

# CIO HERDS AND USER GANGS IN THE ADOPTION OF OPEN SOURCE SOFTWARE

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## Abstract

*Open Source Software (OSS) has received wide attention from the research community, analyzing both the innovation process of software development by distributed and unrelated teams, and the market dynamics at play between “free” and proprietary software. Up until now, OSS adoption has been irregular, although it seems to be breaking the dominance of existing players in some market segments. In this paper, we contend that due to the particularities of its development process, traditional ways of explaining IT adoption -rational decision making, technology diffusion models, and the psychology of the decision maker- are insufficient to explain the case of OSS diffusion. We believe that the existence of a strong and diffused development community leads to a new role of the user community, as both are intertwined. In addition, new concerns for social corporate responsibility and welfare create a new context, in which “user gangs” may exert some degrees of pressure on the IT decision maker. Through the analysis of some significant cases we depict under which conditions significant OSS adoption may unfold, showing that in two of the cases studied user gangs play a significant role. The resulting preliminary framework will inform future work, in which we aim at validating the emerging insights gained in this research.*

*Keywords: Open Source Software, IT adoption, user communities, CIO herding*

# 1 INTRODUCTION

The pace of change in the information technology (IT) field has been accelerating over the past two decades, with a host of promising new software platforms confronting organizations (Taudes, Feurstein and Mild, 2000). In particular Open Source Software (OSS) has irrupted in the software market and although it still has a very minor market share in desktops, where Microsoft's Windows is the absolute leader with over 90% of market share, other OSS applications like the webserver software Apache, are showing strong growth reaching market shares closer to 70%<sup>1</sup>. On the other hand, there are some segments in which no clear market leader exists, like in servers, where although OSS has shown strong growth, Microsoft dominates and even has been increasing its market share<sup>2</sup>.

These three different rates of success displacing the dominant player from its position have prompted us to study the reasons behind these discrepancies, trying to increase the general understanding of the variables that influence software adoption in markets where there is a dominant player. In particular, we believe that the case of OSS, being developed by a community of users with a sense of "democracy" and without any company dependence, has some particular characteristics that might be relevant for IT adoption, beyond those being stated in the traditional IT adoption literature. Specifically, we contend that due to the particularities of the OSS development process some relationship between the developer and the user community exists. As a consequence, user's perspective and criteria can exert some influence in the CIO's decision to choose one platform or another. In addition, the overall "mood" of the OSS movement may have a potential effect on the overall dimension of the IT adoption decision, giving rise to longer-term views other than technological. Corporate social responsibility and maintaining social welfare directly leaving rents in the hands of customers by decreasing the revenues of private companies could be some of these factors.

This paper is organized as follows: after having discussed the literature on OSS, diffusion of innovations and IT adoption, we establish a preliminary categorization of IT adoption dimensions. Next, we explain why we decided to follow a qualitative research methodology, and explain the main traits of the data that we obtained through CIO interviews. Iterating between the data and the preliminary IT adoption dimensions we construct a framework that explains how IT adoption decisions are made, showing that traditional criteria are insufficient to explain part of the OSS adoption phenomena. We introduce a new dimension, the effect of the user community. If the effect of the user community becomes strong, we show that different conditions may lead to high degrees of OSS adoption.

Our contribution to existing research is threefold: First, this work sheds some light on the underlying mechanisms that drive IT managers and CIOs in their OSS adoption decision making process. Second, some of the gained insights may serve to guide future work willing to investigate more generic determinants of IT adoption, offering some additional explanation of the criteria that drive decision makers and how industries and consumer can exert some influence on the way CIOs decide. Third, by studying the particular case of OSS adoption we offer a complementary view to existing literature that is basically devoted to the innovation process *per se*, and that pays only minor attention to the user point of view.

# 2 LITERATURE REVIEW

Three main bodies of literature have informed the research on IT adoption: (1) the mechanistic group, basically analysing rational decision making, (2) research steaming from the more generic technology adoption camps, usually based on diffusion models and that treat the decision process by the CIO as a

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<sup>1</sup> Data as of February 2005. For up-to-date figures see [http://news.netcraft.com/archives/web\\_server\\_survey.html](http://news.netcraft.com/archives/web_server_survey.html)

<sup>2</sup> See <http://www.idc.com> for server market shares and forecasts.

black box, and (3) work related to the psychology of the decision maker, usually centred in the final user and the personal factors that induce him or her to use a new system.

