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Developing "FLOSS", a market driven investment.

First evidence from a francophone companies survey.

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ABSTRACT.

Over the last few years, FLOSS ("Free Libre Open Source Software") has become a commercially viable reality of the first order, with an increasing number of companies getting involved in the communities developing it (Lakhani & Wolf 2005). In this article, we try to explicit the link between market offer and involvement into communities.

To do so, we surveyed francophone companies (France, Belgium, Switzerland) affirming a utilization of FLOSS in their commercial activity. Based on roughly 500 companies concerned, we obtained 141 usable responses and we statistically verified the link between FLOSS commercial strategies and degree of involvement into communities. We propose a typology of commercial strategies explaining the differences in involvement and we validate this typology thanks to a ascendant hierarchical classification (AHC) on them.

KEY WORDS: STUDENTS, USES OF THE INTERNET, QUANTITATIVE STUDIES, INTERNATIONAL COMPARISON.

1 INTRODUCTION.

For a number of years now "free source software" has been making itself felt in the business environment and numerous scientific studies have focussed on the phenomenon, among which those published in "Terminal" in 1999[1] were forerunners. Nine years on, whilst much remains to be done in order to fully understand the development communities, some of the questions raised have found at least partial answers, in particular those referring to the individual developer's incentives. To be precise, until recently FLOSS was solely the affair of computer analysts, who co-developed their tools and had a stake in working together because their skills were complementary (Lakhani & von Hippel, 2002); at that time the 'customers', as it were, of the FLOSS companies tended to be IT departments of major groups. (Jullien, 2003).

Today FLOSS has apparently become an economic issue of considerable importance, in particular as far as Europe is concerned, as the latest report (end 2006) published by the European Commission on the matter shows[2]. Therein, we read: "Whilst concentrating on an ambitious programme of FLOSS production in the embedded systems and domestic networks, Europe can reach several goals: allow free access to a key resource, stimulate competition, promote the achievement of the Lisbon targets, and lastly restore European competitiveness within the ICT" (Dang Nguyen & Genthon, 2006).

Whilst there is still a question of a non-commercial organisation of production, their products are arousing interest within the world of commerce, from IBM's[3] announcement in 2001 an investment of over 1 billion dollars in Linux, to Microsoft's[4] "share source initiative", which takes up the concept of sharing source codes with users, up to and including even distributing a part of its software under an "open source"[5] licence. This is no longer merely an issue for computer analysts or key account markets; the companies proposing "free" solutions are increasingly turning towards small and medium-sized businesses, as noted in the "Journal du Net" of September 2005[6]. Lakhani & Wolf (2005) reveal that amongst the FLOSS developers responding to their survey, "a majority of [their] respondents are skilled and experienced professionals working in IT-related jobs, with approximately 40% being paid to participate in the FLOSS project." Finally, in the interest of the business world for the open source model goes beyond the framework of IT to enter the realm of telecommunications as well[7].

More recently Henkel (2006), while studying the "embedded" Linux system, has shown that business involvement pursued several strategies and that they did not reveal all the codes they produced but rather carefully selected their contributions. Dahlander & Wallin (2006) who, on the other hand, were interested in the "GNOME" graphic interface project, have demonstrated that companies were motivated by strategic aims, follow-up, monitoring development communities; these objectives be-

[1] "Logiciels Libres : de l'utopie au marché", Terminal, numéro spécial N°s80-81, Automne-Hiver 1999.

[2] " « FLOSS is good for the European economy, employment and firms competitiveness... » http://ec.europa.eu/enterprise/ict/policy/doc/2006-11-20-flossimpact.pdf.

[3] The IBM page retracing the "Linux saga": http://www-5.ibm.com/e-business/ch/fr/linux/growing.html

[4] http://www.microsoft.com/resources/sharedsource/default.mspx

[5] http://solutions.journaldunet.com/0404/040407_microsoft.shtml

[6] http://solutions.journaldunet.com/dossiers/libre/sommaire.shtml

[7] Regarding voice on the PI, FLOSS Asterisk, http://www.asterisk.org/, is one of the most popular choices. Motorola has selected Linux as one of three operating systems for its mobile terminals.

ing brought to light by the category of developer involved in the communities which was hiring them.

In Jullien & Zimmermann (2006) we postulated that this involvement may be explained the companies' strategic positioning on their markets combined with each market's respective characteristics.

What we are attempting here is to test this hypothesis starting from a survey carried out among Francophone companies (French, Belgian, and Swiss) who professed to use FLOSS in their commercial operations. Based on a potential of approximately 500 businesses we obtained 141 usable responses.

The article is structured as follows: in section 2 we present our sample an show that there are links between the investments into FLOSS developments and the market positioning. In section 3, we propose a framework to explain the connection between the market positioning and the way companies involve themselves in development community. Section 4 proposes a statistical validation of the analysis carried out in Section 3 using the data presented in section 2.

2 THE SURVEY.

2.1 Scope of the Study.

The main challenge when studying those companies developing commercial activity around FLOSS is to identify them. Regarding development communities, as much as one may be interested in the projects distribution lists and sometimes in those who contribute to the code evolution (via, e.g. "CVS", a system managing successive versions of source code), even in such a case it is sometimes nevertheless difficult to know if the participants are operating in the name of one company. When one is interested in businesses, there is no professional directory of FLOSS companies, and national surveys (such as those of the INSEE – "National Institute for Statistics and Economic Studies") do not take FLOSS issues into account (for example: "Do you sell software, or services based on FLOSS?"), which would enable a quantification of the phenomenon, in particular in activities peripheral to IT (telecommunications, automation technology, etc.). Hence a survey must be carried out which cannot vouch for the representativity of the sample, since neither the extent of the phenomenon, nor the socio-economic attributes (size, seniority, etc.) are known.

A second difficulty is to define what is understood by "a commercial activity using FLOSS", especially in the services sector. This can extend from the training (for example, on "Open Office") to the creation of servers (with Linux or Open Office), but equally to the business management (using FLOSS), or to mail-order selling (based on a site using FLOSS). This is what Gadray (1998) described as services "linked to IT" (accounting, mail-order, etc.) which existed prior to IT and have since been computerised.

Faced with these challenges and with an absence of data, we chose to carry out our own survey as we had done in 2002 (cf. Jullien 2003) with ICT sector companies (hence, for example, no automation technology)[8] proposing provision of services and equipment based on FLOSS. So, our defini-

[8] Thiscorresponds to the following codes APE: 72.1Z - consultancy in computer systems, 72.2A - Issue of software (not user-defined), 72.2C - Other activities of realization of software, 72.3Z - Treatment of data, 72.4Z - Data bank activities , 72.5Z-74.2C - Engineering, technical studies, 51.8G - Wholesale business and computers, peripheral IT equipment and software packages, 80.4C - Adult and further education, 30.0C - 71.3rd, Manufacture of computers and other equipment - Rent of office automation and computer , 32.2B Manufacturing of radio and telecommunications equipment

tion of “a commercial activity using FLOSS” is the one proposed by Bonaccorsi, Rossi and Giannangeli (2006) who define “as those firms that supply, in various ways, OS-based products and services to their customers…even if its offering includes proprietary solutions.” To locate them, over and above those companies who had already replied in 2002, we searched through the directories of professional or related organisations (AFUL, APRIL[9], and MEITO[10]), participants in trade fairs such as “Solution Linux” and we publicised this survey via the FLOSS information channels (in particular Linux). Around 500 businesses were contacted directly.

