SALES GENERATED USING OPEN SOURCE SOFTWARE PROJECTS

by

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ABSTRACT

Data from fourteen software companies in North America and Europe was used to: (i) develop a model that synthesizes the structures used to generate sales enabled by open source projects; (ii) develop propositions anchored around the model of how open source companies generate sales; (iii) identify the risks that software companies face when their sales depend on open source projects; and (iv) distinguish between the motives for software companies to establish and participate in open source software projects.

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GLOSSARY

BSD	Berkeley Software Distribution
CMS	Content Management System
CRM	Customer Relationship Management
ERP	Enterprise Resource Planning
ESB	Enterprise Service Bus
GNU	GNU's Not UNIX
GPL	GNU General Public License
LGPL	GNU Lesser General Public License
MPL	Mozilla Public License
OSS	Open Source Software
RFID	Radio Frequently identification
SIP	Session Initiation Protocol
TMT	Top Management Team
VoIP	Voice over Internet Protocol

1 INTRODUCTION

This research examines the structures used by open source software (OSS) companies to generate sales from the OSS projects that they set up. For the purpose of this research, an OSS company is a company that generates its revenues from the sale of OSS related products and services.

An OSS is a computer program with a distribution license that provides users the freedom to run the program for any purpose, to study and modify the program, and to redistribute copies of either the original or modified program without having to pay royalties to previous developers[1] (Wheeler, 2005).

Researchers have studied the (i) motivations for companies to participate in OSS projects (Lerner and Tirole, 2002; Feller and Fitzgerald, 2002; Bonaccorsi and Rossi, 2003; Henkel, 2003), (ii) relationships companies build with OSS communities (Dahlander and Magnusson, 2005), (iii) approaches companies take to interact with OSS communities (Lerner and Tirole, 2004), (iv) business models that companies use to generate sales based on OSS projects (Raymond, 1999; Dahlander, 2004; Bonaccorsi, Giannangeli and Rossi, 2004; Watson, Wynn and Boudreau, 2005) and (v) risks OSS companies face (Watson et al., 2005). While the research has increased our understanding of OSS companies, much about them is not known.

The rest of this chapter is organized into four sections. The first section describes the research objectives. The second section explains the relevance of this research. The

[1] For the widely accepted definition of OSS, see http://www.opensource.org/docs/definition.php.

third section discusses the contributions this research makes. The fourth section describes how this thesis is organized.

1.1 Research objectives and outcomes

The objective of this research is to answer three questions:

- What structure does an OSS company use to generate sales from the OSS project that it sets up?
- What are the risks that an OSS company may face by becoming dependent on an OSS project?
- Are the motives companies have for establishing OSS projects different than the motives companies have to participate in OSS projects?

The outcomes of this research are:

- Model of the structure an OSS company uses to generate sales
- Propositions anchored around the model
- Risks OSS companies face when they depend on OSS projects
- Motives for OSS companies setting up OSS projects
- Motives for OSS companies participating in OSS projects

1.2 Relevance

This research is relevant for at least three reasons. First, the results provide useful guidelines for the top management teams of software companies that wish to grow their businesses by becoming OSS companies. The results help managers better

understand what they need to do to generate sales enabled by OSS projects and the risks of being interdependent with one or more OSS projects.

Second, scholars interested in why companies participate in OSS projects may be interested to know the differences between the motives companies have for setting up OSS projects and the motives companies have for participating in OSS projects.

Third, companies' strategic planners may be interested in the results of this research for the purpose of assessing the benefits and risks of companies anchoring their businesses around OSS projects.

1.3 Contribution

This research makes at least three contributions. First, this research develops a model that synthesizes the structures that are used by software companies to generate sales from the OSS projects that they set up. While several ways for a company to generate sales using OSS projects have been identified in the professional literature (Koenig, 2004), the structure a company needs to build to generate sales based on one or more OSS projects is not known.

Second, this study identifies the risks faced by OSS companies. The literature is comprised of only one article that describes the strategic risks that one OSS company faced (Watson et al., 2005). This research contributes to our understanding of OSS companies by identifying and categorizing the strategic risks they face.

Third, this research identifies the differences between motives for companies to set up OSS projects and motives for companies to participate in OSS projects. Previous studies have addressed the differences between the motives of individuals and companies to participate in OSS projects (Bonaccorsi and Rossi, 2003). The differences between the motives for companies to set up and participate in OSS projects have not been examined previously.

1.4 Organization

The thesis is organized into six chapters. Chapter 1 is the introduction. Chapter 2 reviews the literature. Chapter 3 describes the research method. Chapter 4 provides the results obtained. Chapter 5 discusses the research results. Chapter 6 provides the conclusions, discusses the limitations of this research, and identifies opportunities for future research.

2 LITERATURE REVIEW

This chapter is organized into six sections. Section 1 examines the studies on the motivations for companies to participate in OSS projects. Section 2 describes companies' approaches of operating businesses based on OSS projects and their relationships with OSS communities. Section 3 discusses the role of business models in generating value from technology innovations. Section 4 examines the research on strategic networks and the role of networks in helping generating revenues. Section 5 discusses the risks associated with OSS commercialization. Section 6 discusses the lessons learned from the literature review.

2.1 Companies' and individuals' motivation to participate in OSS projects

Research on what motivates individuals and companies to participate in OSS projects has been conduced recently. Studies focused on the motivations of software developers to participate in open source software development include Bates, Wolf and Lakhani (2002), Ghosh, Glott, Krieger and Robles (2002), and Hertel, Nieder and Hermann (2003). Studies that focus on why companies become involved in OSS projects include Lerner and Tirole (2002), Feller and Fitzgerald (2002) and Bonaccorsi and Rossi (2003).

Feller and Fitzgerald (2002) proposed a framework for investigating the motivations of individual developers and organizations involved in OSS projects. This framework contains three aspects: economic, social and technological. Rossi and Bonaccorsi (2005) proposed to study these motivations from another perspective, one which is

complementary to the Feller and Fitzgerald's framework. Rossi and Bonaccorsi (2005) distinguish between extrinsic and intrinsic motivations. Extrinsic motivations refer to situations where the needs are satisfied indirectly, especially through monetary compensation (Osterloh and Frey, 2002). Intrinsic motivations refer to when an activity is undertaken to satisfy an immediate need (Kuster, Osterloh and Rota, 2002). Rossi and Bonaccorsi (2005) found that extrinsic incentives drive companies to participate in OSS projects.