## 2.1 Rational Decision Making

Current literature considers that the three main underlying concepts for IT adoption in organizations are radicalness of IT innovations, the existence of knowledge barriers and the presence of network externalities. These factors refer to macro-level dimensions and in our understanding are too broad to be useful to understand the CIO decision making process. Based on the practical experiences of analysts and IT professionals stated in the general press and technical reports<sup>3</sup>, we postulate three individual-level dimensions that affect the decision process for IT adoption in companies: total cost of ownership, technological attributes, and lock-in.

*Cost:* Cost is the main factor that has been postulated by OSS followers in front of proprietary solutions. Cost advantage is a good driver to help decision makers to cope with uncertainty and to soften radicalness of OSS adoption, and cost reduction has been proposed as one of the main criteria of technology adoption (Bethuyne, 2002) in the innovation literature. Most OSS programs can be downloaded free from web sites, but license is not the only cost component in adopting software applications. An in-depth analysis of the cost dimension lead us to consider a Total Cost of Ownership (TCO) approach and conclude that for a company addressing an overall substitution of a Windows-based end-user solution, the hardware and software cost component accounted between 8 and 15 % of the TCO depending on the company IT architecture (Armellini et al., 2004). On the other hand, other factors like technical support and downtime accounted for between 60% and 65% of the total cost (Armellini et al., 2004). Also, license costs do not take into account the often very highly perceived cost of the irreversibility of the decision.

Although we will discuss them later to a larger extent, the presence of network externalities, by increasing the availability of complements and other ancillaries has a strong influence on technology costs (Shapiro and Varian, 1998).

*Technological Attributes:* We have grouped under the concept of technological attributes a set of information technology characteristics that are routinely mentioned by CIOs and by some reports as relevant in the OSS adoption process (Roger, E. 1995; Venkatesh et. al., 2003). Initially, five criteria have been identified: reliability, performance, scalability, security and brand name. All these criteria are going to be evaluated with more or less rigor by decision makers in adopting OSS platforms. Our starting position is that some of these criteria will be taken into account by CIOs in order to advance in the decision making process. Each CIO is going to prioritise each criterion and establish the necessity of each one.

Technological attributes can be seen as the set of factors that may leverage the radicalness degree of IT innovations. We propose that CIOs evaluate radicalness of OSS compared to proprietary solutions through these technological attributes. On the other hand, knowledge barriers are considered to have a strong influence on evaluating these technological attributes in the adoption of an innovation.

*Lock-in:* Switching costs (Shapiro and Varian, 1998) are present in all technology adopting decisions and organizations tend to minimize the lock-in that these costs generate. Lock-in can be due to internal decisions, or by the influence of external situations. In the first case we talk about inner lock-in. Inner lock-in is produced due to many different decisions, like long term agreements with the suppliers, and the refusal of the workforce to learn new software applications. Knowledge barriers and network externalities affect inner lock-in through CIO decisions. If knowledge barriers are low, CIOs will be able to get all the relevant knowledge in order to decide on IT adoption without acquiring a high level

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<sup>3</sup> Bozman, J., Gille, A., Kolodgy, C., Kusnetzky, D., Perry, R. and Shinag, D. (2002), Windows 2000 versus Linux in Enterprise Computing, IDC White paper 02C3512SOFTWA3512, October 2002, and Wang, H. and Wang, C., (2001). Open Source Software Adoption: A Status Report. IEEE Software, March/April 2001

of dependency due to switching costs. Outer lock-in is caused by external situations that, in most cases, organizations can not control. It happens when a supplier has the control of one market, and has the tools to manage its evolution. Most of these effects can be managed by suppliers through the creation of network externalities. Switching costs could be formally considered and accounted as an additional cost in OSS adoption, but our belief is that lock-in is treated by the decision maker from a more qualitative perspective.

## 2.2 Technology Diffusion

Rogers (1995) and Carr (1999) propose a three-pronged classification of approaches to frame this body of literature. These are (1) directional, (2) micro versus macro, and (3) technology versus adopter focused. The directional perspectives analyse diffusion either bottom up, from the grass roots to top management or top-down, where the initiative moves in that direction. The micro level literature analyses decisions at the individual level when the macro is concerned with aggregate patterns of diffusion. Technology adoption can also be viewed as a technical push (deterministic perspective) or adopters pull (process perspective).