2.2 Data.

Between March and July 2007 we put a questionnaire online. The questionnaire was destined for companies (and not developers), since we were interested in company market positioning and global strategy[11].

We decided to retain only one response, even from major companies, and if possible that of the most senior position in the company hierarchy. As the questionnaire was in French, we were confined to the Francophone market and we kept only responses from the French and neighbouring countries (African or Canadian markets being scarcely represented). We procured 141 valid responses (i.e. after checking that the respondent belongs to the company s/he responds for[12])[13].

2.2.1 Sample characteristics.

The responses came primarily from senior management (over 63%) or from technical management (over 11%), most frequently from directors (over 14%) or corporate executives (59%).

volvement. *Date of company creation*

[9] AFUL: Association Francophone des Utilisateurs de Linux et des Logiciels Libres (French speaking Linux and Libre Software Users' Association), http://www.aful.org, APRIL: association pour la promotion et la recherche en informatique libre (association for the promotion and the research in Free computing), http://www.april.org.

[10] MEITO: mission pour l'électronique, l'informatique et les telecommunications dans l'ouest. The Breton association of firms working in the ICT field. Http://www.meito.com

[11] The survey: http://marsouin.infini.fr/entreprisesetlibre/questionnaire.php

[12] To do so, we asked for an email and checked it.

[13] As discussed before, it is impossible to know if the responses are representative of the FLOSS companies, as we were not able to estimate the size of different populations of firms or of the different strategies. So we are not sure to have all the existing strategies, nor that the proportions of respondents belonging to each one are the same in the sample than in the whole population. The data are interesting to test correlation between variables and are used to do so here, but not to have an exact picture of the weight of the different business models within the population.

figure 1. Breakdown of the respondents by number of employees.

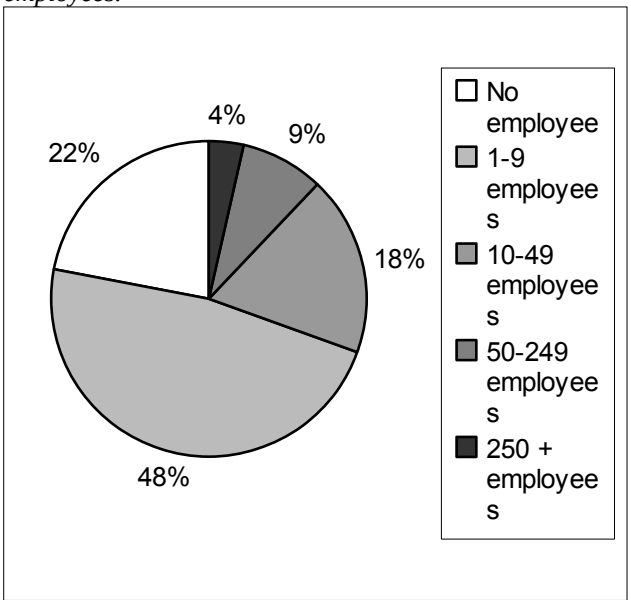
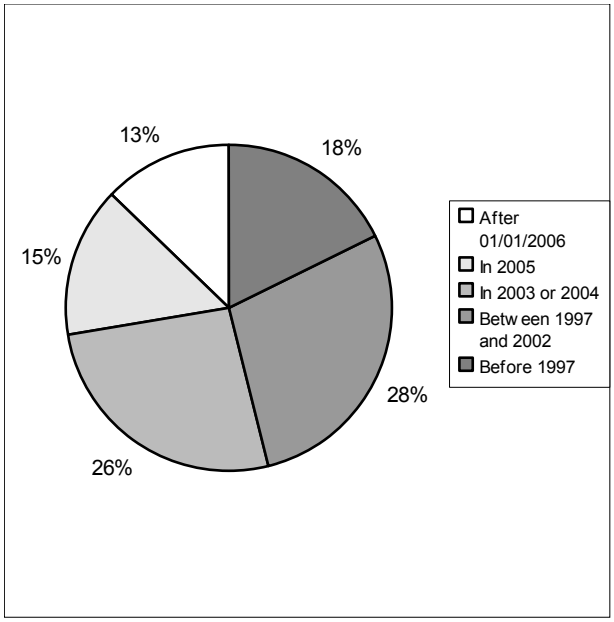


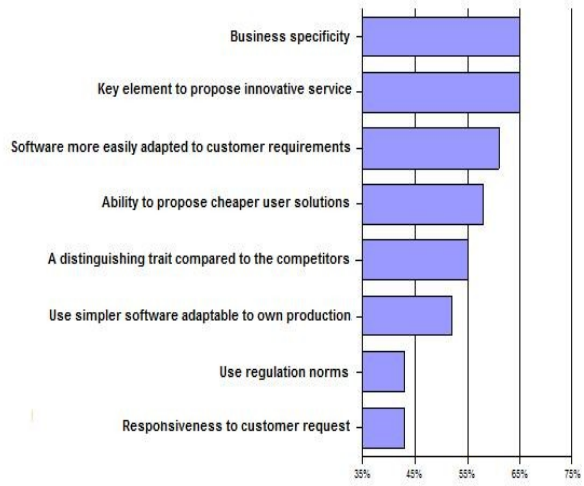
figure 2. Date of company creation.



That is due to the size of the companies, since under a quarter have more than 50 employees (figure 1); executive staff are few in number, it is easier to contact the directors, corporate executives or CEO's directly, who often play a commercial role and thus whose emails are accessible online.

We believe that this, too, is due to the fact that the companies responding were newcomers, created at the same time as FLOSS (three-quarters of them are less than five years old – see figure 2), they are relatively involved in the associations, the professional directories; and often the directors initiated this involvement.

figure 3. Reasons to use FLOSS in the commercial offer.



2.2.2 The link to FLOSS.

FLOSS is used more as an element strong in differentiation, than for technical reasons, or, for that matter, for replying to specific demands.

Hence technical quality is by far the key attribute of the company brand, taking fully 55% of responses to the question “Concerning the offer of goods and/or services of your company, which are the key elements of your brand?”, against 25% for personalisation or variety, and lastly 8, 7 and 6% respectively for reactivity, competitive pricing and novelty.

These enterprises are also very involved in FLOSS development. If at least 60% issue software, over 40% do that under GPL or BSD FLOSS licence. Furthermore, over and above the software they issue, 52% participate (financially, via the involvement of their developers) in FLOSS projects. Here we are referring to involvement decided by the company and not individual company developer involvement.

For companies stemming from FLOSS, however, the strategic interest of development communities is not distinctly apparent. To explain the reasons for the contribution, the companies answered (figure 9) that “It is community practice”, since it was “an obligation if you run a community”, a rather moralistic standpoint. The economic arguments proposed in the relevant brochures to elucidate such a contribution, such as accepting proposals, training developers, becoming well-known, etc., are secondary.

