Firms’ involvement in the projects of the OSS community
Some preliminary empirical evidence
and a research agenda

RESEARCH TEAM (UP TO NOW)
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Rationales under the research

It has been acknowledged that **OSS challenges** the traditional way of doing business out of **software solutions** (Bonaccorsi et al., 2006)

- Increasing **economic important** (Ghosh et al., 2006)
- **Open innovation/knowledge paradigm**: knowledge is produced and shared by developers and users (West and Gallagher, 2006)
- Increasing role of **firms’ involvement** in the movement
  - **Large incumbents**: IBM, Sun Microsystems, and, even, Microsoft
  - **SMEs**: entered the market to explore this new business opportunity

On the relationships between **FIRMS AND THE OSS**

- **Open Source Initiative** as the starting point (1998)
  - Addressing firms’ **GPL fear** and showing that it is possible **to profit** from open standards
- **The economic literature**
  - Some **theoretical contributions**
  - Few **empirical studies**, mainly based on qualitative methodologies
Rationales under the research

Research team of OSS of Sant’Anna School

Gathering data on software **firms involved** in the OSS movement

- Sharp **quantitative approach**
- Survey methodology
  - **ELISS I survey**: on 146 Italian firms providing to their customers OSS-based products and services (**Open Source firms**)  
  - **ELISS II survey**: on 918 software firms (NACE code 72.2) from 5 European countries (Finland, Germany, Italy, Spain, and Portugal)

MAIN EMPIRICAL FINDINGS FROM THE ELISS II SURVEY

It has emerged that **Open Source**

(vii) Is a **sustainable** business model, even without **appropriability**

- 1/3 respondents have chosen an OSS-based business model

(ii) Leading role of **hybrid business models**

  - Mix of **OSS** and **proprietary offerings**
  - POSS, MOSS; and LOSS firms
ELISS findings

Particularly, **OPEN SOURCE FIRMS**

(iii) Do **not** attach **much importance** to traditional IPRs
- Patents do not foster innovation, in many cases they hamper it!

(vi) Rely on a large community and succeed in having a **wider product/service portfolios**

The **community**
- Provides **complementary assets**
- Bears the cost of producing the first copy of the software
- Makes user-innovation

(xii) Are active in **more market segments**
- Also in **less mature ones** (Antispam, antivirus,…)

(xv) Participate in **community projects**
The sample

Size distribution of sample firms across countries

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>N</th>
<th>Min.</th>
<th>Max</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>p50</th>
<th>p75</th>
<th>p95</th>
<th>Anova F-test p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>134</td>
<td>1</td>
<td>640</td>
<td>31.03</td>
<td>77.41</td>
<td>7</td>
<td>18</td>
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<tr>
<td>Germany</td>
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<tr>
<td>Italy</td>
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<td>12.46</td>
<td>3</td>
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<tr>
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<td>13</td>
<td>61</td>
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</tr>
<tr>
<td>Spain</td>
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<td>169.26</td>
<td>17</td>
<td>42</td>
<td>302</td>
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<td>1</td>
<td>1400</td>
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<td>120.40</td>
<td>8</td>
<td>20</td>
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</tr>
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</table>

- The size (number of employees) distribution differs across countries and reflects that of firms in the software sector at the national level.
- German and Spanish firms are, in general, larger than the others: only 28% of them hire less than 10 employees and 8% and 3%, respectively, hire more than 500 employees.
- Italian firms are by far the smallest ones.
The sample