In this context, the decision to adopt or not OSS is particularly interesting due to the fact that cost is negligible as no licence fees apply. Therefore, from a pure cost standpoint, organizations should have high interest in switching to the new technology. Also, from a technological perspective, general consensus exists about the superior technological capabilities of OSS. Therefore, from a deterministic perspective OSS adoption appears as an overall superior strategy. Therefore, to fully understand the OSS adoption problem, one has to study it from a process perspective, acknowledging that the adoption phenomenon is evolutionary, influenced by both objective factors and other more subjective factors that are not directly related to the concrete technology but to the broader organization context in which the IT adoption decision has to be made. In this way, our framework builds up on Rogers (1995) work on the diffusion of innovations:

*“Computer-related innovations create uncertainty in an organization, and uncomfortable state in a system that often leads to a resistance to the technology. This uncertainty is one reason for the special difficulties that computer technologies frequently encounter in the implementation subprocess. The more “radical” an innovation, indexed by the amount of knowledge that organization members must acquire to adopt, the more uncertainty it creates and the more difficult its implementation.” (Rogers, 1995, p.397).*

As Fichman (2003) states, the difficulties in the IT adoption decision process are a consequence of two challenges that can be typically associated with IT platform innovations: uncertainty about the benefits from use of the innovation, and irreversibility in the costs of deployment. Accordingly, the degree of radicalness has often been considered as a primary driver for uncertainty in the adoption of new IT.

*Organizational capabilities:* In this vein, organizational burdens are relevant and have to be taken into account in IT adoption decisions. First, knowledge barriers may restrict innovative IT adoption, as complex organizational technologies impose a learning burden on adopters (Fichman and Kemerer, 1997). This is especially the case if the knowledge involved used in the technical problem solving is “sticky” (von Hippel, 1994), and magnifies the sense of irreversibility of IT platform investments (Kogut and Kulatilaka, 2001). With a somewhat complementary view, some authors (Moore and Benbasat, 1991; Venkatesh et al. 2003) propose the “risk avoidance” mechanism as a driving force to adopt software; risk avoidance puts technological capacities ahead of other dimensions, so that a particular system will not even be considered if it does to have a minimal set of functionalities. Other ways of dealing with risk reduction are allocation of IT budgets that allow for experimentation or IT staff time (Dedrick and West, 2003), or the existence of a general culture of innovation.

*Network externalities.* The presence of network externalities also affects the degree of IT adoption in an organization, as the value of using an IT platform grows in proportion to the size of the adopter network (Brynjolfsson and Kemerer, 1997). This phenomenon, which implies increasing returns to

scale has two distinctive characteristics, as (a) the ultimate benefits of IT adoption will be determined not by the technology as it is in the present, but rather by the expectation of the decision maker on how the technology will become in the future; and (b) increasing returns lead to a distinctive pattern of technology diffusion known as market tipping with “winner takes all” outcomes (Shapiro and Varian, 1998). These two characteristics affect the adoption process of a particular technology in an organization, as managers may be tempted to commit to a major initial rollout of a particular technology within a firm to quickly reach a critical mass of adoption, or they may wish to wait in order to minimize the risk of ending up with a “stranded” technology that imposes a permanent burden to the organization (Markus 1987; Cool, Diericks and Szulanski, 1997). These issues are particularly relevant when we see decisions like Linux adoption as a platform adoption case. There has been a number of papers investigating the adoption of platforms, like MRP (Cooper and Zmud, 1990), EDI (Iacovou et al., 1995) or e-commerce (Zhu et al., 2002), and all of them relate the particular cases to the presence, real or perceived, of network externalities.

### 2.3 Psychology of the Decision Maker

A third stream of research that has informed our work analyses the effect of information cascades and herding behaviour in the adoption of IT systems (Li, 2004; Kauffman and Li, 2003; Tingling and Parent, 2002). Although the concept of herding has just recently been a subject of interest in the IT adoption literature it has been studied in other areas of management for a much longer time (Graham, 1999).

*Informational cascading.* Basically, it explains the behaviour of decision makers when they are subject to bounded rationality and observe the decisions made by their peers without full knowledge of the reasons why these observed decisions were made. Some researchers have analysed decisions through the prisms of agency theory (Laffont and Martimort, 2003), where CIOs do not decide in the overall best interest of the organization but according a different set of individual objectives. Moreover, the resource-based theory of the firm (Grant, 1991, Wade and Hulland, 2004) establishes how resource performance can drive competitive advantages and how competitors amass resources and capabilities to imitate the strategy of other firms in the same strategic group. Based on this theory, CIOs could follow the decision of a successful rival when they are bounded in their decision making process. In these two strands of research, literature points to the fact that CIOs, when facing complex decisions with incomplete information, tend to rationally “run with the pack”.

*Concerns about the reputation of the IT manager.* Of particular interest in platform adoption is what Kauffman and Li (2003) coin as “reputational herding”, where CIOs do not want to be associated with having chosen the “loosing platform” and they will go with the majority regardless of evidence that a non conventional decision could be to the best interest of the company.