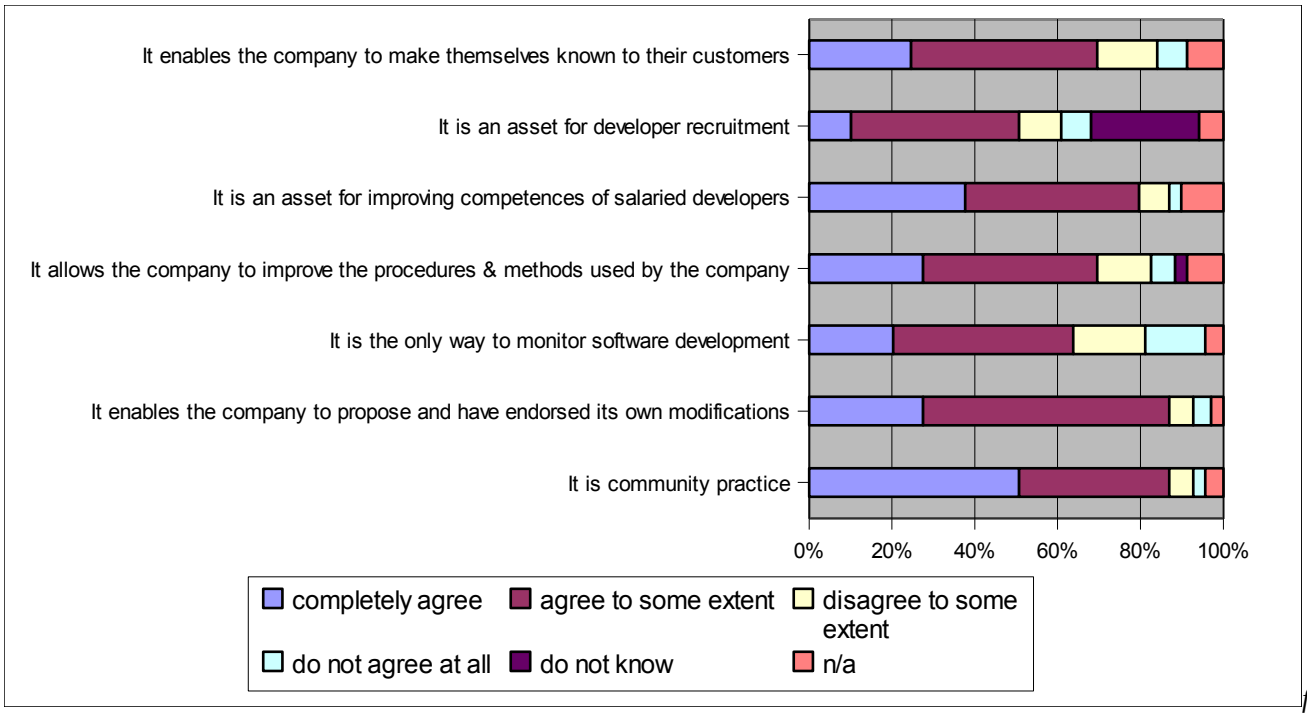


figure 4. Reason why companies contribute to FLOSS projects.

At the same time, this market (or at least the respondent companies in it) has evolved and become more professional compared with 2002. For example, 48 % of them have put in place a quality procedure within the company, compared with only 26 % in 2002 or upon the company's start-up[14].

If the sample is nevertheless not representative of the of those companies using FLOSS, for reasons elicited above, the size was sufficient to allow us to identify differing behaviours, in particular with relation to FLOSS, before testing the hypothesis we have put forward. Moreover, since it is composed mainly of businesses "involved" in FLOSS, it should enable us to identify the links, if any, between involvement and market positioning.

2.3 Correlations between involvement into FLOSS development and market positioning.

Table 1 seams to reveal differences between the activities and the involvement in FLOSS; if it is a main activity **based on FLOSS**, involvement will be intensified. But, more interestingly, if what is sold is close to FLOSS (an activity based on the software or the expertise (consulting), involvement means editing FLOSS. When it is a question of services, the participation seems more important (or at least more developed) than editing (contributing to a project). Finally, when the software is secondary to the activity (sale of equipment), the involvement does not seem necessary, even when the distributed software is free (1st column).

Table 1. Link between main activity and the involvement of companies in FLOSS projects.

	Part of companies not using proprietary software in their commercial offer agon those for which it is...		
	a main activity, FLOSS-based	***an activity[1]***	***not an activity***

[14] Thus if those companies were set up post-2002, we were interested in the start-up procedures. It is clear from these figures that quality procedure is something which frequently plays a role as the company puts its structure in place.

Categories of activities[2]	***Based on the software***	No participation	62 %	25 %	13 %
		Participates	74 %	19 %	7 %
		Editor	84 %	16 %	0 %
	Technical services	No participation	60 %	38 %	2 %
		Participates	81 %	19 %	0 %
		Editor	76 %	19 %	5 %
	Expertise	No participation	46 %	39 %	15 %
		Participates	67 %	30 %	3 %
		Editor	73 %	27 %	0 %
	Equipment	No participation	10 %	35 %	55 %
		Participates	7 %	41 %	52 %
		Editor	13 %	19 %	68 %

1 "activity" means that it is a main activity, but not based on FLOSS, or it is based on FLOSS, but it is a secondary activity.

2 Companies could declare several main activities.

Actually, we found statistical evidences of this link. There is a positive correlation (Xhi² test) between commercial specialization in the FLOSS (% of turnover realised with FLOSS) and a demand for involvement of the company's developer staff in FLOSS development communities. If we look at figures, 47 % of the companies asking their developer to get involved into floss development have a turnover entirely achieved on FLOSS (and 88 % of those who have a turnover entirely achieved on FLOSS display this behaviour). On the other hand, among companies unenthusiastic about this involvement, 46 % declare to make 0 % of turnover with FLOSS (58 % of these display this behaviour).

In the rest of the article, we will propose a theoretical framework explaining these links and we will test its validity on the data collected.

3 Links between the market served and Floss involvements.

To understand the link between marketing of FLOSS and participation in the development, we suggest beginning with an analysis of the evolution of the IT market. This analysis will enable us to elicit various marketing strategies and thereby to explain the competitive advantage that companies can have to build up their offer from FLOSS, but also their degree of involvement in the development of such software.

3.1 The IT evolution towards a customized offer for the mass market.

As Horn (2004, p 17.) explained clearly, the software is a complex "object", sometimes quite intangible (according to the terminology of Hill, 1997) and sometimes it is a service, depending on the way it is manufactured.

Table 2. The various IT components. From Horn 2004, p. 18 ("the software between the products and services").

Tangible products		***Intangible products***		***Services***		
Other products	Programmed electronic components	Software package		Customized software	Computerised services	Other services
		Tools & systems	Application software	Other IT services		

To be more precise, historically the software took the form of services (Langlois and Mowery, on 1996, p. 55, Horn, on 2004) and software packages were developed only recently, from the begin-

ning of the 80s, in order to obtain economies of scale, notably on the microcomputer market (Mowery, on 1996).