Other firms’ structural characteristics

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>p50</th>
<th>p75</th>
<th>p95</th>
<th>Min</th>
<th>Max</th>
<th>p50</th>
<th>p75</th>
<th>p95</th>
<th>Kruskal-Wallis test p-value</th>
<th>Skilled professionals</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Anova F-test</th>
<th>SMEs</th>
<th>Large Firms</th>
<th>Universities</th>
<th>Public sector</th>
<th>End users</th>
<th>Others</th>
<th>Chi-square p-value</th>
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<tbody>
<tr>
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<td>1997</td>
<td>2001</td>
<td>2004</td>
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<td>83.03</td>
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<td>0.50</td>
<td>9.50</td>
<td>1.50</td>
<td>4.50</td>
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<tr>
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<td>2004</td>
<td>1992</td>
<td>1998</td>
<td>2001</td>
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<td>32.12</td>
<td>45.16</td>
<td>41.94</td>
<td>1.08</td>
<td>7.53</td>
<td>2.15</td>
<td>2.15</td>
<td>0.000</td>
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<td>31.07</td>
<td>69.39</td>
<td>20.41</td>
<td>0.00</td>
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<td>2.04</td>
<td>1.02</td>
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<td>1994</td>
<td>1998</td>
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<td>10.29</td>
<td>2.88</td>
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<td>0.50</td>
<td>9.50</td>
<td>1.50</td>
<td>4.50</td>
</tr>
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<td>2004</td>
<td>1995</td>
<td>2000</td>
<td>2004</td>
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<td>0.00</td>
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<td>2.04</td>
<td>1.02</td>
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<td>1.50</td>
<td>4.50</td>
</tr>
<tr>
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<td>200</td>
<td>1971</td>
<td>2004</td>
<td>1994</td>
<td>1999</td>
<td>2003</td>
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<td>21.00</td>
<td>0.50</td>
<td>9.50</td>
<td>1.50</td>
<td>4.50</td>
<td>0.000</td>
<td>83.05</td>
<td>27.99</td>
<td>63.00</td>
<td>21.00</td>
<td>0.50</td>
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<td>1.50</td>
<td>4.50</td>
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<td>1994</td>
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<td>0.50</td>
<td>9.50</td>
<td>1.50</td>
<td>4.50</td>
</tr>
</tbody>
</table>

The variable SKILLS refers to the share of graduate personnel, data on skills are available only for a subset of respondents (N=682).

- **Respondents** are usually young
- In all the countries but Italy and Portugal firms count a considerable share of graduate personnel
- Respondents serve mainly business customers whereas very few work for universities or end users
Is OSS a sustainable business model?

- Information on profitability tend to be considered confidential. Therefore, we had to tackle the topic of sustainability indirectly.

Distribution of the OSS turnover in 2000 and 2003

<table>
<thead>
<tr>
<th>Share of turnover generated by OSS</th>
<th>Year 2000</th>
<th>Year 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>0%</td>
<td>85</td>
<td>33.33</td>
</tr>
<tr>
<td>&lt; 10%</td>
<td>77</td>
<td>30.2</td>
</tr>
<tr>
<td>10% - 30%</td>
<td>42</td>
<td>16.47</td>
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<tr>
<td>31% - 50%</td>
<td>7</td>
<td>2.75</td>
</tr>
<tr>
<td>51% - 70%</td>
<td>10</td>
<td>3.92</td>
</tr>
<tr>
<td>71% - 90%</td>
<td>10</td>
<td>3.92</td>
</tr>
<tr>
<td>91% and 99%</td>
<td>14</td>
<td>5.49</td>
</tr>
<tr>
<td>100%</td>
<td>10</td>
<td>3.92</td>
</tr>
<tr>
<td>TOTAL</td>
<td>255</td>
<td>100</td>
</tr>
</tbody>
</table>

- The share of OSS turnover out of the total has increases over time indicating the sustainability of the OSS business model.
Firms’ assessment of IPRs: patents

- The importance attached by firms to patents as an instrument for increasing revenues is generally low

Firms’ assessment on patents

<table>
<thead>
<tr>
<th></th>
<th>YES (%)</th>
<th>Fisher exact test p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MOSS</td>
<td>LOSS</td>
</tr>
<tr>
<td>We think that patents…&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promote innovation</td>
<td>4.08</td>
<td>27.46</td>
</tr>
<tr>
<td>Hamper innovation</td>
<td>73.47</td>
<td>52.82</td>
</tr>
<tr>
<td>Do not prevent our potential competitors to enter the market</td>
<td>71.35</td>
<td>75.35</td>
</tr>
<tr>
<td>Need a too long legal procedure</td>
<td>87.76</td>
<td>69.72</td>
</tr>
<tr>
<td>Are costly</td>
<td>81.63</td>
<td>76.06</td>
</tr>
<tr>
<td>Constraint versioning</td>
<td>61.22</td>
<td>50.70</td>
</tr>
<tr>
<td>Provide information about innovations and product development by other firms</td>
<td>18.37</td>
<td>28.87</td>
</tr>
</tbody>
</table>

<sup>a</sup> Possible answers: YES, NO; MAYBE. Few firms chose MAY BE and this justifies the use of a Fisher exact test.