Body of Literature	Relevant Dimensions
<i>Rational decision making</i>	Cost (hardware, software, reliability, industry maturity, etc)
	Technological attributes (fit to task, difficulty in administration, ease of experimentation, platform long term availability)
	Lock-in (portability, brand image, etc)
<i>Technology diffusion</i>	Organizational capabilities (budget size, time availability for experimentation, innovative culture)
	Network externalities (availability of complements, skills of existing IT workers)
<i>Psychology of the decision maker</i>	Informational cascading (observation of decisions of peer groups, information overload, existence of conflicting data)
	Reputation concerns of the IT manager (career, incentive incompatibility, agency problems)

Table 1: Main IT adoption decision dimensions in the literature

Summarizing, different literatures have contributed to a fuller understanding of the main dimensions that drive the CIO's IT adoption decision making process, as shown in Table 1. Nevertheless, in general, most adoption decisions are basically driven by the existence of some sort of herding behaviour, which may be perfectly rational when informed by cost, lock-in, network externality or technological capability criteria, or responding to more subjective or deliberate criteria, as in the cases of informational cascading or reputational concerns.

### 3 RESEARCH METHODOLOGY

Since one of the motivations for starting this research was our suspicion that the decision to adopt an OSS platform could be influenced by two factors not considered in the literature, the user driven pressures due to the community effect of the developer community, and broader considerations of social responsibility, we needed to gather a deeper understanding of the overall decision making process of the CIO. Therefore, we decided to adopt a pluralistic research methodology (Mingers, 2001). In a first step, we use qualitative methods, carrying out in-depth interviews with 11 CIOs of national and multinational companies that have been purposefully chosen. In a second step beyond the research described in the paper, we will test the insights gained by carrying out a survey, as suggested by Markus (1994), Ngwenyama and Lee (1997) and Carlson and Davis (1998). This overall research strategy will allow enhancing the generalizability of our results (Lee and Baskerville, 2003).

In this paper, we inform about the results of the first step of the overall research strategy: the determination of the underlying dimensions of CIO decision making. We approach this problem via a series of semi-structured in-depth and open-ended interviews (Orlikowski and Baroudi, 1991). For each interview, we prepared and consensuated a guide based on a previous analysis (Miles and Huberman, 1984; Walsham 1995) of the IT and innovation adoption literature. We performed the 11 interviews to CIOs and in some cases we had follow-up meetings to clarify some unclear issues. These 11 CIOs encompass a full range of companies, from multinational and publicly traded companies to universities, and a public organization created to run a single event that takes place this year. See Table 2 for an overview of the companies; identities have been disguised for confidentiality reasons.

Company	Company Acronym	Industry	Revenues (M€year)	IS strategy and philosophy
Pharmaceutical	EST	Pharma	475	Support for strategy: Sales Force automation, CRM
Public Organization	FOR	Culture	325 (three years)	Support for operations: ERP, and visitors control.
National Subsidiary Pharma Company	NOV	Pharma	500	Support for strategy: Sales Force automation, research.
Savings Bank	ESP	Banking	12,414(in deposits)	Support for strategy: New Sales channel.
Telecommunications	RET	Telco	1,028	Business growth through IS: Internet Data Center
University	UVW	University	68	Support for operations: e-learning and teaching support.
Telecommunications	JAZ	Telco	129	Business growth through IS: Internet Data Center
Purchasing Group	EUR	Retail	6	Support for operations: ERP, extranet.
Cosmetics	COL	Beauty Care	N/A	Support for operations: Infrastructure to run a newly deployed ERP
Telecommunications	TEL	Telco	10,217	Support for strategy and business growth: ERP, CRM, Business Intelligence
Steel Mill	CSA	Steel	2,100	Support for operations: ERP and CRM

Table 2: General information of companies and their overall IT strategy

All interviews were transcribed and then analysed by each of the three researchers. The results were then compared, and after a constant iteration between the data, the emerging insights of the researchers, and existing literature we finally agreed on an emerging framework, which we inform in the next section.

## 4 RESULTS

All companies are major players in their industry and region of operations. As a first indication of their position in relation to Open Source, Table 3 presents what could be considered their in-use platform strategies: all companies use Microsoft's Windows on the desktops, and only two of them have some OSS server systems.

Their infrastructure policies are divergent: while two companies consider that they are not bound to switching costs if they choose to adopt OSS as they are thinking of completely new deployments, all others either have large proprietary systems installed or they have a platform infrastructure that prevents them from easily moving to other architectures.