Bonaccorsi and Rossi (2003) conducted a comprehensive empirical study on Italian companies' motivations to participate in OSS projects. They found significant differences between companies' and individuals' motivations for participating in OSS projects. They found that companies focus on economical and technological incentives for contributing to OSS rather than the social factors that are more typical of individuals. Table 1 provides the list of motivations compiled by Bonaccorsi and Rossi (2003).

Table 1: Taxonomy of companies' motivations to participate in OSS projects

No.	Motivation	Area
1	Because OSS allows small enterprises to afford innovation	Economic
2	Because contributions and feedbacks from the free software community are very useful to fix bugs and improve our software	Technological
3	Because of the reliability and quality of the OSS	Technological
4	Because we want to be independent of the price and license policies of the large software companies	Economic
5	Because we conform to the values of the Free software movement	Social
6	Because we want to place our source code and skills at disposal of the free software community and we hope that others do the same thing.	Social
7	Because in the field of Free Software we can find easily good IT specialists	Economic
8	Because we want to study the code written by other programmers and use it for developing new programs and solutions	Technological
9	Because opening our source code allows to gain a reputation among our customers and competitors	Economic
10	For having products that are not available on the proprietary software market.	Technological
11	Because we think that software should not be a proprietary good.	Social

Source: Bonaccorsi and Rossi (2003)

2.2 Companies' relationships with OSS communities

Several studies examined the relationships between commercial companies and OSS communities, the approaches companies take to interact with OSS communities, and how commercial companies base their business on OSS products and communities (Raymond, 1999; Dahlander, 2004; Lerner and Tirole, 2004; Dahlander and Magnusson, 2005; Bonaccorsi et al., 2004; Watson, Wynn and Boudreau, 2005).

Dahlander and Magnusson (2005) studied four open source companies and identified three basic approaches that companies use to interact with OSS communities. They also identified a set of managerial challenges a company may encounter and operational means an OSS company may adopt. Table 2 summarizes their key findings.

Lerner and Tirole (2004) examined the ways commercial companies work and compete with OSS communities. They found that commercial companies benefit when they offer expertise in some proprietary segment of the market which is complementary to the OSS project. A company can provide services and products that are complementary to the open source product, but are not supplied efficiently by the open source community. Companies may directly devote their programmers to participate in open source projects to learn about the strengths and weaknesses of this development approach. They may even release some of their proprietary source code to the community.

Table 2: Relationships between OSS companies and OSS communities

	Symbiotic	Commensalistic	Parasitic
Description	A company gives something to the community, which often is established by the company. A "company gains – community gains" situation.	A company obtains useful input from the community. A "company gains – community indifferent" situation.	A company obtains useful inputs from the community, while do not obey the OSS values, and rules. A "company gains – community loses" situation.
Company's influence on community	High	Low	None
Managerial challenges	▪ Respect OSS norms and values ▪ Obey license ▪ Resource consumption of developing community	▪ Respect OSS norms and values ▪ Obey license ▪ Getting acceptance of the community for using its resources in commercial applications	▪ Avoiding direct conflicts
Operational means of subtle control	▪ Attracting developers ▪ Aligning different interests ▪ Resolving ambiguity about control and ownership ▪ Devoting personnel to work in communities ▪ Creating and maintaining reputation ▪ Fringe benefits ▪ Interaction tools ▪ Selling development tasks	▪ Devoting personnel to work in community	

Source: Dahlander and Magnusson, 2005

Commercial companies may also compete directly with OSS providers in the same product market. Finally, commercial companies may interface with the OSS communities in order to enhance their public relations with programmers and customers (Lerner and Tirole, 2004).

Dahlander (2004) conducted a multiple case study on the approaches small OSS companies used to appropriate returns from OSS projects. He identified five major

approaches of creating revenues using OSS: (1) consultancy, providing domain expertise in certain areas; (2) education; (3) support (e.g., installation, upgrading and trouble shooting); (4) licensing, adding a proprietary part to the OSS product, or providing a commercial license for the open source code that allows the use of code in their proprietary products; and (5) black-box, the packaging software products in hardware solutions.

Raymond (1999) compiled a list of approaches companies can use to generate revenue from open source. Table 3 lists the seven key approaches proposed by Raymond (1999).

Table 3: Seven approaches to generate revenue from open source

Approach	Description
Loss-Leader/Market Positioner	Using OSS to obtain a market position for proprietary software that generates direct revenue
Widget Frosting	Hardware manufactures providing software as OSS while selling hardware to generate revenue
Give Away Recipe, Open a Restaurant	Providing services rather than software products to generate revenue
Accessorizing	Providing accessories for OSS products, such as CDs, books.
Free the Future, Sell the Present	Providing closed-source products presently, while promising to open the source code in the near future
Free the Software, Sell the Brand	Providing OSS products for free, while retaining an examination suite or set of compatibility criteria, then selling users a brand certifying that their implementation of the technology is compatible with all others wearing the brand
Free the Software, Sell the Content	Providing software for free, while selling subscriptions to contents for profit

Bonaccorsi et al. (2004) studied the business models of open source firms, as well as their strategies. They focused on the hybrid business models adopted by many open

source firms. In a hybrid business model, a company provides both open source and proprietary software products using different types of licensing schemes. They conducted a large-scale survey in Italian open source firms and obtained the empirical results of how the characteristics of OSS production mode and network externalities shape the strategies of new OSS entrants.

Watson et al. (2005) studied JBoss – an OSS company that enjoys a leadership position in the J2EE application server market. The authors describe the principles of what they deemed to be a new business model, Professional Open Source (POS). POS combines the benefits of OSS with enterprise-class development methodologies, support and accountability expected from corporations that want to deploy OSS. Applying POS principles, Jboss built an ecosystem through a partnership program to support its market leadership and growth. The study illustrates how Jboss evolved from a failed dot-com company to a successful OSS company through a series of phases.