We distinguish three types of main strategies in the current offers.

- During the 80s and the 90s, in order to reduce costs and the risks inherent in customized development, a large number of users, notably companies, turned to software packages adapted to the specific requirements by service companies, certified by the software package publisher (Horn on 2004, p. 98). This practice of combined offers, or packages, integrating a standard base and customized services has made its mark in the professional solutions, whether it is for the company management systems (ERP, whose symbolic model is SAP), or the "IT" tools (" middleware "applications, compilers, development tools such as those proposed by the Ilog company), or the solutions specific to a branch, a profession (such as the subsequent version of computer-aided design proposed by the company Dassault Systems). This is the model of the “technically sustained capacity” (Gadray on 1998). The producer organizes the collaboration with his user-innovators around an innovative and evolutionary technical tool; businesses, customers, developers, as users they are a source of innovation (as per Von Hippel on 1988), in a “symbiotic” relationship, in the terms of Dahlander and Magnusson (2005). The producer sells what we called “three A services”: quality Assurance, Adaptation (more or less rapidly) to the user needs, and user Assistance to use the tool (Jullien and Zimmermann, on 2006).

More recently, with the spread of Internet, certain applications (essentially those enabling the sharing and the exchange of information) have in fact been shared by an increasing number of heterogeneous users (from the computer scientist to the most illiterate user). These network side-effects, and the need for standardization which they entail, have a considerable impact on the technological offer. It becomes necessary to, for the basic applications at least, a library of compatible tools satisfying the requirements of both expert developers and beginners, either within the same organization, or belonging to different organizations.

This leads to two types of strategy:

- The software publishers try to increase the range of their offer by adding software to their basic product, in order to satisfy more needs, or to better segment their response, while simultaneously keeping low production costs, since it is always, in the end, a question of a standardized offer. The archetype of this platform strategy being the operating system (the indispensable element to make computer function) whose interest increases with the number of machines working with it and above all of software for applications compatible with this system. Due to these technological inter-connections, the effects of standardization are very strong on these markets. Thus Microsoft extended the features of its operating system (by adding software layers, such as the graphic interface, followed by the Internet browser and then segmented its market by proposing several distinct versions of the product (server pro and family versions). Oracle, however, which sells professional solutions based on its data base technology, has the same strategy. Thus it has just acquired the publisher BEA so as to increase its portfolio of professional solutions[15]. Another example is the publisher Symbian, who proposes an operating system for mobile phones. The producers of such platforms must look for maximum presence on the targeted terrain, through distribution agreements with major wholesalers (Fnac...) regarding products for general consumption, local IT service companies for company products, by

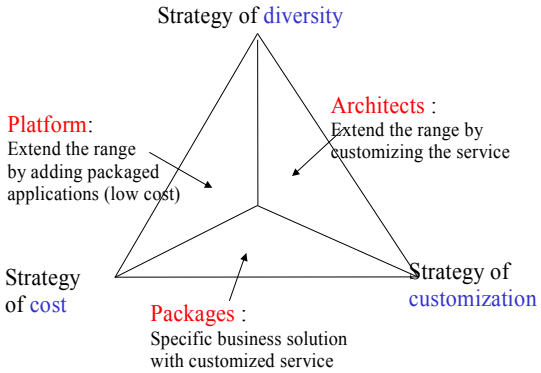
[15] “Ellison saw that if Oracle played its cards right, the confluence of the database, the Internet, and the Web browser could displace the operating system as the focal point of computing and erode Microsoft's industry dominance”.

means of trade or certification agreements, allowing the local retailer to take advantage of the brand awareness to create its offer.

- Service companies, and especially the largest (IBM, Cap Gemini), endeavour to develop a global approach to IS and company organization (by acquiring strategic consultancy companies such as Ernst & Young), while remaining less dependent on one type of software, in order to be able to adapt to the constraints and to the current circumstances of these customers. We describe them as the IT "architects". But the retail service companies behave in the same way, supplying infrastructure on a more local and smaller scale (maintenance of a single server, instead of a global infrastructure), either at a more specialized level, for example in terms of sector (e.g. maintenance services for the food-processing industry), or on a more reduced software base (distributors-installers-adapters of one of the platforms, these are companies "certified" Mirosoft, Oracle, or RedHat). The vocation of all these companies is to develop, in the customer's interest, individualized solutions and to support these solutions. We are approaching what Gadrey (1998) described as the "provision of human capacities", in the sense that what makes the singularity of these companies is that they bring together a team of specialists of differing software, but also of customers' vocational specialists.

These three cases-studies of market brand, demand function (in terms of price, diversity and adaptability of the offer), are rather the norm in the services industry and can be summarized by using the Dang Nguyen and Leray's figure in "triangle of the strategies of service" (2008).

figure 5. The service business strategies triangle. Inspired from Dang Nguyen & Leray (2008).



These offers were created outside FLOSS, and it is worthwhile asking oneself, and if so, how, FLOSS might bring a competitive advantage.

3.2 The commercial motive for FLOSS.

Muselli (2004, 2006) studied the commercial strategies and especially the licences used by FLOSS publishers. She explains that the software publisher strategies are based on four axes, inspired by Bessy and Brousseau (2001): the company-focussed strategies (make the most profit from the soft-

ware), the strategies of cooperation (improve the co-development of the software, or at least the offers built around this software), the distribution strategies (maximize the speed and the distribution volume, in markets resulting in increasing yield of sound adoption) and finally the containment of rival companies (by allowing them or excluding them from a technological sector).

On each of these axes, it discusses the reason for using licences or FLOSS, and shows that the FLOSS publishers' strategies are a compromise determined by the relative importance of the various strategic axes. We shall take up these categories by applying them to the positions we have defined, thereby integrating the services into the analysis.

3.2.1 Packaged offers.

3.2.1.1 Competitive advantage of a FLOSS strategy.

It is clear that the use of free software packages, (meaning avoiding the cost of licences) procures an advantage on the price. Furthermore, in terms of distribution, the fact that the customer can assess the product without paying for the licence is a further advantage. It is obviously an advantage when dominant players are already on the market (CAD “Open Cascade» offer faced with Dassault Systems[16]) or when the customers are very price-conscious (as on the market of the ERP, which addresses more and more small and medium-sized firms, and where FLOSS offers are beginning to show themselves, such as ERP5 or tiny ERP. This strategy also permits the association of a company brand to a product, thus increasing the brand recognition of the former while spreading the word on the latter.

On the other hand, on the technology markets where the customers are computing developers, revealing the code facilitates cooperation. It is what Von Hippel (1988, 2005) called the user-innovators. The producer authorises the contributions, ensures the stability of the tool and helps developers to use it. Developers (possibly companies using the tool), by providing their own innovations, are thereby assured that their needs will be taken into account more rapidly and integrated into the product, a crucial point in cost reduction (according to Von Hippel, yet again, 1988).

MySQL AB, producer of FLOSS for data bases is a prime example of this type of player. This model is not in itself very different from the traditional model of computing tool-producers, such as Ilog. The opening nevertheless enables a better return on behalf of the users, and thus a stronger outsourcing of development costs, whilst ensuring a faster software development.