All companies except two consider the need to reduce their technological risk as the main criteria for software selection and adoption. None of the CIOs considers that a significant branding effect exists in vendor selection decisions.

Company	EST	FOR	NOV	ESP	RET	UVW	JAZ	EUR	CSA	TEL	COL
End-User platform	MsW	MsW	MsW	MsW	MsW	MsW	MsW	MsW	MsW	MsW	MsW
Server platform	IBM	Linux MsW	MsW	UNIX	UNIX	Linux MsW	UNIX	IBM	IBM	IBM- UNIX	IBM
Infrastructure	P	NSwC	PC	ITA	ITA	ITA	NSwC	P	P	ITA	P
Technological risk reduction	1	1	1	1	2	1	1	1	1	2	2
Cost	2	3	2	2	1	2	2	3	2	1	3
Other techno. aspects	3	2	3	3	3	3	3	2	3	3	2
Supplier brand name	No	No	No	No	No	No	No	No	No	No	No
% of budget in OSS systems	1,50%	60%	0%	1%(*)	1%	35%	5%	0%	0%	1%	0%
End-user interest	No	Yes	No	No	No	Yes	No	No	No	No	No

(\*) but supports 25% of all business transactions

*Table 3. IT infrastructure and espoused IT adoption decision making<sup>4</sup>*

In OSS adoption decision making, CIOs consider that they face a situation with some specific peculiarities: First, they do not consider that OSS is a “new technology” in itself. Most CIOs have some experience with UNIX, in form of proprietary solutions of IBM, HP or SUN. Second, they do not consider that OSS offers technologically superior features. Third, although cost has been claimed as a breakthrough advantage of OSS in front of proprietary systems, this does not seem evident to decision makers in practice. Although, license cost and hardware cost are lower for OSS platforms

<sup>4</sup> Legend: MsW: Microsoft Windows, P: Proprietary server platform. PC: obliged to choose from a product catalogue. ITA: IT Architecture guidelines present. NSwC: No switching costs present due to new deployments. 1,2,3: order of importance of the dimension on the decision to adopt OSS.

than for proprietary platforms, they consider that there are many other cost dimensions that are very difficult to identify and measure, but that have to be taken into account.

Hence, a situation emerges in which OSS adoption decision making consists of a two step process. First, CIOs must decide on IT adoption as a new platform for company systems. Once a platform decision has been made, a second step consists in finding concrete OSS applications that show some sort of superior advantage. From the interviews, we deduced that this process is intertwined, although each process is driven by some very specific decision making attributes. As we were not able to clearly identify them by just reading the interviews, we adopted a slightly different approach for the next iteration on the data.

As we needed to clarify both levels of decision making, we decided to introduce an intermediate step that allowed us to map the final output (OSS effectively adopted) in two dimensions, so that we could map each company on a 2x2 matrix. The two dimensions are (a) Openness to deploy OSS, and (b) level of OSS usage. Companies and CIOs may be open to adopt OSS if the opportunity arises independently of whether they have had a chance to do so, and in the other hand they may be in principle reluctant to OSS but if when facing a problem a vendor provides guarantee and support and the solution is cost effective, they may adopt OSS. The results of placing the interviewed companies in this matrix are shown in figure 1.

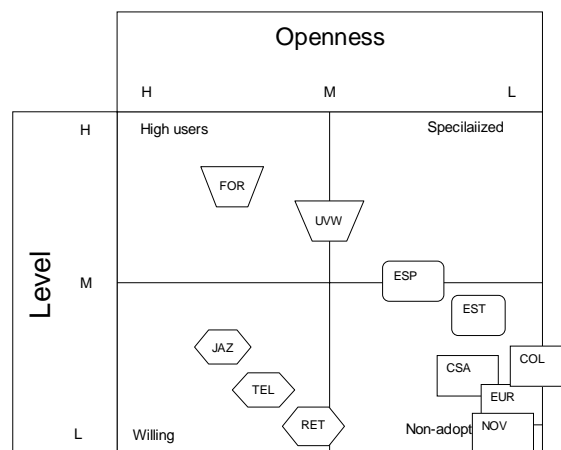


Figure 1: Level of usage and perceived openness towards OSS of each of the companies.

As a result of the mapping process, we found that the companies could be grouped in four groups:

- *Non-adopters*: These companies affirmed their lack of interest in adopting OSS and do not have any meaningful installation.
- *Specialized*: Two companies have adopted OSS for specialized systems (web server and business-to-consumer system) and have not plan to use OSS in other systems. They are not really open to OSS but superior technology has induced them to adoption.
- *Willing*: Companies in this group are open to use OSS when it becomes a suitable choice for a specific system. All of them were open-minded in using OSS and they were actively seeking opportunities to study the feasibility of OSS choices. The level of use of OSS in each company depended on the projects available. None of the companies was planning a full migration of their systems to OSS.