- Patents increase the cost of innovations whereas the impact on expected revenues may be dubious
# Offering profile: products

## Firms’ offering in the 18 products categories

<table>
<thead>
<tr>
<th>ID</th>
<th>Classes&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Product category</th>
<th>NOSS</th>
<th>LOSS</th>
<th>MOSS</th>
<th>POSS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N 514</td>
<td>N 166</td>
<td>N 70</td>
<td>N 19</td>
<td>N 769</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>1</td>
<td>S</td>
<td>163</td>
<td>31.71</td>
<td>93</td>
<td>56.02</td>
<td>11</td>
<td>57.89</td>
</tr>
<tr>
<td>2</td>
<td>S</td>
<td>153</td>
<td>29.77</td>
<td>73</td>
<td>43.98</td>
<td>47</td>
<td>67.14</td>
</tr>
<tr>
<td>3</td>
<td>N</td>
<td>146</td>
<td>28.40</td>
<td>57</td>
<td>34.34</td>
<td>40</td>
<td>57.14</td>
</tr>
<tr>
<td>4</td>
<td>N</td>
<td>135</td>
<td>26.26</td>
<td>73</td>
<td>43.98</td>
<td>39</td>
<td>55.71</td>
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<tr>
<td>5</td>
<td>N</td>
<td>117</td>
<td>22.76</td>
<td>69</td>
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<td>55.71</td>
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<td>6</td>
<td>N</td>
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<td>68</td>
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<td>7</td>
<td>N</td>
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<td>53</td>
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<tr>
<td>8</td>
<td>W</td>
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<td>25.88</td>
<td>63</td>
<td>37.95</td>
<td>40</td>
<td>57.14</td>
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<td>W</td>
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<td>40.00</td>
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<td>10</td>
<td>W</td>
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<td>22</td>
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<td>W</td>
<td>41</td>
<td>7.98</td>
<td>28</td>
<td>16.87</td>
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<td>18.57</td>
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<tr>
<td>12</td>
<td>W</td>
<td>127</td>
<td>24.71</td>
<td>73</td>
<td>43.98</td>
<td>45</td>
<td>64.29</td>
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<tr>
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<td>W</td>
<td>150</td>
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<td>70</td>
<td>42.17</td>
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<td>W</td>
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<td>39</td>
<td>23.49</td>
<td>27</td>
<td>38.57</td>
</tr>
<tr>
<td>15</td>
<td>O</td>
<td>333</td>
<td>64.79</td>
<td>84</td>
<td>50.60</td>
<td>38</td>
<td>54.29</td>
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<td>16</td>
<td>O</td>
<td>274</td>
<td>53.31</td>
<td>82</td>
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<td>40.36</td>
<td>34</td>
<td>48.57</td>
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</tbody>
</table>

<sup>a</sup> Products have been grouped as follows. S: server products, N: network infrastructure products; W: Web products; O: Other kind of products
Offering profile: services

Compared with NOSS, **OSS firms** have a *broader product portfolio*

- The number of **supplied products increases** with the **degree of openness**

**Firms’ offering in the 11 service categories**

<table>
<thead>
<tr>
<th>ID</th>
<th>Software related services</th>
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<tr>
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<tr>
<td></td>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
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<td>45.38</td>
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<tr>
<td>9</td>
<td>Adapting codes written by others to suit customers’ needs</td>
<td>219</td>
<td>99</td>
<td>54</td>
<td>17</td>
<td>389</td>
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<tr>
<td></td>
<td></td>
<td>42.61</td>
<td>59.64</td>
<td>77.14</td>
<td>89.47</td>
<td>50.59</td>
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<tr>
<td>10</td>
<td>On order software development from the scratch</td>
<td>356</td>
<td>129</td>
<td>62</td>
<td>14</td>
<td>561</td>
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<td></td>
<td></td>
<td>69.26</td>
<td>77.71</td>
<td>88.57</td>
<td>73.68</td>
<td>72.95</td>
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<tr>
<td>11</td>
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<td>95</td>
<td>51</td>
<td>17</td>
<td>448</td>
</tr>
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<td></td>
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<td>55.45</td>
<td>57.23</td>
<td>72.86</td>
<td>89.47</td>
<td>58.26</td>
</tr>
</tbody>
</table>