2.3 Business models

Business model emerged and widely spread during the Internet booming time (Magretta, 2002). Chesbrough and Rosenbloom (2003) investigated the role of business models in capturing value from technological innovation in Xerox's technology spin-off companies.

Chesbrough and Rosenbloom's identify six key functions of a business model (Chesbrough and Rosenbloom, 2003):

(1). Articulate the value proposition, i.e., the value created for customers with technological solutions;

(2). Identify a market segment, i.e., the users to whom the technology is useful and for what purpose, and specify the mechanisms for generating revenues;

(3). Define the structure of the value chain required to create and distribute the offering, and determine the complementary assets needed to support the company's position in the value chain;

(4). Estimate the cost structure and profit potential of developing the products, based on the chosen value proposition and value chain structure;

(5). Describe the position of the company within the value network linking suppliers and customers, including identification of potential partners and competitors;

(6). Formulate the competitive strategy by which the innovating company will gain and hold competitive advantage over competitors.

Chesbrough and Rosenbloom (2003) conclude that a business model provides a coherent framework that takes technological characteristics and potentials as inputs, and converts them through customers and markets into economic outputs. A business model is a construct that mediates between technology innovations and economic value creation (Chesbrough and Rosenbloom, 2003).

Magretta (2002) explained the importance of a business model in determining the success or failure of a business. She also explained the differences between business models and strategy, and discussed some important issues managers need to be aware of when defining a business models. Her work provides some practical guidelines for business managers to use business models.

2.4 Strategic alliances and strategic networks

Companies do not compete as autonomous entities. Companies are embedded in networks of social, professional, and exchange relationships with other organizations in the same industry or across-industries (Granovetter, 1985; Gulati, 1998; Galaskiewicz and Zaheer, 1999). Agents in a strategic network usually include suppliers, customers, competitors and partners and the relationships in such network may consist of strategic alliances, joint ventures and partnerships (Gulati, Nohria and Zaheer, 2000). Examining the strategic network in which a company is embedded and the relationships in such a network can help better understand the conduct and performance of a company (Gulati et al., 2000). Company relationships in a strategic network bring opportunities to the company and set constraints (Gulati et al., 2000).

Gulati (1998) proposed a five-aspect framework for studying a strategic alliance: (1) the formation of the alliance, including the motivation of entering an alliance, and how they choose partners; (2) the choice of governance structure, i.e., what types of contracts do companies use to formulate an alliance; (3) the evolution of an alliance, i.e., how the alliance and relationships evolve over time; (4) the performance of an

alliance, in particular, what factors affect the alliance success; and (5) performance consequences on the companies in the alliance, i.e., how the alliance affect the performance of member companies.

Rothaeamel (2001) studied the incumbents' advantages of exploiting complementary assets in a strategic alliance using information on 889 strategic alliances in the biotechnology industry. He found that incumbents that focus their network strategy on exploiting complementary assets outperform incumbents that focus on exploring new technology.

Lee, Lee and Pennings (2001) examined how internal capabilities as well as external networks influence the performance of a technology start up. To undertake their research, they integrated two perspectives: resource-based view (RBV) which is the traditional view of studying a company's internal capabilities, and the social capital theory, which is often used to examine a company's external networks.

Lee, Lee and Pennings (2001) examined the internal resources of a start up from three aspects: entrepreneur orientation, technological capabilities and financial resources. For external networks, they studied the partnership linkage and sponsorship linkage of a company. In particular, they measured the partnership linkage of a company using four indices: (1) number of marketing and technology partners; (2) number of venture capital companies investing in the company; (3) number of collaboration R&D projects with universities or research institutions; (4) number of entrepreneurial

associations a company participates in. Based on their sample including 137 Korean start-up companies, they found that venture capital plays a significant role in terms of influencing a company's performance. Other factors do not have significant effects.

Peng (2004) examined the attributes of the partnerships formed by major Linux distributors. The study examined whether the number of partners formed by Linux distributors is correlated to the number of new entrants, whether the motives for a Linux distributor's partners varied over adoption stages, and whether the type of partners selected by Linux distributors was a function of partnership motive.

2.5 Risks that OSS companies face

Empirical studies on the risks that a company faces when its revenue depends on an OSS project do not exist. Watson et al. identified four risks that the OSS company Jboss faces (Watson et al., 2005): (1) demand risk, which means the risk fluctuating demand or market collapse, which usually come from changes in economic conditions, customer taste or competitive situations. (2) innovation risk, which means the innovation in a company is not as good as its competitors; (3) inefficiency risk, which means the inability to match the competitors' unit costs; and (4) scaling risk, which means a company cannot scale fast enough and efficiently enough to catch up with the market growth. They argued that generally, professional open source companies will meet such risks during their growth, and they provided suggestions and approaches for mitigating these risks.

A recent Forrester research report[2] reported on customers' concerns about OSS products and services. The report suggests that the cost advantage of OSS may not be significant especially when it comes to developing mission-critical enterprise systems. Some other widely cited difficulties of deploying OSS include: integration problems, lack of knowledge and skills within IT departments, inconsistent or limited support, complex and sometimes restrictive licenses, lack of coherent architecture for OSS products and systems, inconsistent standards and platforms, complicated organizational structures of OSS companies, and changing strategic priorities of OSS companies.

2.6 Lessons learned from the literature review

The following lessons were learned from examining the literature:

Lesson 1: Need specific theoretical framework for understanding OSS commercialization

OSS commercialization is a relatively new phenomenon. Though studies have examined various aspects of OSS commercialization, it is necessary to develop a specific theoretical framework that can explain OSS commercialization. Such a framework should be able to explain, how external and internal factors affect the performance of an OSS company.

[2] http://www.technewsworld.com/story/46955.html

Lesson 2: Need to build a model of the structure for generating sales

Though several researchers have studied OSS companies' business models (Dahlander, 2004; Raymond, 1999; Bonaccorsi et al., 2004; Watson et al., 2005), the structure used by OSS companies to generate sales is not known.

Lesson 3: Need to examine the difference in motivations to set up and participate in OSS projects

Companies' motivations to participate in OSS projects have been identified (Bonaccorsi and Rossi, 2003). However, the motives for companies establishing OSS projects are not known.

