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. It is viewed as an extrem case of open innovation (Chesbrough, 2003), and thus of a laboratory for analysing innovation production in Internet based/knowledge based industries.

It the FLOSS field an increasing number of companies are getting involved in the communities of development (Lakhani & Wolf 2005). Scholars (see, for instance Dahlander & Wallin 2006) has analysed this as a way to control a complementary asset, without owning it (as defined by Teece 1986, Teece & al. 1997). In this article, we defend the idea that involvement can be of different intensity, from complementary to specific asset, and that this intensity depends of the market of the firm.

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, via an ascendant hierarchical clustering (AHC) we statistically verified a link between FLOSS commercial strategies and degree of involvement into communities. We propose a typology of commercial strategies explaining this differences in involvement.

KEYWORDS: IT industry, FLOSS, Market strategy, core competencies, Survey, Ascendant Hierarchical Clustering.

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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 were forerunners (Debois & al. 1999). 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, 2003); 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[1]. 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). Finally, 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[2].

Scholars see this phenomenon as an extrem case of open innovation (Chesbrough, 2003), and thus of a laboratory of innovation production in some Internet based/knowledge based industry. The question being the investments firms have to innovate on this production, ans especially how they involve into the cooperative production process.

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) looking at the “GNOME” graphic interface project, standing on Teece's theory defend the idea that, hiring developers who participe to this development project, these firms try to control a complementary asset important for building their product and service. This enlight IBM's strategy of supporting and investing in the development of Linux while selling Hardware (mainframe) and software (Lotus suite).

However, they have looked at a community already established, where the software developed is shared by numeros actors, people or firms. This hardly explains why some companies, like MySQL AB, which owns a whole software (MySQL), thus a specific asset, open source it and, still, remains responsible for the majority of its development, as if it was the core asset of its business[3].

In this article, we propose to go one step further in the analysis of the involvement of firms into FLOSS communities, still basing the conceptual framework on Teese's theories as exposed by Dallander & Wallin (2006) regarding FLOSS. We postulated that there is various degrees of involvement within the communities and that this variation may be explained by the companies’ core competencies (position on their markets combined with each market’s respective characteristics).

To do so, we inverse the usual point of view, which looks at firms' involvement in Floss via employees involvements in communities. We surveyed firms directly, and we surveyed them on their market, and on their strategy of participation to communities, regarded at firm level. The reasons are twofolds. First, technically, it is hard to have a good picture of firms' involvement looking at communities as we should look at all the communities, and, as pointed by former studies, even if it were possible, it would remain hard to identify at the employer of each participant. Second, and more important, as we tried to

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

[2] Regarding voice on IP, 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.

[3] To own means, here, that this firm has the ownership of the whole copyright. If any developer/contributor wants to make a contribution to the official MySQL product, she has to transfer her copyright to MySQL. http://forge.mysql.com/contribute/cla.php. Once owning the whole copyright, the firm can manage a dual licensing scheme, distributing the product under the licence she wants, either GPL or more classical closed licence...

work on Teece's framework, we needed to have information on the whole innovation chain, ie product development, production and marketing.

So we have surveyed some Francophone companies (French, Belgian, and Swiss) who professed to use FLOSS in their business (we define precisely what we mean by that in section 2).

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 make an ascendant hierarchical clustering (AHC) based on firms' market approach, with, in illustrative variables, those having something to do with their involvement into FLOSS development, showing different market and FLOSS involvement behaviors. In section 4, we propose a framework to explain the connections found in section 3 between the market positioning and the way companies involve themselves in development community.

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 Gadrey (1998) described as services “linked to IT” (accounting, mail-order, etc.) which existed prior to IT and have since been computerised.

A third difficulty lies on the quality of the data collected. Direct Internet and FLOSS organisations study provide has a strong methodological asset, regarding the study of actors' action: working on registred contribution allow to base the studies not on declarations/justifications by actors, but on their actions. So the analysis is less biased by actors' interpretation, transvestism of the truth, etc. But here, we want to survey firms on their vision of their involvement into firms and on their vision of the market, in addition to the classical collection of their participation. So we needed also their declaration/justification, making necessary face-to-face or survey interviews.