- This is made possible by the **exploitation** of the **open knowledge base** created by the community of developers
Offering profile: summary

NOSS are active in mature segments
- Mainly in Office Automation, Management Software & Databases
- MS Office is the leader in Office Automation (over 90% market share), SAP is the leader in Management & Data Management

OSS FIRMS
- Have entered also less mature segments

- Seem to be very active in segments in which it is acknowledge the existence of a wide community of users/producers
  - In the absence of a large incumbent
  - The Apache Web server
Starting point

From the ELISS II survey: **OSS firms contribute to the projects of the community**

- By fixing **bugs**, providing **mailing list assistance**, and, even, **writing code**

This **believes** the idea that they simply **exploit** the code of the OS developers

<table>
<thead>
<tr>
<th></th>
<th>PARTICIPATED</th>
<th></th>
<th>COORDINATED</th>
<th></th>
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<tr>
<td></td>
<td>From the start of OS</td>
<td>2003</td>
<td>From the start of OS</td>
<td>2003</td>
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<td>Min</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Max</td>
<td>150</td>
<td>50</td>
<td>30</td>
<td>15</td>
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<tr>
<td>Mean</td>
<td>7.2</td>
<td>4.0</td>
<td>2.1</td>
<td>14</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>17.7</td>
<td>8.1</td>
<td>4.2</td>
<td>2.6</td>
</tr>
</tbody>
</table>
OSS projects the firm has participated to/coordinated in 2003

Participation: N = 113; Coordination: N = 121
Contribution to OSS community

- Contributing code that was accepted in projects’ official versions: 69.1%
- Writing documentation: 61.6%
- Providing user assistance within the projects’ mailing lists: 56.6%
- Contributing code that was NOT accepted in projects’ official versions: 51.5%
- Fixing bugs: 45.8%

Question 26

N = 139
DO FIRMS TAKE PART IN COLLECTIVE ACTION PROCESSES?

- Few investigations on whether and how OSS firms directly feed open code basin by contributing their own developments back to the community

METHODOLOGICAL CONCERNS

- Focus on a single project or on few firms (Henkel, 2006)

- Qualitative methodologies (Dahlander and Magnusson, 2005; Lin, 2006)

- Shortcomings of survey data (Bonaccorsi and Rossi, 2003)
  - No information on the projects to which respondents take part
  - Few information about firms’ activities within the projects
  - The very concept of project participation is surrounded by confusion
    - Over/Under/Estimation
    - Small samples
Research questions

Within this framework, **four basic research questions** come to the limelight

1. Do firms act not only as **takers** but also as **givers** by directly contributing to OSS projects?

   □ **Methodology**: data collection from **SourceForge** and its linked Web sites

2. If yes, what do **firms do** within the projects?

   □ Do they only carry on ancillary works, or do they also provide code and undertake coordination activities?

3. Does the presence of firms shape **the evolution of the projects**?

   □ Are there significant differences between projects participated by firms and the others? Or after and before firms’ entrance?

4. Do firms joining in OSS projects **innovate more** or in a **different manner**?

Basing on preliminary **empirical findings**, a **research agenda** for the future is proposed
Data and methodology

Data are collected using **SourceForge**: the largest OSS repository on the Internet

- Plenty of information about the hosted projects
- No risk of subjective interpretation of the information

**Project selection**: on the basis of the **level of activity**

- Ranking of projects’ activity determined by the repository
- Selection of the 300 most active projects (Klincewicz, 2005)

Data collected from

- **SourceForge repository**
  - Number of developers and administrators
  - Date of registration on the repository
  - Type of licence under which the code is released…

- **Web sites and other instruments** outside SourceForge and linked to it
  - Information on companies’ participation (Mainly through projects’ mailing lists, Web sites, and forums)
Main results: projects’ characteristics

A. PROJECT DIMENSIONS. The developing team is fairly narrow
- In line with other researches on the topic (Ghosh et al., 2002a, 2002b)
- The median number of programmers is 7, 15% of one man projects

B. LICENSES. The most widespread licence is GPL (Lerner and Tirole, 2005)
- GNU GPL: 57.91%
- LGPL: 12.84%
- BSD licence: 7.76%