Lesson 4: Need to understand the potential risks

The literature on the risks OSS companies face is limited to one case study. The limited understanding of potential risks that OSS companies face may have significantly negative effect on their business performance and success.

Lesson 5: Need a comprehensive set of variables

Existing literature on OSS consists on a very small number of empirical studies. It is necessary to identify the variables that affect the performance of OSS companies.

3 RESEARCH METHOD

This chapter describes the research method. It is organized into six sections. The first four sections describe the unit of analysis, study period, research method and sample selection. The fifth section describes the approach undertaken to collect the data used in this research. Finally, the sixth section explains the approach undertaken to analyze the data.

3.1 Unit of analysis

The unit of analysis is a software company that generates revenue through the sale of products and services that depend on the software of an OSS project that was set up by the company.

3.2 Study period

The study period is from January 1995 to September 2005.

3.3 Research method

There is little empirical work on OSS companies. To discover novel constructs and achieve theoretical advances it was decided to use multiple case studies for the purpose of undertaking this research. This is consistent with Eisenhardt's view of the usefulness of case studies (Eisenhardt, 1989) and the inductive process described by Carlile and Christensen (2005). Using an inductive process, researchers classify phenomena and observations into categories of things with similar attributes. Then based on the categorization, researchers are able to make theoretical statements or

build models. Table 4 provides the 11 research steps undertaken to identify a model that describes how an OSS company generates revenue. For each step, the dominant activity undertaken and the reason for the step are identified.

Table 4: Research method

No	Step	Activity	Reason for the step
1	Getting started	Define research questions and the reasons of why it is relevant Identify deliverables and the contributions that are expected to make	Focuses efforts. Sets goals for research completion
2	Select first wave of cases	Specify population of companies to be examined. Define dependent variables Identify first wave of companies to examine based on their data availability and contribution to insights, not randomness	Focuses on available companies Provides flexibility to decide what type of companies and OSS projects later.
3	Define data collection protocols	Identify method that will be used to collect data and the role of investigators	Strengthens grounding and foster different perspectives.
4	Collect data on first wave of companies and the OSS projects they set up	Collect news releases and other information publicly available on companies that set up OSS projects	Shortens the time required for analyses and reveals the breadth and depth of data. Gains familiarity with the data.
5	Analyze the groups, the things that link them, and the attributes	For each company-OSS project, identify groups, what links these groups and the attributers of groups and what links the groups	Examines data and generate insights through theoretical lenses.

		Generate insights	
6	Develop first model	Identify distinguishing dimensions and prepare table comparing cases on each dimension Develop model For each company-OSS project, use model to explain how each company in sample creates and appropriates value	Sharpens insight definition, validity, and measurability. Compares, extends and sharpens theory. Builds validity.
7	Compare with the literature	Sharpen constructs, insights and definitions.	Sharpens insights and raises theoretical level.
8	Collect data on 2nd and 3rd waves of service deployment	Extend table to include new cases and new distinguishing dimensions Fix model and use model to explain how each company creates and appropriates value Repeat steps 5 to 9	Improves analysis Sharpens insights and raises theoretical level.
9	Cross case comparison	Make cross case comparison about the insights generated from different cases.	Replicates logic across company-OSS projects
10	Identify variables that can be used to examine how to generate sales	Identify different variable that can be used to predict how a company can use OSS projects to generate sales	Generalizes findings.
11	Develop propositions for future research	Develop propositions that can be used for future research on the creation and appropriation of value	Helps to predict the outcomes for similar cases in the future

3.4 Sample selection

The criteria used to select the companies examined in this research are:

- The software company set up an OSS project

- All of the company's revenue is derived from products and services related to this OSS project
- The OSS is enterprise level and widely used software

Companies in the sample were identified in three waves. The first wave included six companies, the second wave four companies and the third wave four companies. Using a list of open source enterprise software published in InfoWorld, a well-recognized industry magazine, six companies were selected for the first wave of companies[3]. The InfoWorld list includes thirty nine top contenders of OSS projects organized in twelve categories of enterprise software: business intelligence, business process management, content management system (CMS), customer relationship management (CRM), directory services, enterprise resource planning (ERP), enterprise service bus (ESB), identity, point of sale, portals, radio frequency identification (RFID) and voice over Internet protocol (VoIP).

To identify the first wave of companies, the following four steps were undertaken:

1. Randomly selected an OSS project from the list of OSS projects
2. Determined if a single company set up the OSS project selected. If yes, go to step 3; if no, go to step 1.
3. Determined whether all of the company's revenue in 2004 was derived from products and services related to the OSS project selected. If yes, go to step 4; if no, go to step 1

[3] "Open Source Apps-Get the Job Done" by Gordon Studer , InfoWorld 2005(32), pp. 37-47. InfoWorld is a well recognized IT magazine, whose electronic version can be reached at http://www.infoworld.com

4. Include this company in the sample.

Four companies were identified in the second wave. These companies were drawn at random from a list of OSS projects assembled by the researcher. The new list included the OSS projects in the InfoWorld list that were not selected for the first wave, and the list of projects described in two other magazines of interest to information technology professionals: InfomationWeek[4] and eWEEK[5].

Appendix F provides the list used to draw the companies in the second wave. The same four steps described to select companies in the first wave were used to identify the four companies in the second wave.

The researcher compiled a third list of OSS projects. The list included OSS projects identified by Watson, Wynn and Boudreau (2005) and Lerner and Tirole (2002) and those OSS projects described in CNET News.com[6].

Appendix G provides the list used to draw the companies in the third wave. The third wave of companies was selected using the same four steps used to select the first and second waves of companies.

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[4] http://www.informationweek.com/
[5] http://www.eweek.com/
[6] http://news.com.com/

3.5 Data collection

Data on the companies and the OSS projects that they set up was collected in three steps.

In the first step, data on each company in the sample was collected from publicly available sources accessible via the Web.

Table 5 describes the nature of the data collected and the source of the data. The data collected was organized into four broad categories. The first category included general information about the company and the OSS project it set up and the company's history, profile, and top management team. The second data category included information on the company's offerings and links to customers. The third data category included information on the company's partnership program and partners. The fourth data category included information on the company's motives for establishing and participating in the OSS project and the risks the company faces by being dependent on an OSS project.