These challenges and the absence of data, lead us 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)[4] proposing provision of services and equipment based on FLOSS. So, our definition of “a commercial activity using FLOSS” is the one proposed by Bonaccorsi, Rossi and Giannangeli (2006): “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,

[4] This corresponds 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

APRIL and MEITO[5]), 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. It was available online, in French[6].

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, checking the email given in the answers). 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.

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%).

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

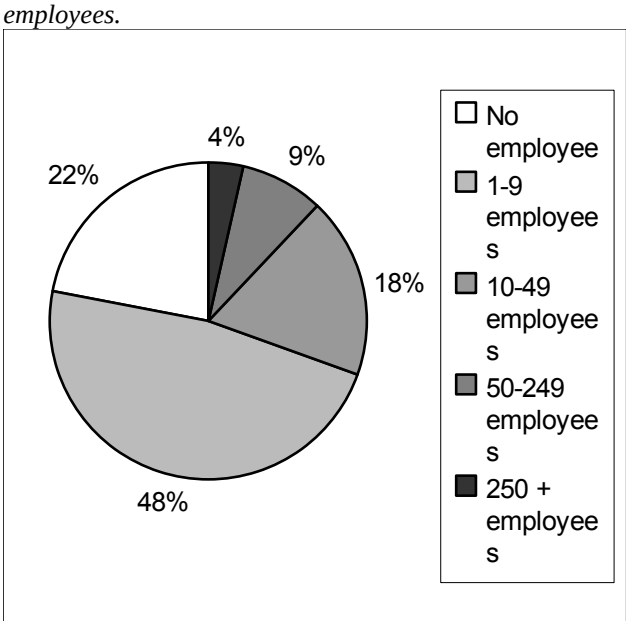
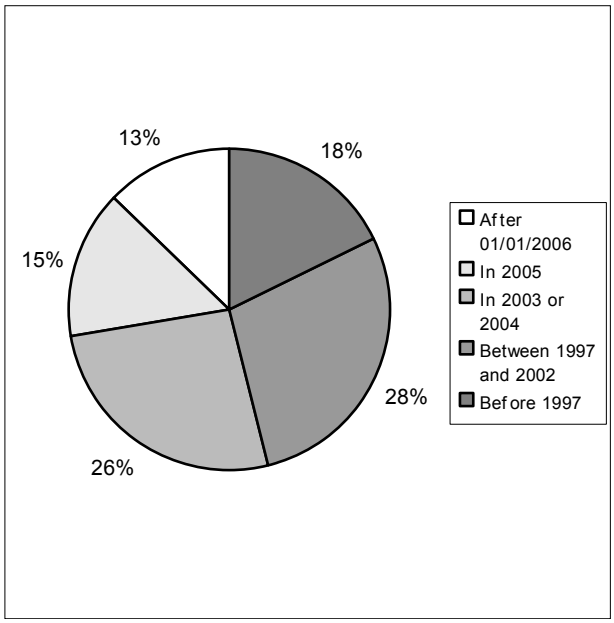


figure 2. Date of company creation.



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.

