Open-Source Platforms: 
*Multiple studies in the mobile devices industry*

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**Abstract**

This doctoral student research addresses the emergence of open-source based platforms currently attaining notorious relevance within the mobile devices industry. It aims at providing a better understanding on “how and why corporations follow open-source based platform strategies?” within high-networked markets under constant technological evolution. Drawn over the constructs of multi-sided platforms (Rochet & Tirole, 2003; Hagiu & Wright, 2011) and plenty of studies on open-source software adoption such as Lerner and Tirole (2002), Feller and Fitzgerald (2002) and Weber(2004), this research also bridges business strategy in network economics (Gawer & Henderson, 2007; Gawer & Cusumano, 2008) with the psychological and anthropological concepts of sense of community (SoC) and communities of practice (CoP). The researcher follows a theory testing approach, where established theories developed on previous decades over the Personal Computer and Operating Systems are replicated in a completely new and emergent context. By taking a pure qualitative case-study approach on the moulds of Eisenhardt (1989) and Myers (1999), the researcher developed a set of descriptive and in-depth case-studies within the mobile devices industry, answering the lack of empirical research on strategies used by open-source platform providers. Natural occurring data was collected from Internet s and semi-structured interviews were conducted within an industrial key-player with the goal of providing a framework and a theory that would extend what is known on open-source products to open-source platforms. Practitioners are then provided with better guidance for designing and implementing their networked technological strategies, to let their computer-based platforms succeed in high competitive under network effects.

**Keywords:** OSS, FLOSS, Open-source, Platforms, Eco-systems, Technological-strategy
1 Introduction
The research author seeks to complement the existing body of theoretical knowledge on open-source software, drawn mostly from research on open-source software products, by pointing his lenses to software platforms (often referred empirically as “ecosystems”).

With a purposive-focus on the telecommunications industry, the researcher studies the emergence of mobile open-source platforms such as Maemo, Meego, Android and Bada empowering big corporations such as Google, Nokia, Intel and Samsung within the high-competitive mobile devices market.

Computer-based platforms combine core components with complementary products and services habitually made by a variety of external entities (Gawer & Cusumano 2008). In the case of high-technology and high-competitive markets, many firms follow a platform-based strategies due to the impossibility of satisfying by themselves an exceedingly complex consumer group (Hagiu 2004).

2 Research questions
The aim of this research study is to investigate the strategies used by open-source platform providers. Its core objective is to provide a better understanding on how companies like Apple, Google and Nokia integrate open-source software technological components under public domain into their platforms empowering proprietary mobile devices. A set of research questions include:

- **RQ1**: What are the open-source software technological components integrated by the mobile devices vendors?
- **RQ2**: How open-source software affects the competitive dynamics of the mobile devices industry?
- **RQ3**: How rival platform-vendors collaborate in the open-source arena?
- **RQ4**: Why companies follow open-source platform-based strategies?

The research questions follow and What, How and Why logic. The researcher strategically addressed first the What and How questions, without rushing to answer to the final Why question (RQ4).

3 Literature review
This research reviews multi-disciplinary literature, mostly within the information systems, economics and strategy research streams. The research author pursued to cover the current body of theoretical knowledge addressing the open-source software (OSS) phenomena, as addressed by Lerner and Tirole (2002), Feller and Fitzgerald (2002) and Weber (2004); research addressing computer-based platforms and multi-sided platforms (Rochet & Tirole, 2003; Hagiu, 2004; Hagiu & Wright, 2011); and research bridging business strategy and network economics (Gawer & Henderson, 2007; Gawer & Cusumano, 2008).

Regarding the review of OSS literature, a crucial part of this research, the author identified several recent and comprehensive literature reviews addressing the OSS phenomena (Stol & Babar 2009; Aksulu & Wade 2010; Hauge et al. 2010; Lindman 2011).
A notable systematic literature review by Stol and Babar (2009), covering specialized conference proceedings, pointed-out the heterogeneity and lack of empirical studies dealing with OSS in organisations. Another systematic literature review from Hauge et al. (2010), confirmed the heterogeneity in which companies approach OSS prompting lack of empirical research on OSS adoption in organizations.

Lindman (2011) extended the two previous mentioned reviews, in yet another systematic literature review covering both open-source journals (Hauge et al. 2010) and top Information Systems journals (Rainer & Miller 2005). He argues that current body of knowledge emphasis on OSS community-driven development with limited interest on OSS within organizations.

Last but not the least, yet another literature review by Aksulu and Wade (2010) paused and reflected on the state of open-source research; analysed and categorized a wide-set of open-source research; and proposed a framework to situate OSS research within a wider nomological network while proposing future directions for open-source research.