Table 5: Data collected and data source

Data Collected	Data Source
About company and open source project's general information: company's history, profile, TMT and OSS project's profile	Company's website; OSS community's website; Forum messages from OSS community; Industry reports; Media coverage
About company's linkages to customers: company's offerings and connection to customers	Company's website; Forum messages from OSS community
About company's linkages to partners: partnership program, strategies and partners' information	Company's website; Partners' websites; Documentation of partnership program; OSS forums
About company's motives for establishing and participating in the OSS project and the risks they face	Company's website; TMT's published interviews; Industry reports; Published cases studies; Online articles from recognized IT magazines or websites, e.g., CNET news (news.com.com), OpenEnterprise Trends.com (www.oetrands.com), InfoWorld (www.infoworld.com), eWEEK (www.eweek.com), Linux Journal (www.linuxjournal.com), and ComputerWold (www.computerworld.com); Answers from seven companies to the questions sent via emails and one phone interview

In the second step an email was sent to the executives of the companies in the sample asking them to identify the risks of building their business using the OSS project they set up. The question was stated as: What are the risks your company faces by building a business based on the OSS project it set up?

In the third step, executives of the companies in the sample were asked to examine the ten risks identified from steps 1 and 2 and identify which of them their companies faced.

The wording of the email used to collect data on the third step is:

"Dear Sir/Madam,

I am a graduate student at Carleton University in Ottawa, Canada. I am completing my master's thesis titled "Structures used by software companies to generate sales from the open source software projects that they set up." Your company XXX (company's name) is one of the 14 companies in my research sample.

With the first round of survey from these 14 open source companies, I have identified the following risks that open source companies face:

1. Developers do not contribute code to OSS project
2. Company can't grow network of partners and resellers
3. Company faces increased competition
4. Support requirements become too large and profits from providing it become too low
5. Failure to manage balance between code company releases and code it keeps
6. Difficult to resolve conflicts arise with partners and resellers
7. Company objectives and project objectives become incompatible
8. Company can't innovate fast enough to keep up with OSS releases

9. Failure to treat customers and developers properly

10. Control over the OSS tree, version plan and priority setting is lost

I need your help to identify which of the specific risks listed above your company faces. Please kindly write me back letting me know which risks you company faces. Please add any new risks which I have not identified in the list above. Due to the urgency of this study, please kindly respond at your earliest convenience. I greatly appreciate your cooperation. Thank you. "

3.6 Data analysis

The information on the company's history and background, offerings to customers, partnership programs and sales generation as well as information on the OSS project was organized into a table. This information was collected from secondary sources.

The motives for establishing and participating in OSS projects and risks of depending on OSS projects were organized into another table. The information was drawn from secondary sources (e.g., company's website, published articles in IT magazines), replies to the emails sent in steps two and three and one telephone interview. Then key words were used to classify the data into different categorizes. Three tables in Appendix E shows the key words and phrases used to organize the data on risks and motives. The key words were extracted from the raw data to which the references are provided in Appendix D.

A preliminary model of the structure used by OSS companies to generate sales was identified using the information on the two tables for the first wave of cases and the method described by Bailetti and Callahan (1995). They developed models to illustrate what is needed for a company to conduct standards management in order to fill their goals. The approach used by Bailetti and Callahan (1995) is a very effective way to develop models that make visible links among the groups and the work objects that these groups share.

The information from the second and third wave of companies was used to modify and detail the preliminary model.

4 RESULTS

This chapter is organized into six sections. The first section describes the sample used in this research. The second section provides the model of the structure that software companies use to generate sales from the OSS projects they set up. The third section provides a list of propositions used to clarify the model developed. Section four identifies the risks that OSS companies face due to their dependence on OSS projects. The fifth and sixth sections identify the companies' motives for establishing OSS projects and their motives for participating in OSS projects respectively.

4.1 Sample

The sample used in this research is comprised of 14 OSS companies that (i) generated sales from enterprise software applications in 2005, (ii) set up OSS projects and (iii) were founded between January 1995 and April 2004.

For each company in the sample, Table 6 identifies whether the company was part of wave one, two or three during the data collection stage, the company's product market, the name of the OSS project the company set up, and the URL of the company's website.

Table 6: OSS companies included in the sample

No.	Company	Wave that included company	Company' s product market	OSS project	Company's website
1	Pingtel Corp.	1	VoIP PBX	sipX	http://www.pingtel.com
2	Digium Inc.	1	VoIP/Voice PBX	Asterisk	http://www.digium.com
3	eZ systems AS.	1	CMS	eZ publish	http://ez.no/
4	Alkacon software GmbH	1	CRM	OpenCms	http://www.alkacon.com
5	SugarCRM Inc.	1	CRM	SugarCRM	http://www.sugarcrm.com
6	ComPiere Inc.	1	ERP	Compiere	http://www.compiere.org/
7	Open-Xchange Inc.	2	Groupware	Open-Xchange	http://www.openxchange.com
8	Liferay	2	Portal	Liferay portal	http://www.liferay.com
9	Greenplum	2	Business Intelligence	Bizgres	http://www.greenplum.com
10	Jboss Inc.	2	Middleware system	Jboss	http://www.jboss.com
11	MySQL AB	3	Database	MySQL	http://www.mysql.com
12	Ping Identity Corp.	3	Identity management	SourceID	http://www.pingidentity.com
13	JasperSoft Corp.	3	Reporting system	JasperReports	http://www.jaspersoft.com
14	Sendmail Inc.	3	Email infrastructure	Sendmail	http://www.sendmail.com

Table 7 provides a profile of the companies in the sample. The profile was built using the data included in Appendix A. The range of the age of the 14 OSS companies in the sample is between one and ten years. Six companies (43% of sample) were founded before 2000. Ten of the 14 OSS companies (71%) were founded in the USA,

two in Germany, one in Norway and one in Sweden. Twelve of the 14 companies (86%) were founded to be OSS companies. Two companies first operated as traditional proprietary software companies and then transformed into OSS companies. These two companies released their proprietary software to the OSS project that they set up. Half of the companies in the sample have obtained VC funding.