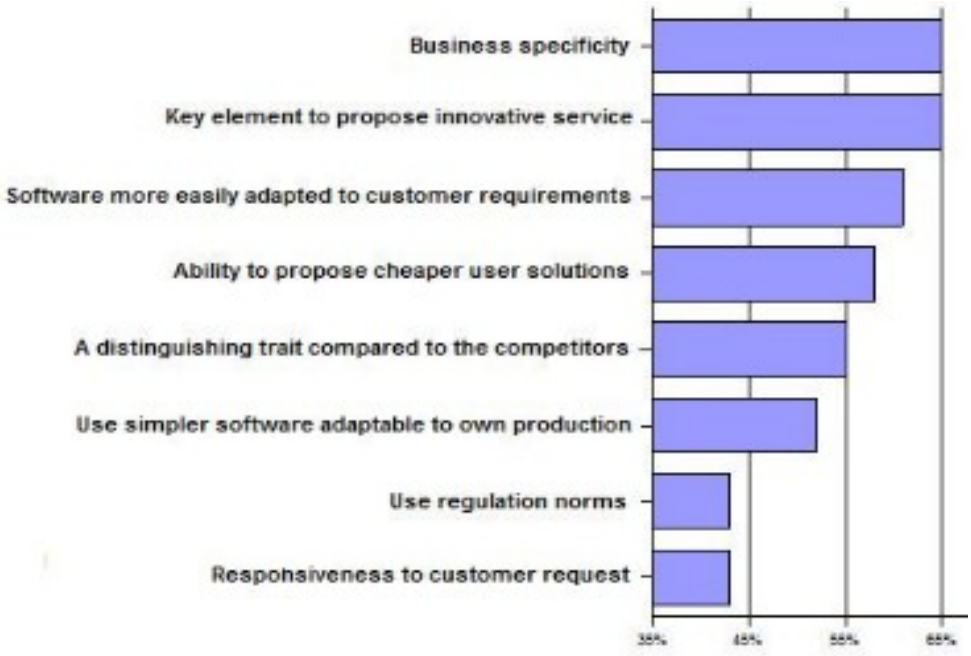
The link to FLOSS.

As shown by figure 3, FLOSS is firstly seen as an element of technical differentiation: a “key element to propose innovative services because “software [is] more easily adapted”).

[5] 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. 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

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

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



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 re-activity, 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 4) 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 litterature to elucidate such a contribution, such as accepting proposals, training developers, becoming well-known, etc., are secondary.

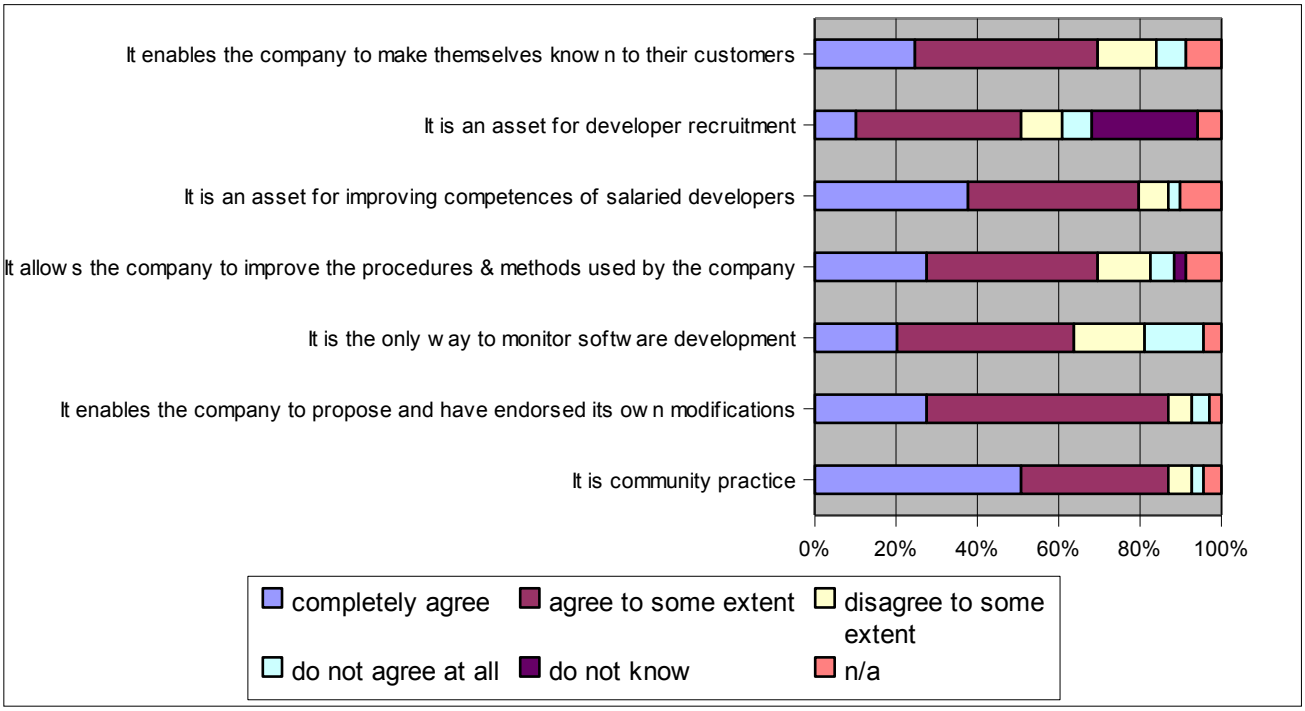


figure 4. Reason why companies contribute to FLOSS projects.