Besides the existence of the previously reported recent, comprehensive and systematic literature reviews on OSS, and in order to review relevant theoretical knowledge on other relevant constructs such as computer-based platforms and multi-sided platforms (Rochet & Tirole, 2003; Hagiu, 2004; Hagiu & Wright, 2011), business strategy and network economics (Gawer & Henderson, 2007; Gawer & Cusumano, 2008), the author was forced to perform his own systematic literature review.

From the beginning of the doctoral project, the author kept reviewing by systematic manners a literature review bridging OSS with platforms. This in-progress literature review, based on search keywords and research databases, was initially defended at the Information Systems Research Seminar in Scandinavia (IRIS) seminar in 2011, and submitted as a working paper to the European Conference on Information Systems (ECIS) in 2012. The research author identified a set of emergent research, with stronger focus on platforms over products, that highlighting the limited empirical research on strategies used by open-source platform providers on industry.

For concluding this chapter, from reviewing a very wide body of theoretical knowledge, the author identified a limited but emergent research stream addressing both OSS and platforms. If the scholars Stol and Babar (2009), Hauge et al. (2010) and Lindman (2011) argue, on a common voice, that current research lacks empirical studies bridging OSS with organisations, the author argues that current research lacks even more empirical studies bridging OSS platforms with organisations.

4 Theoretical background

This study lays down on previous research built around the concept of multi-sided platforms as introduced by Rochet and Tirole (2003) and further developed by Hagiu (2004), Rochet and Tirole (2006) and Boudreau (2008), the concept of computer-based platforms first coined by Pohl (1998); and key studies on OSS adoption (Wang & Wang 2001; Feller & Fitzgerald 2002; West 2003; Dedrick & West 2004).

With a strong multidisciplinary research character, constructs from outside the perceived boundaries of the information system research were included; Such as the Gawer and Cusumano (2008) strategy tool kit for firms pursuing platform based operational models and the work from Katz and Shapiro (1994) who looks at the role of network effects in the telecommunication industry in a pure network economical
context. From philosophy, the theoretical propositions of sense of community (SoC) from McMillan and Chavis's (1986) were adopted, as well as the concept of community of practice (CoP) as proposed by the cognitive anthropologists Lave and Wenger (1991).

5 Methodology and scope

5.1 Epistemological Ontologies and Method

The research author, committed to an article-collection dissertation strategy, did not follow a single epistemological and ontological trajectory. Rather than choosing a particular research approach *apriori* of the field work, the researcher adopted different approaches for each paper while pursuing epistemological consistency on each individual research project.

The author took the stance of a pluralist (Mingers, 2004) employing multi-dimensional research strategies (Mason, 2006) that is, accepting and celebrating a wide variety of paradigms and research approaches on the same topic (Mingers, 2001), in this case the integration of OSS by platform-vendors in the emergent mobile devices industry.

Driven by What, How and Why research questions, the approach of this research is mostly qualitative and most original articles are interpretative (Klein & Myers 1999; Walsham 1995). The research was conducted according to ethnographic principles that empower data collection with limited influence from the established body of theoretical knowledge (Myers 1999; Atkinson 2006). The author was more interested by grounding theories rather than building variance based models (Benbasat et al. 1987; Myers 1997; Markus & Robey 1988; Urquhart & Fernández 2013). By taking and ethnographic approach, the theoretical integration was performed *a posteriori* of the field work and data collection.

The researcher built its methodological awareness both by attending doctoral-level courses and seminars and by reviewing three books in the following order Silverman (2009), Eriksson & Kovalainen (2008) and Myers (2002), all wide-recognized methodology book on qualitative research applied on social sciences, business studies and Information Systems.

The following table summarises the research questions, methods and methodological sources driving each individual research project, as reported in more detail on the author’s article collection bundled in doctoral dissertation.

<table>
<thead>
<tr>
<th>Author article</th>
<th>Research question</th>
<th>Method</th>
<th>Methodological references</th>
</tr>
</thead>
</table>
| Article 1      | What do we know about open-source and platforms? | Literature review | Webster & Watson 2002  
Järvinen 2008 |
| Article 2      | Measuring the openness of computer-based multi-sided platforms | Literature review | Webster & Watson 2002  
Järvinen 2008 |
| Article 3      | RQ1               | Descriptive case-study | Eisenhardt 1989 |
| Article 4      | RQ2               | Descriptive case-study | Eisenhardt 1989  
Kozinets 2002 |
5.2 Data collection

Data was collected mostly from public-available and naturally-occurring qualitative data on the Internet such as: listed-companies public financial information, companies-press releases, generalist press, specialized press on technology and mobile devices, open-source software projects source-code and documentation, open-source software projects bug-repositories and the change-log from an open-source software project version-control-system. In addition, and for addressing the Why research question (RQ4), semi-structured interviews were conducted in a major firm within the Mobile devices industry.