Table 7: Sample profile

Group	Number of companies	Percentage of companies in sample
Companies founded before 2000	6	43%
Companies founded in 2000 and after	8	57%
Companies founded in US	10	71%
Companies founded in Europe	4	29%
Companies founded to work with OSS	12	86%
Companies not founded to work with OSS	2	14%
Companies with VC funding	7	50%
Companies without VC funding	7	50%

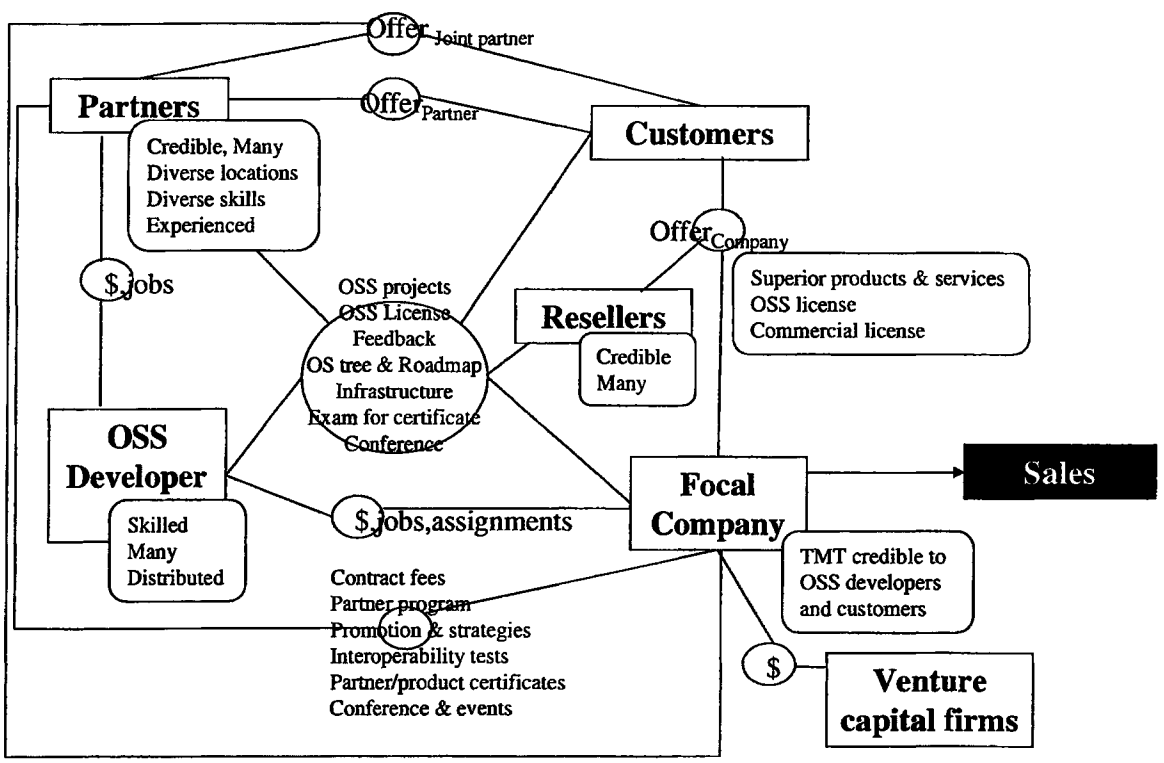
OSS companies are still in an early stage in their development. There is no list of OSS companies available. However, the researcher is of the opinion that the 14 companies in the sample represent the population of OSS companies.

4.2 Structure used to generate sales

A traditional software company generates a portion of its sales by selling software licenses. The structures used by these companies to generate sales are well understood. However, what is the structure used by OSS companies to generate sales?

Figure 1 provides a model developed to describe the structure an OSS company uses to generate sales from the OSS project that it sets up. The model was developed following the approach in Bailetti and Callahan (1995).

Figure 1: Model of the structure used by an OSS company to generate sales



In the model, rectangle boxes represent agents (i.e., groups that perform a role) Circles represent the objects that bind the agents together. Boxes with round corners are attributes of agents or objects.

4.2.1 Agents in the model

The model in Figure 1 identifies six agents: (i) focal company, (ii) partners, (iii) resellers, (iv) OSS developers, (v) customers, and (vi) venture capital firms.

Focal company

The focal company refers to a company that has a core business that is based on the OSS project it set up. One attribute of the focal company was identified. The focal company's top management team must be credible to OSS developers and customers. In 13 of the 14 companies examined, the founder of the OSS project is also the founder of the OSS company and remains in the company's top management team.

Partners

Partners are companies that sell products and services that are based on the focal company's products and services. Five attributes of the partners of the focal company were identified. Partners need to be:

(1) credible, so that customers can trust them and help increase the credibility of the focal company

(2) many, so that the focal company's network can be large

(3) in diverse locations, so that they can serve world-wide customers

(4) experienced, so that can attract and retain customers and work with focal company to deliver solutions that customers want

(5) skilled in various domains, so that they can complement the focal company's products and services and serve customers in various ways

Resellers

Resellers are companies or individuals that sell the focal company's products or services to customers.

Two attributes were identified for resellers. Resellers need to be:

(1) credible, so that customers can trust them and help increase the credibility of the focal company

(2) many, so that the focal company's network can be large.

OSS developers

OSS developers are individuals who contribute to the OSS project that was set up by the focal company. OSS developers contribute code to implement new features, test and fix bugs.

Three attributes of OSS developers were identified. OSS developers need to be:

(1) skilled so that they can contribute quality code, solve problems and improve the product

(2) many so that the OSS project can innovate fast and improve fast

(3) distributed so that they can help increase the awareness of the OSS project world-wide.

Customers

Customers are the individuals, groups and organizations that pay money to buy products and/or services from the focal company and the focal company's partners and resellers. There is no data available to identify the attributes of customers.

Venture capital firms

Venture capital firms are the companies that invest risk capital in the focal company. Venture capital funding of OSS companies has increased since 2003. Half of the companies in the sample had been funded by venture capital firms. No attribute of venture capital firms were identified from the data available.

4.2.2 Open commons bind five of six agents

The focal company, partners, resellers, OSS developers, and customers have links into what in this research is referred to as the OSS commons. These five agents use the OSS common to co-create value. The OSS commons binds these agents together.