- *High Users*: Two companies are using OSS widely as a platform for their systems. FOR is using OSS for their ERP and UVW is using it for their Intranet and for their e-learning system.

In a next step, we went then back to the interview transcripts, in order to analyse them in terms of the IT adoption criteria that we found in the literature. We found that these criteria could satisfactorily explain the behaviour of three of the four groups, but it could not fully explain the case of high users. In these two companies, we found that both CIOs gave significant importance to user community power. We summarize these findings in table 4.

	Non-adopters	Specialized	Willing	High Users
TCO			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Lock-In	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Network Externalities		<input checked="" type="checkbox"/>		
Technological capabilities			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Organizational capabilities		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Informational cascading	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Reputation of IT Managers	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
User community effects				<input checked="" type="checkbox"/>

Table 4: IT adoption dimensions in terms of resulting groups.

In the case of high usage, the two companies were driven by significantly different motivations. In the case of FOR (company created to organize and run a four month long cultural event), the CIO had to follow a general company consensus, driven in part by the political owners, that the implementation of an OSS initiative was close to the overall company ideology and that it would give the right signal about the organization’s intentions to the environment. In the case of the university UVW, faculty was a driving force. They are considered to be heavy users and their interest in the OSS movement for both research and teaching purposes was one part of the final generalized OSS adoption decision. In addition, some sort of “ganging” took place at the user level as other universities in the same region were also deploying OSS.

Regarding the other three groups, besides the relationships already depicted in table 4, the analysis of the interviews also showed to some extent the interplay of the different dimensions within each group:

- TCO influences *Willing* and *High User* groups. JAZ told us that they are committed to adopt OSS in all opportunities they have, but only when ROI analysis is adequate. TEL and RET express their commitment to OSS adoption based on TCO study. In our research we didn’t captured any case of *High User* adopter with a positive or negative effect of TCO. One company of the *Willing* group have refused to adopt OSS because a software vendor gave them a 90% rebate in the license costs. With that cost the CIO couldn’t defend the adoption of OSS. Cases like Google and Amazon have to be considered in the group of *High Users* with a strong influence of costs in their adoption process and are consistent with our findings.
- Lock-In has been voiced as one of the most important negative factor for adopting OSS by *non-adopters*. Most of them are using proprietary platforms or have been engaged with a supplier for a long time and they are not ready to open a new line of platforms. Companies in the *Specialized* group mentioned lock-in as one of the difficulties in expanding their OSS usage. Old and proprietary systems, IT staff training, and so on introduce many additional costs for companies in that group.
- Network externalities earned in adopting standards platforms have been mentioned by all the companies in the *Specialized* group. In some cases, OSS adoption was the first step to open their platform and to be freed of a proprietary environment.
- Technological capabilities are the main reason for Companies in *Willing* and *High users* group to expand their OSS usage.

- Organizational capabilities negatively influence adoption of OSS in companies from the *Specialized* group. These companies encounter a lot of organizational constraints in order to widen OSS usage. On the contrary, companies that have decided to promote OSS in their platform adoption decisions use most of the organizational capabilities to increase OSS adoption. They share a culture of innovation and have time and budget available to experiment.
- Reputation of IT managers in front of making decisions that changes the current infrastructure of the company is the main concern for *non-adopter* CIOs. They are not ready to assume the cost of a failing adoption.
- Finally, user community effects, as it has been mentioned before, were the main dimension in adopting OSS in the two companies of the *High user* group, superseding any TCO or technological fit analysis.

## 5 CONTRIBUTIONS, LIMITATIONS, AND FURTHER RESEARCH

The results reported in this research have allowed us to gain a deeper understanding of the CIO decision making process of IT adoption. Although we studied one particular case, OSS adoption, we found some interesting new insights that, albeit supporting most reported evidence of existing literature, will require some careful reconsideration. First, although in the interviews CIOs explicitly tend to state one set of reasons to make a decision, we found that they seem to implicitly operate by another. Two CIOs stated cost as the main driving factor for software adoption, although they did not adopt Linux after considering it because one had architectural constraints, and the other did not believe the system could sustain the expected growth the company had. Another CIO, after stating that his company decided based solely on cost, explained that he would install a Linux server only if IBM guaranteed its reliability and provided support. Actually, this phenomenon is not new and has been widely studied in the organizational learning field, which differentiated between an individual's "espoused theories" versus the "theories-in-use" (Argyris and Schön 1978). We addressed and solved this problem by classifying the companies according to the observed output, and then going back to the interviews to understand their underlying reasoning process. This has been one main contribution of this research.

