1 and 10.2 of South Africa's OSS strategy states (GITOC, 2003):

- "Government will implement OSS where analysis shows it to be the appropriate option. The primary criteria for selecting software solutions will remain the improvement of efficiency, effectiveness and economy of service delivery by Government to its citizens."
- "OSS offers significant indirect advantages. Where the direct advantages and disadvantages of OSS and Proprietary Software (PS) are equally strong and where circumstances in the specific situation do not render it inappropriate, opting for OSS will be preferable."

A preferred OSS strategy is very different to a mandating OSS strategy, as the latter is a more radical approach in that it commands the use of OSS systems throughout Government, which implies replacing the entire existing proprietary infrastructure. Such a strategy entails large implementation and training costs and is quite clear in terms of what government departments are required to do - change all existing proprietary software to OSS, and only procure OSS in future (Wong, 2004).

A preferred strategy is different in the sense that FOSS solutions are only preferred for new software procurements, and in cases where proprietary

software is demonstrated to be significantly superior” (point 1 of the SA FOSS Policy above), Government departments only need to defend their proprietary choice by providing “justified” reasons. A downfall to a preferred strategy is that clauses in the policy, such as “unless proprietary software is demonstrated to be significantly superior”; “whenever comparable software exists”; and “unless analysis on specific content shows that proprietary licensing or confidentiality is substantially beneficial”, provide loop holes by which different departments could easily bypass the FOSS policy with ‘good reasoning’, as these are open to different interpretations. In this way they were still allowed to ‘nurture’ their relationships with the proprietary software industry, and for many governments departments this meant ‘business as usual’ even after the implementation of the new OSS policy (Byrne and Jolliffe, 2007).

Further more, it is imperative to mention that there isn’t unanimous support for the FOSS Government policy in government departments, or as Byrne & Jolliffe (*op.cit.*) put it “there is not a sole voice within government”. With the exception of a few, such as the Department of Science and Technology (DST), most of them seem to be rather unwilling to jump onto the FOSS bandwagon. Although SITA was given the task to set up an Open Source Programme Office to ensure and coordinate the implementation of OSS in all Government departments, it had by June 2008 not even implemented the FOSS policy in SITA itself.

We will now look at this policy in relation to our above discussion of diffusion and innovation models.

4. Discussion

In Table 1, one can see that the *Policy on FOSS Use by the South African Government* doesn’t address many of the elements of the human-environmental model. In comparing the human environmental model described in section 2 and the South African policy on FOSS use by the South African Government in section 3, it is apparent that the diffusion and adoption of FOSS in South African government departments is merely assumed. The different elements are clearly not treated as a cohesive whole, but rather as separate sides to a box.

Social context element	Description	Current position of the <i>FOSS Policy of the South African Government</i>
Individual	Ethnic culture; world views; technological frames of reference; power bases; empowerment and disempowerment; ‘sense-making’; infusion	Recognition of the need for champions to drive the process (SITA and the CSIR), although SITA doesn’t seem to succeed in fulfilling this role; FOSS does though offer the potential of empowering people in ways that proprietary software does not allow, by offering users the choice to explore, change, learn from and modify the software, exploiting the power of many small contributions from a large network of individuals to suit their needs; FOSS provides the ability to customise software to local languages and cultures; and the intention is to develop a