The OSS commons includes: OSS projects, OSS licenses, feedback, OS tree and roadmap, infrastructure, certificate exams, and conferences.

OSS project

An OSS project is comprised of source code, technical documentation, binary code, utility tools, and user's manual.

OSS license

An OSS license is a document that gives official permission to a person or group to modify and distribute the software without paying fees to previous developers of the software. There are various types of OSS licenses. The OSS licenses used by the companies in the sample are: GNU[7] General Public License (GPL), GNU Lesser General Public License (LGPL), Adjusted Mozilla Public License (Adjusted MPL), Berkeley Software Distribution (BSD) License, MIT License, and one own company open source license.

Table 8 shows the OSS companies in the sample organized by the OSS license of the projects that they set up.

7 GNU is a recursive acronym for "GNU's Not UNIX", which is a free software operating system and was announced by Richard Stallman in 1983. The official website of GNU is http://www.gnu.org.

Table 8: OSS companies by the license of the OSS projects they set up

License of the OSS project	Companies that set up the license	Number of companies that set up the license	Percentage of sample
GPL	Digium, eZ system, Open-Xchange, MySQL AB	4	29%
LGPL	Pingtel, Alkacon, Jaspersoft, Jboss	4	29%
Adjusted MPL	SugarCRM, ComPiere	2	14%
BSD	Greenplum	1	7%
Adjusted BSD	Sendmail	1	7%
MIT	Liferay	1	7%
Own open source license	Ping Identity	1	7%
		14	100

The GPL license comes from the Free Software Foundation (FSF)[8] and originally written by Richard Stallman for the GNU project. It has become the most popular license for free software[9] or open source software.

The LGPL license is a modified version of the GPL. It is an FSF approved free software license designed as a compromise between the GPL and simple permissive licenses such as the BSD license and the MIT License. It was written by Richard Stallman and Eben Moglen.

[8]FSF is dedicated to promoting computer users' rights and freedom to use, study, copy, modify, and redistribute computer programs, http://www.fsf.org/.
[9] Free software, as defined by the FSF, is software which can be used, copied, studied, modified and redistributed without restriction.

The MPL license is used as the open source license for the Mozilla Application Suite and related software. The adjusted MPL license is a derivative of the Mozilla Public License (MPL). For example, the SugarCRM's adjusted MPL license consists of the MPL Version 1.1[10], modified to be specific to SugarCRM with additional terms. The ComPiere's adjusted MPL license consists of the MPL Version 1.1 with ComPiere's own amendments.

The BSD license was originally used as the license for BSD software[11] by the University of California, Berkeley starting in the 1970s. Recently, the BSD license has become one of the most widely used licenses for open source software. Sendmail's adjusted BSD license only adds the information "Sendmail is the trademark of Sendmail Inc." in the original BSD license.

The MIT license is very similar to the BSD license. The MIT License, also called the X License or the X11 License, originated at the Massachusetts Institute of Technology. It allows reuse for open source or proprietary software.

One OSS project set up by a company in the sample, Ping Identity, has its own OSS license. The license allows the free download of the OSS, but dose not allow the use of source code in any commercial or proprietary product.

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[10] http://www.mozilla.com/MPL

[11] BSD (Berkeley Software Distribution) software is the Unix derivative distributed by the University of California, Berkeley starting in the 1970s.

Feedback

Feedback refers to the statements posted in the various gathering places supported by the electronic infrastructures of the OSS project. Feedback includes natural language statements made by customers, developers, partners, resellers and focal company employees and other agents. Feedback includes bug reports, features requests, suggestions for the OSS product roadmap and conversations among users.

OS tree and roadmap

Open source tree and roadmap refer to the various configuration of a product and its future directions or development plan. OSS projects use concurrent versioning systems (CVS) or CVS-like source code repositories to manage the source code and documentations, as well as software configurations. Each configuration is represented as a branch in the OS tree. It may be for a special group of customers, or may be just a simple experiment of a set of new features. The roadmap of an OSS project depicts the development plan and future directions. Each direction may also be represented as a branch in the source code tree.

Infrastructure

Infrastructure is comprised of a collaboration platform that allows software developers and users to work together to solve problems, provide feedback, and provide general education and technical support. The infrastructure may include a project website, an online forum, a mailing list, a CVS source code repository, a bug report database, and so forth.

Certificate exams

A certificate exam is a document that attests to the fact that an individual has successfully completed an exam that qualifies him/her to provide a particular OSS related service or software solution. Typically, the focal company is the organization that issues certificate exams. Individuals that are certified are usually developers or partners' employees. Certificate exams can be OSS project specific or technology specific.

Conferences

A conference is a meeting, sometimes lasting for several days, in which people with an interest in the OSS project and/or the products enabled by the OSS project participate in discussions or listen to lectures to share information. Conferences serve as a platform for communication, education, marketing and identifying sales leads

Typically, the focal company organizes the conferences.

4.2.3 Links among agents

The model shown in Figure 1 highlights four links: (1) Focal Company – OSS Developers; (2) Focal Company – Customers; (3) Focal Company – Partners; and (4) Partners – Customers. These links are necessary for an open source company to generate sales.

Focal Company – OSS Developers Link

This links represents how a focal company and the developers that contribute to the OSS project interact. This link is anchored around the elements of the open commons identified above.

The focal company,

(1) attracts, retains and grows relationships with many skilled OSS developers who are distributed worldwide

(2) manage two networks of developers: i. Network of developers who are paid by the company and ii. Network of developers that volunteer

(3) manages the development project

(4) act on the feedback from OSS developers

(5) certifies OSS developers

Focal Company – Customers Linkage

Focal companies interact with customers for the purpose of providing them with superior products and services. This link is anchored around the OSS company's market offers that represent the major sources of revenue for the company.

Appendix B provides the market offers of the 14 companies included in the sample. The market offers of OSS companies include (i) packaged products, (ii) services, and (iii) related products such as books and CDs and related services such as conferences . Packaged products include the hardware based on OSS, software based on OSS but

under commercial licenses with or without extensive functionalities, and add-on software products.

Eight of the fourteen OSS companies in the sample have adopted the dual license strategy to generate sales from customers.