Second, this research informs about a new dimension in IT adoption decision making: user community effects. Different factors can drive this dimension, such as pressure from programming community, social corporate responsibility, non for profit organization or culture and social welfare criteria. In some sense, user gangs are influencing CIOs decisions to adopt OSS at the platform level.

Third, this research adds evidence to already existing research on OSS adoption, as we found significant support for most of the current explanations, although we also found that they seem to be of varying significance depending on the concrete context and state of level of adoption of each company. In this sense, we support Dedrick and West's (2003) results of technological, organizational and environmental driven OSS adoption.

Nevertheless, as most qualitative research, the generalizability of our results is very limited. This is why we are already starting with the second step of our overall research strategy, conducting a survey, so that we can confirm not only the existence of these dimensions on a broader basis, but also get more insight about the relationships that underlie the decision making processes of CIOs.

## REFERENCES

- Argyris, C. and D.A. Schön (1978). *Organizational Learning: A Theory of Action Perspective*. Reading, MA, Addison-Wesley.
- Armellini, G., F. Miralles and J. Valor (2004). *Criterios de Evaluación para la Toma de Decisiones en la Adopción de Tecnologías: El Caso del Software de Código Abierto*, IESE Case SIN-0049.

- Bethuyne, G. (2002). The timing of technology adoption by a cost-minimizing firm. *Journal of Economics*, 76 (2), 123-154.
- Bonaccorsi, A. and C. Rossi (2003). Why open source software can succeed. *Research Policy*, 32 (7), 1243-1258.
- Brynjolfsson, E. and C. F. Kemerer (1997). Network externalities in microcomputer software: An econometric analysis of the spreadsheet market. *Management Science*, 42 (12), 1627-1647.
- Carlson, P. and G. Davis (1998). An investigation of media selection among directors and managers: From "self" to "other" orientation. *MIS Quarterly*, 22 (3), 335-362.
- Carr Jr, V.H. (1999). Technology adoption and diffusion. <http://www.au.af.mil/au/awc/awcgate/innovation/adoptiondiffusion.htm>
- Ciborra, C. and R. Andreu (2001). Sharing knowledge across boundaries. *Journal of Information Technology*, 16 (2), 73-81.
- Comino, S. and F. Manenti (2003). Open source vs closed source software: Public policies in the software market. <http://opensource.mit.edu/papers/cominomanenti.pdf>.
- Cool, K.O. Diericks, I. and G. Szulanski (1997). Diffusion on innovations within organizations: Electronic switching in the Bell System, 1971-1982. *Organization Science*, 8 (5), 543-559.
- Cooper, R.B. and R.W. Zmud (1990). Information Technology Implementation Research: A Technological Diffusion Approach. *Management Science* 36 (2), 123-139.
- Dedrick, J. and J. West (2003) Why Firms Adopt Open Source Platforms: A Grounded Theory of Innovation and Standards Adoption, in *Proceedings of the Workshop on Standard Making: A Critical Research Frontier for Information Systems*, John L. King and Kalle Lyytinen, (eds.), Seattle, WA, December 12-14, 2003, pp. 236-257, <http://www.si.umich.edu/misq-stds/proceedings>.
- Franke, N. and E. von Hippel (2003). Satisfying Heterogeneous User Needs via Innovation Toolkits: The Case of Apache Security Software. *Research Policy*, 32.
- Fichman, R.G. (2003). Real options and IT platform adoption: Implications for theory and practice. Under review at *Information Systems Research*.
- Fichman, R.G. and C.F. Kemerer (1997). The assimilation of software process innovations: An organizational learning perspective. *Management Science*, 43 (10), 1345-1363.
- Garud, R. and A.H. Van de Ven (1992). An empirical evaluation of the internal corporate venturing process. *Strategic Management Journal*, 13 (5), 93-110.
- Graham, J. (1999), Herding Among Investment Newsletters: Theory and Evidence, *Journal of Finance*, 54, 1, 237-269.
- Grant, R.M. (1991), The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation, *California Management Review* 33 (1), 114-135.
- Iacovou, C.L., Benbasat, I. and A.S. Dexter (1995). "Electronic data Interchange and Small Organizations. Adoption and Impact of Technology" *MIS Quarterly*, 19 (4), 465-485
- Katz, M.L. and C. Shapiro (1986) "Technology Adoption in the Presence of Network Externalities" *The Journal of Political Economy*, Vol. 94 (4) 822-841.
- Kauffman, R.J., and X. Li (2003). Payoff Externalities, Informational Cascades and Managerial Incentives: A Theoretical Framework for IT Adoption Herding. Published in: A. Bharadwaj, S. Narisimhan and R. Santhanam (Eds.), *Proceedings of the 2003 INFORMS Conference on IS and Technology*, Atlanta, GA, October 2003.
- Kogut, B. and N. Kulatilaka (2001). Capabilities as real options. *Organization Science*, 12 (6), 744-758.
- Laffont, J. and D. Martimort (2002) *The Theory of Incentives: The Principal-Agent Model*, Princeton University Press, Princeton, N.J.
- Langley, A. (1999). Strategies for theorizing from process data. *Academy of Management Review*, 24 (4), 691-710.
- Lee, A.S. and R.L. Baskerville (2003). Generalizing generalizability in information systems research. *Information Systems Research*, 14 (3), 221-243.
- Li, X. (2004). Informational Cascades in IT Adoption. *Communications of the ACM*, Vol.47 (4), 93-97.