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[7].

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.

3. Links between the market served and Floss involvements.

To make emerging some categories of usages of FLOSS in the market and to study the link with involvement in FLOSS, we have computed an ascendant hierarchical clustering (AHC) based on the importance of FLOSS in firms' commercial offers[8]. In concreate, we have taken the business practices as explanatory variables and the variables having something to do with the involvement into FLOSS development as illustrative variables. Since we try to analyse the link between a use of Floss in offers and, we excluded from our sample the companies for whom this use was very secondary or non-existent. In practical terms, this means, in question 1.1.1 ("Is firm's revenues are coming from the software, the technical services, the expertise and\or the hardware), the compagnies answering no to all the items or hardware suppliers. they represented 8 % of our sample, i.e. 12 companies. Our final sample, then, comprises 134 answers.

3.1 Creation of categories.

As said above, in the creation of the categories (or clusters), only the variables from the questionnaire relevant to the commercial positioning (hardware, software, service, etc.) and to the use of FLOSS in the mounting of the offers were retained[9]. To be more precise, the questions taken into account are as follows:

- Q1.1.1.: Is their revenues are coming from the software, the technical services, the expertise and\or the hardware". The possible answers were: it is not an activity (value 3), it is an activity

[7] 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.

[8] For a definition of clustering analysis, see http://en.wikipedia.org/wiki/Cluster_analysis

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

(value 1), it is a main activity in FLOSS (value 2). In the tables annexed, these are the variables “pACT_1” to “pACT_14”;

- Q1.2.1: is the use of FLOSS in their commercial offer deemed to be or not a specificity of the company (in the tables annexed, it is the variable “rUT_1”, taking the value “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 (in the tables annexed, variable “rut_propr”, with value 1 corresponding to utilisation, whether “from time to time”, “often used”, or “it remains the cornerstone of the offer” and value 2 to “no utilisation of proprietary software”);
- Q1.2.2 the development, or not, of particular connections (certification, exclusive distributor agreements, etc.) with certain companies (Novell Suse, RedHat, Mandriva, Microsoft, etc.) In tables annexed, it is the variable “parts”,which is allocated at 1, if there are special agreements, and -1 either;
- Q1.3.1 the publishing or not of software (variable “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” worth a 1, if the procedure exists, and -1 either);
- Q2.1.6 technical quality as key market positioning element (variable “robj”, worth a 1, if yes, and -1 either).

The other questions were put in illustration, meaning that they are not used to create the categories, but can ilustrate some specificities of the clusters.

3.2 The FLOSS business models.

The best classification is in six clusters, but some of them have not enough elements to be statistically significative. So we had to use the second best classification, in four clusters. They are detailed in appendix 1.

Cluster 1.

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 consulting prestations (precisely 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”. Looking at the question of the part of its turnover made with FLOSS (it is the question 4.1.13 of the survey, illustrative variable rCA_LIB in the tables), the value 4, which means a turnover is entirely made with the FLOSS, is sur-represented in this cluster.

Cluster 2.

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 (Microsoft or RedHat “distributors”, for instance).

Cluster 3.

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).

Regarding the market positioning, we can hardly say that FLOSS is a key element of their business strategy.

Cluster 4.

This category groups brings together the companies using FLOSS, but which have no commercial activities directly based on FLOSS (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 user, but whose core business is not software production, adaptation or setting up.

Their market strategy is to propose "new" offers (robj_1 in 2), and that may explain why they are interested in FLOSS: these new technologies may be more suited or more flexible[10].

Discussion of market strategies.