3.2.1.2 Sources of income in a FLOSS model.

Obviously, asset pricing is more difficult. In general, it depends on what is being sold. As Muselli explained (2004), if we control the whole software, we can apply a strategy of dual licensing, allowing the sale of the software, if customers so wish (e.g. because they wish to integrate it into a wider, or more restricted offer). This is what companies such as Qt or MySQL propose.

If this, however, is not the case, the "3A" services must be sufficiently important to enable the financing of the product development: assistance for the installation and configuration, training, help for utilisation and maintenance. This explains why the FLOSS offers develop mainly among software "professionals" (ERP, IT infrastructure software, as well as databases), where the configuration services and maintenance are important.

[16] The software: http://www.opencascade.org/ ; the company: http://www.opencascade.com. Horn (2002) proposes a monograph of this company.

3.2.1.3 Involvement in the communities.

In both strategies (dual licence or technical assistance) it is important to be fully acquainted with the software, in terms of intellectual property rights, but also with guarantees offered to the customer: only the owner of the software is allowed to propose dual licensing, and only the one who integrates contributions is capable of verifying and of guaranteeing their correct functioning.

Thus the company based on this model publishes the software and is heavily involved in its development, and the software and company name are often identical.

3.2.2 Platforms offers.

3.2.2.1 Competitive advantages of a FLOSS strategy.

Coris (2004), Dang Nguyen and Genthon (2006), Jullien and Zimmermann (2004) have endorsed the idea that the FLOSS licence facilitated, as in the previous case, the distribution, but above all the co-operations (i.e. the offers built around the system), because the elements of inter-operability are public and because the producers of additional assets can themselves ensure the compatibility of the platform with their product. For instance, SUN, creator of JAVA, is responsible, in the Web server Apache software, for the sub-programme which focuses on Java's porting on Apache. West (2003) has developed a complete study of that case.

3.2.2.2 Sources of income in a FLOSS model.

These platforms are, then, a cluster of software mounted around a pivotal component, and returns can be made on a customized assembly taken from a component library whose good performance we vouch for. This is what the retail publishers of the operating system Linux propose, such as RedHat, Novell, Mandriva or Ubuntu (retail supported by the company Canonical): Canonical, for example, assures the installation of Ubuntu for Linux PCs, which Dell offers. Beyond the development of specific packs, such as those produced by Canonical, earnings can result from a maintenance service (retail update).

Nevertheless, the monitoring of competitors is weak (thus Mandriva started by proposing an modification of RedHat distribution, with new graphic interface), and earnings making it possible to finance weaker projects, since there is no longer payment on the core offer, the operating system, but merely on the secondary services. Here we are in a "bundle" strategy, or rather linked, which resembles somewhat the strategies of play-station manufacturers; selling the platform cheap to better sell the follow-on services (games). It is, nevertheless, a reversal compared to the standard strategy, emphasising "efficiency", whose earnings, as a rule, come initially from the platform sale, and whose wealth eventually arises through ancillary services and of which Microsoft is the prime example.

3.2.2.3 The involvement in communities.

The platform manufacturers are involved in a classic arbitration in the dispute over standards (see, discussions by Katz & Shapiro, 1985, 1986, Teece 1986, Langlois & Robertson 1992, and for a review of literature, West 2004): it is essential to keep control of the platform since it is the cornerstone of the competitive edge, while opening it just sufficiently to integrate the maximum of accessory products. It is only natural, then, that they get involved in the basic software of their distribution, and, for the same reasons, in the formulae. Hence RedHat is very involved in the development of Linux (core of the operating system), but also of Gnome (graphic interface). At the same time, this company proposes a system enabling it to create its "packages" itself, i.e., to propose new software to RedHat retail business without constraints. This collaboration is coordinated through a special

project named Fedora. RedHat sells (among other things) an extract of Fedora to its customers (RedHat Enterprise Linux) together with performance guarantees.

3.2.3 Architects.

Competitive advantage of a FLOSS strategy.

As Horn (2004, p.100) pointed out, the precondition to effectively be able to use components is accessing the code source (a compatibility issue), being able to adapt them to users' and to other components' needs, i.e. that they be available in the form of open software, with sources we can modify.

The competitive advantage of using FLOSS, over and above the price, is to propose an assembly of components, whose inter-operability is controlled better, which ought to improve the quality of the finished product, a high standard of service which is one of recurring problems of the computing industry (see De Bandt, 1995).

The only uncertainty in the model arises from the availability of such components: who develop(s) them, who maintain(s) them? On the other hand, customers with these companies may have software already installed (owners), a fact which needs to be taken into account.

Ultimately, the FLOSS strategy can only be a guarantee of means (using a maximum of FLOSS), but not a guarantee of results (using only FLOSS), unless the customer requests it, for in this model, he has the final say.

3.2.3.1 Sources of income in a FLOSS model.

Income stem from assembly services and from components adaptability, just as for classic providers.

3.2.3.2 The involvement in communities.

FLOSS and the production communities are, in the end, additional assets, as Teece (1986) depicted them.

And, as Dahlander and Wallin (2006) explain, if ownership is not essential to monitor innovation, employing key developers in the development communities can allow a better appropriation and a better supervision of the latter, but it is not absolutely necessary to hire a lot. Above all, it is neither essential to be owner, nor to be publisher of the software.

In these companies developers may have some "spare time" to participate in their particular development projects since this enables the company to broaden its range of tool components software, which it controls.

3.2.4 A summary of the different cases.

In the three strategic options we find competitive advantages distinct from using FLOSS, entailing different relations the software production (Table. 4).

Table 3. A synthesis of the link between FLOSS commercial strategy and software development

	Type of offer		
	Package	***Platform***	***Architect***
Economic model	Specific offer for software and user assistance	Standard platform and supplementary offer	Provision of component-based service
Competitive	Best relation with clients	price	Best technical quality, top

advantage of FLOSS	(user-innovator) and price		quality service
Sources of income in FLOSS	Services only. Insurance, assistance, adaptation. Temptation to sell software.	Sale of supplementary services, customized software aggregation for the platform (possibly outsourced to local distributors)	As for standard service companies.
Involvement in the communities	Heavy involvement (monitoring) of software as cornerstone of the offer. No scattering.	Important for key platform components. From zero to weak elsewhere. For local platform distributors, zero involvement.	Participation in key component production to be able to contribute.

4 A VALIDATION BY TYPOLOGICAL ANALYSIS.

To test the hypothesis of a link between the market and the involvement in FLOSS, such as has been presented in the previous section, we have classified the companies, i.e. produced a study of the contiguity between companies based on the importance of FLOSS in their commercial offer[17]. The advantage of this analysis is that it does not define ranking or relations between variables, a priori, but rather proffers the most appropriate links.

So we will test the two following hypothesis :

H1. Looking at business strategies, **the ascendant hierarchical classification should discriminate the three business strategies in three categories**, regarding their source of income ("Economic model" and "source of Income in FLOSS" in in table 3).

H2. **Each of these categories should have a different involvement in the communities** (or FLOSS production), **following the hypothesis presented** in row "Involvement in the communities" **in table 3**.