C. TECHNICAL ASPECTS
- Widely use of the instruments put at the disposal of developers
- Java as the most widespread programming language
- Compatibility with the Windows operating systems
  - Evolution of the OS movement from its strong ideological origins
- Projects mainly targeted on advanced users or developers
  - High skills required
Main results: firms’ participation

97 PROJECTS (32.33%) SHOW THE INVOLVEMENT OF FIRMS

A. COORDINATION: the most frequent form of participation (60 cases)
- Good relationships between firms and the OS community: the leadership emerges from the bottom up (O’Mahony, 2003)
  - Foundation of the project, provision of valuable code, bright solutions to critical technical problems (Bonaccorsi et al., 2006)
- Ways in which firms succeeded in achieving the leadership
  - Creating the project
  - Entering an existing project and replacing the coordinator
  - The firm was settled up by the members of the project coordinating group

B. COLLABORATION to development in different ways (bug fixing, testing or offering services, 37 cases)

C. PROVISION OF CODE (7 cases)
Main results: Peculiarities of the projects participated by firms

Several disparities emerge between projects participated by firms and the others

- Firms’ presence shapes project evolution?
- Endogeneity concerns

In general, projects participated by commercial firms

- Are MORE ACTIVE
  - Are larger: more developers and more coordinators
  - More intense bug reporting activity
  - Wider use of the mailing lists

- MANAGE IPRS IN A DIFFERENT WAY
  - Less GPLed projects (45.36% vs. 73.89 % )

- PROVIDE DIFFERENT TYPOLOGY OF SOFTWARE
  - More products targeted to companies
  - The average user seems to have higher computer science skills

- SHOW SOME TECHNICAL DIFFERENCES
  - For instance: use of different programming languages, with a wider presence of the Java language
Conclusions

Our empirical results reveal as, at present, the OS movement differs considerably from its origins

A. Increasing role of for profit firms
- Almost 1/3 of the 300 sampled projects: some form of firms’ involvement

B. Different types of links between these companies and the OS community
- Coordination, code offering, or provision of other kinds of contributions

C. Firms have an impact on the evolution of the projects
- Differences between the projects participated by firms and the others
  - Are more active and larger: more developers, more coordinators, more debugging
  - Make less use of the GPL licenses
  - Show several technical peculiarities
  - Solutions targeted mainly on companies and high skill-users
Research agenda

Our findings do not provide **definite conclusions** → Research agenda

1. **A wider survey of literature on firms’ participation in collective action**
   - To disentangle the main aspects of the topic
   - **Interdisciplinary** approach
     - Sociology and psychology have widely contributed to the understanding of PPCG

2. **Clear research hypotheses should drive the empirical analyses**
   H1. Are projects in which firms involved more successful than the others?
   Methodological problems
   - The concept of success is hard to define: integration of different metrics
   - Endogeneity concerns: is it firms’ involvement to shape the success of a project or, viceversa?
   - Inferential procedures are not suitable to address these issues
     - Definition of empirical models and application of appropriate econometric techniques
Research agenda

H2. What are the characteristics of the firms involved in OS projects?
- Case studies focusing on the relationships between companies and projects
- Data should be gathered on structural characteristics of these firms
  - Age, size, competence
  - Do they differ from those following the traditional model?
  - How these difference are related to project participation?

H3. How project participation shapes the innovation activity?
- Are firms participating in OS projects more innovative than the others?
- Open innovation model (Chesbrough et al., 2006): firms can achieve a greater return on their innovation by using a broad range of knowledge sources
- OS is a clear example of open innovation (West and Gallangher, 2006)
  - The OS community is a large knowledge basin
  - OS licenses are designed to foster instead of forbidden the access to the information
Research agenda

METODOLOGY

c. Enlarging our sample from 300 to 1,000 projects

B. Data gathered from different sources: underestimation the phenomenon

- Firm making few contribution to the code: no cited in project Website
- Collecting information directly from the code posted on SourceForge
- Software scanning applications (CODD, Ghosh and Prakash, 2000)

C. A more rigorous methodology is needed
Firms’ involvement in the projects of the OSS community
Some preliminary empirical evidence and a research agenda

RESEARCH TEAM (UP TO NOW)
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