Social context element	Description	Current position of the <i>FOSS Policy of the South African Government</i>
		model to support structures and services for FOSS users.
Information Technology	Non-deterministic aspects; determining capabilities of IT; influence of IT on: values and judgment, business processes, organizational learning, internal communication; bricolage	Recognition of the relative advantage of adopting the FOSS policy justified in terms of the contribution to efficiency and effectiveness, but an assumption is made that government departments will realise this benefit and adopt OSS as a result; the requirements for open standards and interoperability not clearly stated – these would be necessary if the bricolage approach is to work, but this again opens up a new 'battle front' with the producers and vendors of proprietary software.
Task	Changes in work content	This is not recognised, although moving to FOSS indirectly assumes the same work content on a new similar system, i.e. no significant change.
Organisation	Organisational culture; politics; learning; norms and values; information politics; emergence	Recognition that FOSS would not be suitable for all software in all departments, especially where confidentiality reigns supreme – 'non-mandating policy'.
Environment	The influence of unions; disintermediation; competition from outside IT suppliers; industry innovations; influence of institutions	No recognition although one of the aims of the policy is to lower entry barriers for various kinds of new businesses into the IT industry, but completely missing from the policy is the power of proprietary software companies in terms of their influence on IT and IT policy adoption as strong competition that will need to be addressed in this highly competitive and lucrative industry.
Group	Technological frames; relevancy; shared understanding; 'sense-making'; partnership; resistance to change; ethnic culture; attitudes towards management, users and the IT division; user ownership of systems	No recognition, although the loop holes described in section 3 provides for opting out if no fit can be seen.

Table 1: The human-environmental dimensions and the South African policy on FOSS use by the South African Government

The project office to be established by SITA, and the fact that the CSIR and SITA is tasked to ensure the smooth implementation of this policy throughout South Africa, indicates the recognition of a need for a FOSS champion - someone who through a variety of influential processes, could vigorously promote the vision of using FOSS in government, in spite of not having much authority or access to funds. The reality though, that SITA had, by June 2008, not even implemented the FOSS policy itself, indicates that the suggested 'champion' has not taken on this planned role.

Furthermore, the FOSS policy inherently assumes that by setting up this support function and by the mere expectation that government departments would 'recognise' that OSS would be to the benefit of the South African Government's service delivery, the adoption of OSS will automatically follow. That is, the policy on FOSS use by the South African Government implicitly adopts an overly simplistic (deterministic) way in which the adoption and use of IT will occur. How to handle the different world views of the agents of change (those who came up with the policy and/or those who have to

implement the policy) and the people in the different government departments (those who are expected to adopt the policy), is not addressed (Du Plooy, 1998). An individual's world view influences the possibility of a good 'fit' between the technology and that individual. World views thus influence the process of making sense out of the new technology (in this case FOSS). Users often resist new technology and conflict develops. However, adoption and use go much more smoothly if the world view of the individual is taken into account in the design of the new system or in this case, in the adoption of FOSS.

The success of a new information system may depend more on managing relationships than on the applicability or suitability of the technology. Power bases are not mentioned in the FOSS policy. Using power bases for influencing the adoption and use of FOSS is part and parcel of the political game that is played in government departments. The power base of the potential or real user is of the utmost importance in the successful adoption of a new technology.

Issues of politics and culture within and between government departments are not mentioned and little is said about the impact of the FOSS policy on the different government departments' culture, on organisational learning, and on the change management process. The policy does not address or consider the duality of technology (in this case the interaction between FOSS and the different government departments within which it is to be implemented). What is found to be missing is an analysis of the process by which the movement to FOSS will occur - the process by which the different disparate technological frames of the individuals and groups in government departments, who need to support this policy, are aligned, and how support is to be given to executors of the policy, who tries to implement new FOSS systems or to migrate current software to FOSS.

It is interesting to note that the 'loop holes' in the FOSS policy (as discussed in section 3) could be perceived as contributing favourably to the adoption and diffusion of FOSS in terms of recognising the non-fit to the human environment in which the policy will be implemented. In this sense the policy doesn't force the implementation of FOSS unconditionally upon software users in the different government departments, but it allows for situations, where the fit seems impossible, to carry on with proprietary software as usual. On the contrary, these 'loop holes' could lead to government departments choosing to ignore the FOSS policy in its totality, by merely gathering sufficient evidence to proof their non-compliance.