4.1 Creation of categories.

To create the categories of companies, only the variables from the questionnaire relevant to the commercial positioning (equipment, software, service, etc.) and to the use of FLOSS in the mounting of the offers were retained. To be more precise, the variables taken into account are as follows:

- Q1.1.1. Is the activity based on the software, the technical services, the expertise and\or the hardware (with the following subsections: it is not an activity (value 3), it is an activity (value 1), it is a main activity in FLOSS, value 2). In the tables annexed, these are the subsections "pACT_1" to "pACT_14"

- Q1.2.1 the use of FLOSS in their commercial offer deemed to be or not a specificity of the company (rUT_1; 1 corresponding to "a company specificity" and 2 to "a distinct element")

- Q1.1.6 The fact of using, or not, proprietary software to mount their commercial offer (rut_propr, 1 corresponding to utilisation, whether "from time to time", "often used", or "it remains the cornerstone of the offer" and 2 to "no utilisation of proprietary software")

- Q1.2.2 the development, or not, of particular connections with certain companies (Novell Suse, RedHat, Mandriva, Microsoft, etc., variable parts, which are allocated a 1, if there are special agreements.

[17] Based on an ascendant hierarchical classification.

- Q1.3.1 the publishing or not of software (editlog_lib, worth a 3 for “does not publish", a 2 for “publish its main software under proprietary licence”, and a 1 for “publishes its main software under open source licence”.

- Q2.1.5: the implementation or not of a quality procedure (variable norm -1 to 1, if the procedure exists)

  - Q2.1.6 technical quality as key brand element (robj -1 to 1) variable names should be removed

Since our analysis depicts the economic models of software and services, we excluded from our sample the companies for whom these activities were secondary or non-existent. In practical terms, it concerns suppliers, who represent 8 % of our sample, i.e. 12 companies. Our final sample, then, comprises 134 answers.

4.2 The FLOSS business models. Hypothesis 1.

The best classification is in six categories, but some of them have not enough elements to be statistically significatif. So we had to use the second best four categories classification. This is detailed in appendix 1. The names given the the categories propose a summary of their caracteristics.

4.2.1 Category 1. The “FLOSS “formula” providers”.

The norm for companies of this category is a company whose business is built upon FLOSS.

Publisher of one (or several) software (s) under open source licence, its main activity is based on the integration and the support of (free) open source software, the training (on FLOSS), and to a lesser extent on audit and guidance (on FLOSS). (Nevertheless, the company does not sell hardware or related support.

If it uses proprietary software to mount its offer “from time to time”, it considers its FLOSS activity as “the specificity of the company”, and its turnover is entirely made with the FLOSS (rCA_LIB in 4, i.e. 100 %).

4.2.2 Category 2. The “FLOSS architects”.

The norm for companies of this category is a services company based on FLOSS products, and this more on IS infrastructure than on applications profession.

Its main activities, all based on FLOSS, are administration services (network-computer), hosting, integration, audit, even software support, and, in a minor fashion, sales and hardware maintenance.

More frequently than the average, companies of this category have agreements with partners.

4.2.3 Category 3. The “classical” architects.

These companies have the same type of activity as the previous ones (service and support, some in partnership with publishers), but not necessarily in FLOSS, or at least, not principally in FLOSS (value “1”of the variables). Even if the FLOSS is “a distinguishing element” of these companies, it is not their “specificity” (variable rUT_1). They have a turnover based on FLOSS lower than 50 % (rCA_LIB being worth 1 or 2).

4.2.4 Category 4. The “users of FLOSS”.

This category groups brings together the companies using FLOSS, but which have no commercial activities directly based on this software (value 3 for all the pACT_ * variables.)

If we look at companies belonging to this category, it concerns Web agencies (customized development of Web site), companies hosting sites, to be concise, companies which are software users and, in reality, FLOSS. But whose core business is not software production and adaptation.

Their brand is to propose "new" offers (robj_1 in 2), and that may explain why they are interested in FLOSS[18].

4.2.5 Discussion of Hypothesis 1.

The analysis highlights clearly the fact that there are commercial strategies based on the FLOSS as a distinguishing element (categories 1 & 2), and circumstances where companies have integrated these tools into a more classic process (categories 3 and 4). The three first categories presents the main characteristics of the “package” (category one) and the “architect” (categories two and three) strategies as we defined them in section 3. The distinction between categories 2 and 3 is in the intensity of use of FLOSS, what we see as a good example of the fact that these companies see the pieces of software as complementary assets and not the core of their business, so are able to chose different programs or solutions according to their speciality or their internal competencies.

Only platform companies (and category) are eventually missing to fully validate hypothesis 1. Actually considering the population surveyed (European French speaking firms) and the nationality of the main platform producers (the US), this is not surprising.

So we consider that hypothesis 1 is partially validated.

4.3 Link between business model and involvement in FLOSS production. Hypothesis 2.

As illustrative variables (i.e. not serving to construct the categories, but facilitating a refinement of the companies' characteristics) we have retained the ones concerning the involvement into communities:

– The term employed to speak about FLOSS.

- The existence of developers; whether companies hire developers involved in FLOSS projects, etc.

4.3.1 Category 1. The package companies.

Their involvement in communities is strong, since besides managing the development of one (or several) FLOSS project, they “participate” in FLOSS projects.

Concerning the involvement of the salaried developers, they are under the average for the following behaviors:

- “recruiting a developer because he or she had a strong involvement in a specific community” (variable (rrdev indent)

[18] Thanks to Stefan Kosh for this remark.

- "the involvement of developers in FLOSS communities is a criterion of recruitment" (variable rrdev_crit)
- "the involvement in development communities is encouraged in the company" (variable rrrdev_impl).

This is consistent with our hypothesis that these companies specialized themselves on FLOSS programs they edit, but are not involved into FLOSS community in general.

4.3.2 Category 2. The FLOSS architects

The involvement in FLOSS projects is less strong, even if some companies publish software (under open source licence).

They often have more developers than average (rdev to 4 negative), and, more than average, developers have a little spare time to get involved in projects (rrdev_tps).

This two points are consistent with our hypothesis that if FLOSS architects are less deeperly involved in FLOSS projects, they have to participate to some of them, to be able to follow them.

4.3.3 Category 3. The classic architects.

There are not characteristic elements regarding they participation to FLOSS communities. We think it is consistent with our hypothesis, as they are less specialized in FLOSS products so they have less needs for closely surveying these ones than category two.

Category 4. The users of FLOSS

They do not participate in the development of FLOSS, nor do they publish software, which is also consistent with our hypothesis.

4.3.4 Discussion of Hypothesis 2.

Hypothesis 2 was that firms will invest into communities differently, according to their business strategy. Our findings are consistant with this hypothesis and in line with the propositions made on the specialization of their engagement (Table 3, page 11). The three following facts seem the most consistent :

- FLOSS specialists (categories 1 and 2) are much more involved into FLOSS development than « technology takers (categories 3 and 4);
- editors are the most involved into FLOSS, but this involvement seems more focussed on projects than on the whole ecosystem;
- FLOSS architects are less involved into development, and explore more the technological possibilities (« free » time given to developers to participate to their own project).