- Markus, M.L. (1994). Electronic mail as a medium of managerial choice. *Organization Science*, 5 (4), 502-527.
- Markus, M.L. (1987). Toward a 'critical mass' theory of interactive media: Universal access, interdependence and diffusion. *Communication Research*, 14 (5), 487-505.
- Markus, M.L. Manville, B. and C.E. Agres (2000). What makes a virtual organization work? *Sloan Management Review*, 42 (3), 13-26.
- Markus, M.L. and D. Robey (1988). Information technology and organizational change: Causal structure in theory and research. *Management Science*, 34 (5), 583-598.
- Miles, M.B. and A.M. Huberman (1984). *Qualitative Data Analysis: A Sourcebook of New Methods*. Newbury Park, CA, Sage Publications.
- Mingers, J. (2001). Combining IS research methods: towards a pluralist methodology. *Information Systems Research*, 12 (3), 240-259.
- Moore, G.A. (2002). *Crossing the Chasm: Marketing and Selling High-tech Products to Mainstream Customers*. New York, HarperBusiness Essentials.
- Moore, G. and I. Benbasat (1991). Development of an instrument to measure the perceptions of adopting and information technology innovation. *Information Systems Research*, 2 (3), 192-212.
- Ngwenyama, O. and A. Lee (1997). Communication richness in electronic mail: Critical social theory and the contextuality of meaning. *MIS Quarterly*, 21 (2), 109-131.
- Orlikowski, W.J. (1992). The duality of technology: Rethinking the concept of technology in organizations. *Organization Science*, 3 (3), 398-427.
- Orlikowski, W. and J. Baroudi (1991). Studying information technology in organizations: Research approaches and assumptions. *Information Systems Research*, 2 (1), 1-29.
- Raymond, E.S. (1999). *The Cathedral and the Bazaar*. Sebastopol, CA, O'Reilly and Associates..
- Rogers E. (1995). *Diffusion of Innovations*. 4th Edition. New York, Free Press.
- Shapiro, C. and H.R. Varian (1998). *Information Rules: A Strategic Guide to the Network Economy*. Boston, MA, Harvard Business School Press.
- Taudes, A. Feurstein, M., and A. Mild (2000). Options analysis and software platform decisions: A case study. *MIS Quarterly*, 24 (2), 227-244.
- Tingling, P and M. Parent (2002) Mimetic Isomorphism and Technology Evaluation: Does Imitation Transcend Judgement?. *Journal of the Association of Information System* 3, 113-143
- Venkatesh, V., Morris, M.G., Davis, G.B. and F.D. Davis (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27 (3), 425-478.
- Von Hippel, E. and G. von Krogh (2003). Open source software and the 'private-collective' innovation model: Issues for organization science. *Organization Science*, 14 (2), 209-223.
- Von Hippel, E. (1994). 'Sticky information' and the locus of problem solving: Implications for innovation. *Management Science*, 40 (4), 429-439.
- Wade, M. and J. Hulland (2004). The Resource-Based View and Information Systems Research: Review, Extension, and Suggestions for Future Research, *MIS Quarterly*, 28 (1), 107-142
- Walsham, G. (1995). The emergence of interpretivism in IS research. *Information Systems Research*, 6 (4), 376-394.
- Zhu, K., Kraemer, K.L. and S. Xu (2002) A Cross-Country Study of Electronic Business Adoption Using the Technology-Organization-Environment Framework. *Proceedings of the 23rd International Conference on Information Systems*, Barcelona.