An additional practical way in which the six dimension of the human environmental model could be examined further, is the application of Max Boisot's (1995) conceptual Information Space or *I-space* model. Paralleling the Human Environmental Model of Du Plooy, Boisot recognises that IS are

not simply social or technical (Boisot, 2004) and that both aspects need to be examined in terms of the individual, the organisation and the environment (which he refers to as 'external scaffolding'). According to Boisot (*op. cit.*), the diffusion of an innovation is complex and depends on the context of the situation; the agent involved; and the particular information to be diffused. Successful diffusion requires an understanding of the environment's social learning style; the institutional and cultural processes within the organisation; as well as the type of information, innovation or knowledge. Investigating these three issues further could provide an even finer grained approach in exploring the dimensions of Du Plooy's human environmental model.

5. Conclusion

An organisation rarely chooses innovation freely, but it is rather determined by "events, trends, pressures, opportunities, or restrictions in the international or national arena" (Avgerou, 2001). The situation with the South African policy on FOSS use by the South African government is not any different.

IS innovation should be studied as "a combination of technical/rational and institutional action" (Avgerou, 2001). Not only is an IS implementation an intervention which is rationally planned, but several studies have shown that there are subjective, irrational elements of actions within organisations which tend to interfere with the "rational, planned and methodical actions". These social, cultural, or cognitive forces are located within and beyond an organisational setting and in many cases drive the overall organisational performance (Avgerou, 2001).

IS studies are in essence contextual, as they address a changing entity within its environment (the information system within the organisation). This is also the case when studying the diffusion and adoption of an IS in an organisation, such as FOSS in government. The "diffusion of an innovation" is spreading the word about a new idea or innovation. The adoption or rejection of the idea or innovation would, in time, follow diffusion. Adoption is in turn followed by some kind of change in the social system in which the adoption occurred.

When studying the social context of IS diffusion and adoption, one needs to study the technological change brought about (the "content" of change), and the socio-organisational conditions under which it happens (the "context" of change). An IT innovation and its context are so entangled that it would be an oversimplification to see the technology as the content and the society as the context (Callon and Law, 1989). Such a simplification makes it difficult to understand the multifaceted processes in which technology and humans take part to form socio-technical entities, or in terms of actor-network theory vocabulary, "heterogeneous networks". When studying change in the field of

IS, one should therefore not only study the IS innovation as the content of change, but rather the change of heterogeneous networks of organisations and people within which these innovations will play a role.

FOSS has potential of closing technical gaps based on cost and technical quality, but if the philosophy behind the software is not embraced by those using it, and aligned with organisational values, this misalignment can prevent the adoption of the FOSS software packages. ICTs are not neutral tools, but have embedded philosophies in them which impact the nature, pace and direction of implementation. Some recognition of the multi-dimensional nature of FOSS needs to be reflected in government policies if they are to give due recognition of the complexity of the relationship between ICT and development.

A useful approach to the formation of ICT policy would be to develop the policy around the six dimensions of Du Plooy's human environmental model (Du Plooy, 1998) and explain the multi-faceted approach of structuration using Giddens' structuration theory (Giddens, 1984). Thus, the authors are of the opinion that understanding, and as Du Plooy (1998) puts it "cultivating", the human environment within which the IT is to be implemented, i.e., "the full social context of IT, the organizational, social, political and ethical concerns that govern and influence IT adoption and use", which in the case of the policy on FOSS use by the South African Government, relates to the social context of the individuals in the government departments, the departments themselves, the groups within the different divisions in the departments and the community the department serves, the tasks performed and the IT used to perform it, and the broader environment within which the government departments are positioned, would enable a more holistic and contextual policy for the use of FOSS to be adopted.

Although generalising from interpretive case studies is found to be a significant challenge (Walsham, 1995; Lee and Baskerville, 2003), results from a particular case study, whether in terms of methodologies adopted or theoretical insights generated, can be abstracted and applied to other settings. The making of generalisations from qualitative research is recognised as valid, though there are still limitations on the extent to which qualitative researchers do so (Jensen and Rodger, 2001; Flyvbjerg, 2006; Ruddin, 2006). Therefore, the framework proposed here is not only limited to the FOSS policy of South Africa. The Human Environmental Model is equally applicable to other IS innovations in other contexts, of which the South African policy on ICT education (Byrne and Weilbach, 2008) is another example.

6. References

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