5 Conclusion.

In this article, we proposed a typology of the software and services markets, putting forward, for each of these markets, an explanation for the interest in a FLOSS strategy. Our analysis demonstrates that, following the markets, companies choosing a FLOSS strategy had to develop different links to the development communities, particularly in terms of involvement in these communities,

but also in terms of the degree of specialisation of this involvement (participation in the development of one or more software).

These hypotheses have been verified by courtesy of an on-line survey with French-speaking European companies using FLOSS in their commercial activities. The small size of the sample (134 responses) did not, however, allow us to provide evidence of the platform model, which is merely followed by a minority of companies worldwide. But the two most common models, that of the "package", or publishing professional solutions, and that of the "architect", appear distinctly in our analysis and manifest the characteristics expected.

We consider that these results are a pristine validation of the hypotheses proposed on the business models and the link between these models and the involvement in FLOSS. An international survey (concerning notably Anglo-Saxon companies) should enable a more in-depth study.

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ANNEX 1. DESCRIPTION OF THE BREAKDOWN/ SUBDIVISIONS

DESCRIPTION OF THE Section 'a' of the parse tree in 4 categories

CHARACTERIZATION OF THE CATEGORIES BY MODE

CHARACTERIZATION BY MODE OF THE CATEGORIES OR THE MODES

From Section 'to' parse tree in 4 categories

Category 1 / 4

V.TEST	PROBA	CAT/MOD	MOD/CAT	GLOBAL	CHARACTERISTICS	OF VARIABLES	IDEN	WEIGHT
			46.27	Category 1 / 4			aa1a	62
5.58	0.000	73.33	70.97	44.78	1	rut_propr	BB_1	60
5.51	0.000	59.41	96.77	75.37	3	pACT_14	AL_3	101
5.26	0.000	63.53	87.10	63.43	1	rUT_1	AV_1	85
5.14	0.000	60.64	91.94	70.15	3	pACT_13	AK_3	94
5.03	0.000	74.51	61.29	38.06	4	rCA_LIB	AO_4	51
4.74	0.000	67.16	72.58	50.00	2	pACT_6	AG_2	67
4.48	0.000	72.00	58.06	37.31	2	pACT_9	AI_2	50
4.28	0.000	69.81	59.68	39.55	3	pACT_8	AH_3	53
3.81	0.000	64.06	66.13	47.76	1	editlog_lib	BI_1	64
3.22	0.001	59.72	69.35	53.73	2	pACT_2	AD_2	72
3.15	0.001	60.29	66.13	50.75	1	PARTICP_LIB	AA_1	68
3.02	0.001	57.50	74.19	59.70	2	pACT_3	AE_2	80
3.02	0.001	57.50	74.19	59.70	2	rPROSP_1	AW_2	80
2.83	0.002	62.75	51.61	38.06	2	rterme	BA_2	51
2.35	0.009	56.16	66.13	54.48	2	pACT_10	AJ_2	73
-2.12	0.017	15.38	3.23	9.70	3	pACT_10	AJ_3	13
-2.33	0.010	14.29	3.23	10.45	3	rrdev_indent	BE_3	14
-2.47	0.007	23.08	9.68	19.40	1	rCA_LIB	AO_1	26
-2.55	0.005	19.05	6.45	15.67	3	rrrdev_impl	BF_3	21
-2.73	0.003	12.50	3.23	11.94	4	TR_SAL	AM_4	16
-2.73	0.003	12.50	3.23	11.94	3	rrdev_crit	BD_3	16
-2.80	0.003	7.69	1.61	9.70	3	pACT_3	AE_3	13
-2.87	0.002	28.26	20.97	34.33	3	rterme	BA_3	46
-3.02	0.001	29.63	25.81	40.30	1	rPROSP_1	AW_1	54
-3.11	0.001	11.11	3.23	13.43	2	rCA_LIB	AO_2	18
-3.11	0.001	11.11	3.23	13.43	3	pACT_2	AD_3	18
-3.15	0.001	31.82	33.87	49.25	2	PARTICP_LIB	AA_2	66
-3.32	0.000	23.08	14.52	29.10	1	pACT_1	AC_1	39
-3.36	0.000	20.59	11.29	25.37	2	pACT_8	AH_2	34
-3.90	0.000	5.26	1.61	14.18	3	pACT_9	AI_3	19
-3.93	0.000	0.00	0.00	11.19	2	editlog_lib	BI_2	15
-4.40	0.000	4.55	1.61	16.42	4	ranc	BK_4	22
-4.69	0.000	13.51	8.06	27.61	1	pACT_13	AK_1	37
-4.91	0.000	6.90	3.23	21.64	3	pACT_6	AG_3	29
-5.26	0.000	16.33	12.90	36.57	2	rUT_1	AV_2	49
-5.36	0.000	6.25	3.23	23.88	1	pACT_14	AL_1	32
-5.58	0.000	24.32	29.03	55.22	2	rut_propr	BB_2	74

Category 2 / 4

V.TEST	PROBA	CAT/MOD	MOD/CAT	GLOBAL	CHARACTERISTICS	OF VARIABLES	IDEN	WEIGHT
			17.16	Classe 2 / 4			aa2a	23
6.54	0.000	46.81	95.65	35.07	2	pACT_5	AF_2	47
5.77	0.000	52.94	78.26	25.37	2	pACT_8	AH_2	34

3.98	0.000	27.50	95.65	59.70	2	pACT_3	AE_2	80
3.89	0.000	28.77	91.30	54.48	2	pACT_10	AJ_2	73
3.30	0.000	34.09	65.22	32.84	2	rrrdev_impl	BF_2	44
3.11	0.001	43.48	43.48	17.16	2	rrdev_tps	BG_2	23
3.06	0.001	37.50	52.17	23.88	1	pACT_14	AL_1	32
3.02	0.001	35.14	56.52	27.61	1	pACT_13	AK_1	37
2.89	0.002	29.63	69.57	40.30	1	rPROSP_1	AW_1	54
2.83	0.002	33.33	56.52	29.10	1	pACT_1	AC_1	39
2.80	0.003	26.87	78.26	50.00	2	pACT_6	AG_2	67
2.67	0.004	24.39	86.96	61.19	1	rdev	BC_1	82
2.61	0.005	100.00	13.04	2.24	2	pACT_13	AK_2	3
2.59	0.005	39.13	39.13	17.16	3	rrclient_prin	AQ_3	23
2.08	0.019	25.00	69.57	47.76	1	editlog_lib	BI_1	64
2.05	0.020	34.78	34.78	17.16	1	part	AX_1	23
-1.99	0.023	8.00	17.39	37.31	1	rAPE	AS_1	50
-2.05	0.020	13.51	65.22	82.84	2	part	AX_2	111
-2.09	0.018	3.45	4.35	21.64	3	pACT_6	AG_3	29
-2.67	0.004	5.77	13.04	38.81	4	rrdev_tps	BG_4	52
-2.67	0.004	5.77	13.04	38.81	2	rdev	BC_2	52
-2.67	0.004	5.77	13.04	38.81	4	rrdev_crit	BD_4	52
-2.67	0.004	5.77	13.04	38.81	4	rrdev_indent	BE_4	52
-2.67	0.004	5.77	13.04	38.81	4	rrrdev_impl	BF_4	52
-2.89	0.002	8.75	30.43	59.70	2	rPROSP_1	AW_2	80
-2.93	0.002	4.17	8.70	35.82	1	pACT_10	AJ_1	48
-3.03	0.001	2.44	4.35	30.60	1	pACT_3	AE_1	41
-3.25	0.001	2.27	4.35	32.84	1	pACT_5	AF_1	44
-3.44	0.000	9.90	43.48	75.37	3	pACT_14	AL_3	101
-3.90	0.000	0.00	0.00	32.09	3	pACT_5	AF_3	43
-4.15	0.000	7.45	30.43	70.15	3	pACT_13	AK_3	94
-4.59	0.000	0.00	0.00	39.55	3	pACT_8	AH_3	53