The following table sensitises the research data-collection procedures employed at each individual research project. More details are provided on each article bundled with author's doctoral dissertation.

<table>
<thead>
<tr>
<th>Author article</th>
<th>Research question</th>
<th>Unit of Analysis</th>
<th>Collected data</th>
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<tbody>
<tr>
<td>Article 1</td>
<td>What do we know about open-source and platforms?</td>
<td>Body of theoretical knowledge</td>
<td>Research papers retrieved from research databases indexing books, journals and conference proceedings.</td>
</tr>
<tr>
<td>Article 2</td>
<td>Measuring the openness of computer-based multi-sided platforms</td>
<td>Body of theoretical knowledge</td>
<td>Research papers retrieved from research databases indexing books, journals and conference proceedings.</td>
</tr>
<tr>
<td>Article 3</td>
<td>RQ1</td>
<td>Mobile devices industry players controlling the iOS, Android and Maemo platforms.</td>
<td>Open-source software projects source-code and documentation</td>
</tr>
<tr>
<td>Article 4</td>
<td>RQ2</td>
<td>Mobile devices industry players controlling the iOS, Android and Maemo platforms.</td>
<td>Companies public financial information, companies-press releases, generalist press and specialized press on technology and mobile devices</td>
</tr>
<tr>
<td>Article 5</td>
<td>RQ3</td>
<td>The WebKit open-source software project</td>
<td>Open-source software projects bug-repositories and the change-log from an open-source software project version-control-system.</td>
</tr>
<tr>
<td>Article 6</td>
<td>RQ4</td>
<td>Major firm within industry steering an open-source based mobile platform</td>
<td>8 Semi-structured interviews: Software developers, Testers, Integrators, Marketing and Strategy</td>
</tr>
</tbody>
</table>

Table 2: Data-collected for each article unit-of-analysis
5.3 Data analysis
Reflecting the pluralism employed on this research (Mingers 2001; Mingers 2004; Mason 2006) a multitude of qualitative data-analysis and theory-building approaches were employed. The following table enumerates the employed data-analysis and theory-building approaches and corresponding methodological sources that guided the research design. More detail is provided in each dissertation article.

<table>
<thead>
<tr>
<th>Author article</th>
<th>Collected data</th>
<th>Approach</th>
<th>Methodological references</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article 1</td>
<td>Research papers retrieved from research databases indexing books, journals and conferee proceedings.</td>
<td>Analysis of literature review</td>
<td>Webster &amp; Watson 2002 Järvinen 2008 Vom Brocke et al. 2009 Okoli, K Schabram 2010</td>
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<tr>
<td>Article 3</td>
<td>Open-source software projects source-code and documentation</td>
<td>Multiple-case study</td>
<td>Eisenhardt 1989</td>
</tr>
<tr>
<td>Article 4</td>
<td>Companies public financial information, companies-press releases, generalist press and specialized press on technology and mobile devices</td>
<td>3 rich description of the OSS strategies employed by Apple, Nokia, Google Cross-case analysis</td>
<td>Eisenhardt 1989</td>
</tr>
<tr>
<td>Article 6</td>
<td>8 Semi-structured interviews: Software developers, Testers, Integrators,</td>
<td>Categorization Grounded theory</td>
<td>Benbasat et al. 1987 Myers 1999</td>
</tr>
</tbody>
</table>
6 Expected contributions

Besides testing last-decades knowledge on computer-based platforms (Pohl 1998; Gawer & Cusumano 2008) and multi-sided platforms (Rochet & Tirole, 2003; Hagiu, 2004; Hagiu & Wright, 2011), this study aims to provide scholars with rich descriptions of real-world issues faced by corporations following open-source based platform strategies. Both from combining multiple case-studies, multiple-research approaches and from bridging theoretical constructs across different disciplines, the author proposes both a framework and a theory for analysing the manifestations of open-source platform-based strategies in the mobile devices industry.

This researcher also matters to practitioners by producing a valuable framework giving guidance on why and how corporations follow an open-source based platform strategy, what are the main benefits/outcomes pursued and what are the main barriers and risks to face. The research will produce, as well, relevant information for both consumers and suppliers of open-source software competing in today’s high-networked economy.

Acknowledgement

The author would like to thank his supervisor Professor Reima Suomi for constantly reviewing the many versions of his doctoral studies research proposal.

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Lindman, J. (2011). *Not Accidental Revolutionaries: Essays on Open Source Software Production and Organizational Change*. Aalto University, School of Economics, Department of Information and Service Economy.