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 software editors (category one) and service (categories two and three) strategies. The distinction between categories 2 and 3 is in the intensity of use of FLOSS, what, as we will explain in section four, 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 technological bases, so are able to chose different programs or solutions according to their speciality or their internal competencies.

3.3 Link between business model and involvement in FLOSS production.

Data analysis shows that there are various market strategies, represented by the various categories of firms emerging from the AHC. We are now going to test the hypothesis that this various market strategies imply various strategies of involvement into FLOSS development. To do so, we propose to look, among the illustrative variables (i.e. not serving to construct the categories, but facilitating a refinement of the companies' characteristics), at the ones concerning the involvement into communities to see if in some of the clusters there are particular behaviors. More precisely the variables evaluated are:

- the term employed to speak about FLOSS.
- the existence of developers; whether companies hire developers involved in FLOSS projects, etc.

Cluster 1. The editor 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)
- “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).

[10] Thanks to Stefan Kosh for this remark.

Cluster 2. The FLOSS service companies.

The involvement in FLOSS projects is less strong than in category 2, 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 (variable rrdev_tps).

Cluster 3. The service companies using FLOSS.

There are not characteristic elements regarding they participation to FLOSS communities.

Cluster 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. A DISCUSSION OF THE RESULTS.

We made the hypothesis that firms will invest into communities differently, according to their business strategy. Our findings are consistant with this hypothesis as there is various degrees of involvement, between FLOSS specialists (categories 1 and 2) and FLOSS « takers » (categories 3 and 4), but also between the FLOSS specialists as editors are most involved into FLOSS, even if this involvement seems more focussed on projects than on the whole ecosystem.

We propose, in this section, to look at the core competences of each categories to explain the rôle played by the FLOSS products, and why, in some cases they are viewed as specific assets, and in other circumstances, as (more or less) complementary ones.

4.1 Editors, or the Package strategy: FLOSS as a specific asset.

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 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). 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 2006). This is the model of the “technically sustained capacity” (Gadrey 1998). The core competence of the firm is on this capacity to make the product evolving to follow the needs of the users, but making this evolution “sustainable” (ie making it stil appropriable and without a decrease of the performance, for bug reasons).

It is clear that the use of free software packages, (meaning avoiding the cost of licences) procures an advantage on the price. Furthermore the customer can test the whole product before putting it in production. It is obviously an advantage when dominant players are already on the market (CAD “Open Cascade» offer faced with Dassault Systems[11]) 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.

But the specific asset of the producer lays on its package knowledge and on its capacity to manage the dynamic of evolution. This makes the open sourcing of a software owned the specific asset of the firm:

– on the technology markets where the customers are computing developers, revealing the code facilitates cooperation. The producer organizes the collaboration in a “symbiotic” relationship (using

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

the terms of Dahlander and Magnusson 2005). 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 to reduce their costs (Von Hippel, 1988); from the producer's point of view, this decrease the R&D cost as the users provide him with new feature requirements and, more original, implementation;

– on the other hand, only the one who integrates contributions is capable of verifying and of guaranteeing their correct functioning and to help clients to use it.

So, a FLOSS based package model means that the firms who publishes the software remains heavily involved in its development in order to control it. This is why the companies of this category (publisher of one (or several) software (s) under open source licence) answered us that their business is built upon FLOSS, which means :

– their main activity is based on the “integration” (Adaptation in our 3A terminology) and the “support” (Assurance) of (free) open source software”, the training (on FLOS), and to a lesser extent on consulting prestations (precisely audit and guidance on FLOSS, or “Assistance” to the use);

– as their core competence lies on the management of the software edited, the companies only invests on the software they edit, and the involvement of salaried developers in other projects in not encouraged (under the average), which is the exact opposite of service companies, for which FLOSS is complementary asset.

4.2 Service companies, or the Architect strategy. FLOSS as a complementary asset.

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" Microsoft, 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 their singularity (or their core competence) is that they bring together a team of specialists of differing software, but also of customers' vocational specialists. In the following, we will call it **“architect 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. So 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.

And, as Dahlander and Wallin (2006) explain, if ownership is not essential to monitor innovation and component quality, 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. FLOSS and the production communities are, in the end, complementary assets: you have to be able to monitor them, to to own them.