Category 3 / 4

V.TEST	PROBA	CAT/MOD	MOD/CAT	GLOBAL	CHARACTERISTICS	OF VARIABLES	IDEN	WEIGHT
				17.91	Category 3 / 4		aa3a	24
5.49	0.000	42.86	87.50	36.57	2	rUT_1	AV_2	49
4.87	0.000	73.33	45.83	11.19	2	editlog_lib	BI_2	15
4.67	0.000	33.85	91.67	48.51	1	pACT_9	AI_1	65
4.59	0.000	39.58	79.17	35.82	1	pACT_10	AJ_1	48
4.17	0.000	54.55	50.00	16.42	4	ranc	BK_4	22
4.15	0.000	42.11	66.67	28.36	1	pACT_6	AG_1	38
3.98	0.000	29.73	91.67	55.22	2	rut_propr	BB_2	74
3.86	0.000	43.75	58.33	23.88	1	pACT_14	AL_1	32
3.79	0.000	40.54	62.50	27.61	1	pACT_13	AK_1	37
3.56	0.000	36.36	66.67	32.84	1	pACT_5	AF_1	44
3.17	0.001	50.00	37.50	13.43	2	rCA_LIB	AO_2	18
3.11	0.001	42.31	45.83	19.40	1	rCA_LIB	AO_1	26
3.09	0.001	34.09	62.50	32.84	1	pACT_2	AD_1	44
2.92	0.002	34.15	58.33	30.60	1	pACT_3	AE_1	41
2.65	0.004	33.33	54.17	29.10	1	pACT_1	AC_1	39
2.46	0.007	42.11	33.33	14.18	4	rCA2007	AP_4	19
2.46	0.007	39.13	37.50	17.16	1	part	AX_1	23
2.34	0.010	43.75	29.17	11.94	4	TR_SAL	AM_4	16
-1.99	0.023	11.11	33.33	53.73	2	pACT_2	AD_2	72
-2.20	0.014	11.25	37.50	59.70	2	pACT_3	AE_2	80
-2.46	0.007	13.51	62.50	82.84	2	part	AX_2	111
-2.59	0.005	8.06	20.83	46.27	3	pACT_1	AC_3	62
-2.99	0.001	4.26	8.33	35.07	2	pACT_5	AF_2	47
-3.24	0.001	6.25	16.67	47.76	1	editlog_lib	BI_1	64
-3.48	0.000	9.57	37.50	70.15	3	pACT_13	AK_3	94
-3.75	0.000	9.90	41.67	75.37	3	pACT_14	AL_3	101
-3.82	0.000	2.00	4.17	37.31	2	pACT_9	AI_2	50
-3.90	0.000	1.96	4.17	38.06	4	rCA_LIB	AO_4	51
-3.96	0.000	5.48	16.67	54.48	2	pACT_10	AJ_2	73
-3.98	0.000	3.33	8.33	44.78	1	rut_propr	BB_1	60
-4.52	0.000	2.99	8.33	50.00	2	pACT_6	AG_2	67
-5.49	0.000	3.53	12.50	63.43	1	rUT_1	AV_1	85

Classe 4 / 4

V.TEST	PROBA	PERCENTAGES CAT/MOD	PERCENTAGES MOD/CAT	PERCENTAGES GLOBAL	MODES CHARACTERISTICS OF VARIABLES		IDEN	WEIGHT
					Classe 4 / 4			18.66
							aa4a	25
7.02	0.000	68.97	80.00	21.64	3	pACT_6	AG_3	29
5.80	0.000	48.84	84.00	32.09	3	pACT_5	AF_3	43
5.27	0.000	84.62	44.00	9.70	3	pACT_3	AE_3	13
5.27	0.000	72.22	52.00	13.43	3	pACT_2	AD_3	18
5.07	0.000	68.42	52.00	14.18	3	pACT_9	AI_3	19
4.63	0.000	76.92	40.00	9.70	3	pACT_10	AJ_3	13
3.92	0.000	34.48	80.00	43.28	2	robj_1	BJ_2	58
3.74	0.000	31.82	84.00	49.25	2	PARTICP_LIB	AA_2	66
3.25	0.001	32.73	72.00	41.04	3	editlog_lib	BI_3	55
3.25	0.001	32.73	72.00	41.04	3	reditlog	BH_3	55
2.56	0.005	22.52	100.00	82.84	2	part	AX_2	111
2.48	0.007	33.33	52.00	29.10	3	rCA_LIB	AO_3	39
2.13	0.017	25.68	76.00	55.22	2	rut_propr	BB_2	74
2.08	0.019	38.10	32.00	15.67	3	rrrdev_impl	BF_3	21
1.98	0.024	28.57	56.00	36.57	2	rUT_1	AV_2	49
1.97	0.025	34.62	36.00	19.40	2	rrclient_prin	AQ_2	26
-1.98	0.024	12.94	44.00	63.43	1	rUT_1	AV_1	85
-1.99	0.023	6.06	8.00	24.63	2	ranc	BK_2	33
-1.99	0.023	0.00	0.00	12.69	1	rrrdev_impl	BF_1	17
-2.13	0.017	10.00	24.00	44.78	1	rut_propr	BB_1	60
-2.37	0.009	7.84	16.00	38.06	4	rCA_LIB	AO_4	51
-2.56	0.005	0.00	0.00	17.16	1	part	AX_1	23
-2.74	0.003	9.59	28.00	54.48	2	pACT_10	AJ_2	73
-2.89	0.002	4.55	8.00	32.84	1	pACT_5	AF_1	44
-3.11	0.001	8.33	24.00	53.73	2	pACT_2	AD_2	72
-3.13	0.001	4.26	8.00	35.07	2	pACT_5	AF_2	47
-3.36	0.000	4.00	8.00	37.31	2	pACT_9	AI_2	50
-3.74	0.000	5.88	16.00	50.75	1	PARTICP_LIB	AA_1	68
-3.92	0.000	4.69	12.00	47.76	1	editlog_lib	BI_1	64
-3.92	0.000	6.58	20.00	56.72	1	robj_1	BJ_1	76
-4.69	0.000	2.99	8.00	50.00	2	pACT_6	AG_2	67
-5.25	0.000	3.75	12.00	59.70	2	pACT_3	AE_2	80

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