In the answers (cluster 2), more than the average developers have some "spare time" to participate in their particular development projects since this enables the company to broaden its portfolio of tool components software.

We consider this reflect a change in the technologies used, thus of the complementary assets thes firms need to manage, not really in the core competences. Traditional architect firms (cluster 3) do not involve into FLOSS development, as they do not use these technologies. But they may have other process for surveying the evolution of the complementary asse, the technologies they use. They may participate to editors' training sessions, or conclude “global alliance” with their key partners, as Cap Gemini does[12].

We see their behavior as close to the one of firms that have to do research to be able to follow the evolution of the technologies, as studied by Cohen & Levinthal (1989).

4.3 Software users.

As explained before, these compagnies use software technologies to built a service on the Web. So they do not directly sell FLOSS product or services and are a bit out of the scope of this study. However, their behaviour confirms the link between the market and the involvement into communities : as these technologies are not at the core of their offer, we can consider them as complementary asset, but less strategic than for architects. Thus, they do not need to closely monitor the evolution of their tools, participating to FLOSS development.

5. Conclusion.

In this article, we proposed an analysis of an on-line survey of French-speaking European companies using FLOSS in their commercial activities.

We identify two models of business based on FLOSS, and show that firms of each model defers on the way they involve themselves into the communities. Using Teese (1997)'s framework, we defend the ideas that this difference is due to the difference in the core competences of these firms, and on the way they manage their assets.

In one case the dynamic capability of the firms lies on their capacity of managing a specific, specialized technological offer, and FLOSS product is their specific asset, implying a strong investment. In the other case, the dynamic capability of the firms lies on their capacity of monitoring the technologies available to answer to their clients' evolving needs. In this case, FLOSS products are complementary assets and the involvements aim at finding interesting components, monitoring their evolution, being able to adapt them, but not controlling them, as demonstrated by Dallender & Wallin (2006).

And when FLOSS products are less used (in the commercial offers), like by firms belonging to category 3, the involvement into FLOSS production decreases, to reach zero when FLOSS products are just commodities, like in cluster 4.

The small size of the sample (134 responses) did not, however, allow us to be sure of having identify the whole types of medels existing. For instance, editors of Linux distribution see to follow a third model, as they agregate hundreds of products. It this particular case, this is also due to the fact that this model is followed by a few minority of companies worldwide and thus non statistically significative. These actors may have been the most studied. In a nutshell, 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 2003 and 2004).

It is essential to keep control of the platform since it is the corner-stone 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.

[12] http://www.capgemini.com/collaboration/alliancepartners/

We have sumarize this different strategies in table 1.

Table 1. A synthesis of the link between FLOSS commercial strategy and software development

	Type of strategy			
	Package	***Platform***	***Architect***	***Software users***
Economic model	Specific offer for software and user assistance	Standard platform and supplementary offer	Provision of component-based service	Provision of services based on software (website...)
Competitive advantage of FLOSS	Best relation with clients (user-innovator) and price	price	Best technical quality, top quality service	Reducing price of the technical solution used, technical independence from editors.
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)	Same as for standard service companies.	None
FLOSS communities	Specific asset for the package community. Heavy involvement (monitoring) of software as cornerstone of the offer. No scattering.	Specific asset for the plateforme community. Important involvement for key platform components. From zero to weak elsewhere. For local platform distributors, zero involvement.	Potentially strategic complementary asset Participation in key component production to be able to contribute.	Complementary asset. No involvement.

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, and of the accuracy of Teese theoretical framework to explain them.

They also plead for complementary studies in three directions: an international survey (concerning notably Anglo-Saxon companies) should enable a more in-depth study of the link between market and involvement into communities; this should be completed by inside firms studies on the way developers are managed and the degree of control by the hierarchy of developers' time spend in participating to floss development; last these open knowledge production control strategies may be found in other industries, such as biotechnologies. Comparative studies should make us progress on that topic.

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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	MODES 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	CAT/MOD	MOD/CAT	GLOBAL	MODES CHARACTERISTICS	OF VARIABLES	IDEN	WEIGHT
								18.66
					Classe 4 / 4		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