Services include technical support sold by the hour, consulting services, training, customizing the product after the customers need and subscribed service package.

Focal Company – Partners Linkage

In addition to interfacing directly with customers, OSS companies provide products and services to customers through resellers and partners.

Appendix C provides information on company partnerships. The sample companies operate partnership programs for the purpose of growing their businesses. The number of partners each company has ranges from 5 to over 70. Several types of partners have been identified:

(1) technology partners that provide technical platforms, fundamental technologies to OSS projects and focal companies

(2) solution partners that provide complementary or bundled solutions to customers

(3) service partners that provide customers with consulting service, customizations, training, and technical support.

Typically, an OSS company provides a variety of partnership programs. An OSS company may also charge contract fees to its partners. This is an additional source of revenue. Seven of the fourteen companies in the sample provide certificate programs for partners. Such certificate programs ensure that the partners are capable of meeting certain technical standards in order to provide customer services and solutions.

OSS companies may provide partners with co-marketing opportunities and sales leads generation.

Partners – Customers Linkage

Partners usually have direct linkage with the customers of OSS companies. They may be the service providers, or provide customized solutions. These partners, sometimes including resellers, help alleviate the burden on a focal company, usually caused by high demand of services. It is a good way to address the scaling challenge when more and more users and customers are demanding professional and customized services.

4.3 Propositions

A set of propositions was developed for the purpose of clarifying the model shown in Figure 1. The propositions focus on the factors that may increase an OSS company's ability to generate revenue from the sale of products and services to customers and from conferences, partnership programs, and certification programs.

The propositions developed in this research are:

Proposition 1

Advantage of company's offers over competitors' offers and benefits that developers derive from developing the open source software are positively related to sales.

Proposition 2

Benefits derived by company's partners are positively related to sales.

Proposition 3

Company control over open source tree, OSS projects, and roadmap is positively related to sales.

Proposition 4

Monopoly over commercial license is positively related to sales.

Proposition 5

Company control over certificates of product interoperability tests, partner certificates, products and service certificates, and training certificates is positively related to sales.

Proposition 6

Number of credible and experienced partners is positively related to sales.

Proposition 7

Diversity of partners is positively related to sales.

Proposition 8

Number of partner locations is positively related to sales.

Proposition 9

Number of resellers is positively related to sales.

Proposition 10

Number of services offered to customers and partners is positively related to sales.

Proposition 11

Credibility of founders of open source project with customers and open source developers is positively related to sales.

Proposition 12

Company control over the open source license is positively related to sales.

Proposition 13

Number of open source developers solving customer problems is positively related to sales.

4.4 Risks that arise due to company's dependence on an OSS project

Information on the risks faced by an OSS company that depends on an OSS project is available for seven companies. The data was obtained from secondary data sources

(e.g., companies' website, news articles and published media.), or from replies to the questionnaire sent via email or phone interviews. Appendix D provides the information and references on strategic risks by companies in the sample. Appendix E1 provides the key words, phrases or cues to determine the categorization of risks.

The researcher identified ten risks an OSS company faces and organized these risks into four categories:

(1) risks related to OSS project dynamics

(2) risks related to partners and customer support

(3) risks related to development effectiveness

(4) risks related to competition

In addition, risks can also be categorized as company-controllable and non-company-controllable. For each risk category, Table 9 identifies the risks identified by the researcher and a judgment on whether or not the risk identified is fully controllable by the company (denoted with a ✓), partially controllable by the company (✓–) or not controllable by the company (x) .

Table 9: Risks faced by OSS companies by risk category

Category	ID	Risk	Controllable
OSS project dynamics	R1	Company objectives and project objectives become incompatible	✓–
	R2	Control over the OSS tree, version plan and priority setting is lost	✓
	R3	Failure to manage balance between code company releases and code it keeps	✓
	R4	Developers do not contribute code to OSS project	✓–
	R5	Failure to treat customers and developers properly	✓
Partners and support	R6	Company can not grow network of partners and resellers	✓–
	R7	Support requirements become too large and profits from providing it become too low	×
	R8	Difficult to resolve conflicts arise with partners and resellers	✓–
Development Effectiveness	R9	Company can not innovate fast enough to keep up with OSS releases	✓
Competition	R10	Company faces increased competition	×

Note: "✓" – fully controllable; "✓–" – partly controllable; "×" – not controllable by the OSS company.

4.5 Motives for establishing an OSS project

Examination of the information on the 14 OSS companies in the sample included in Appendix D provides the information and references on motives of companies for setting up OSS projects. Appendix E2 provides the key words, phrases or cues to determine the categorization of motives.

Table 10 identifies the 7 motives and the companies count for each particular motive. The motives for setting up OSS projects are presented ordered by the number of instances that support each statement.

Table 10 shows that the two most frequently cited motives for establishing an OSS project are to:

(1) attract developers in order to make better software

(2) seed the market for a new company and accelerate product acceptance in a new market

Table 10: Motives for establishing OSS projects

Motives for establishing OSS projects	Number of cases
Attract developers to make better software	9
Seed the market for a new company and accelerate product acceptance in a new market	8
Solve an advanced problem for existing software	3
Provide customers an alternative to proprietary software	2
Maintain product that is not core to the existing business	2
Satisfy and retain partners and customers	1
Meet needs of non-for profit and small business organizations	1

4.6 Motives for participating in OSS projects

Examination of the information on all fourteen companies led the researcher to identify 13 motives for an OSS company to participate in OSS projects. Appendix D provides the information and references on motives of companies for participating in OSS projects. Appendix E3 provides the key words, phrases or cues to determine the categorization of motives.

Table 11 lists the thirteen motives for participating in OSS projects that were identified. The motives are presented ordered by the number of statements found to support the motive.

Table 11: Motives for participating in OSS projects

Motives for participating in OSS projects	Number of cases
Reduce development costs	11
Attract developers to make better software	10
Reduce pre-sales costs	6
Increase market share of existing product	5
Obtain feedback from diverse communities	4
Offer more options and features faster	3
Improve product interoperability	3
Set standard	3
Accelerate the exploration of new ways of doing things	3
Accelerate the incorporation of innovation into product	2
Satisfy and retain partners and customers	2
Develop expert user base	2
Reduce risk of technology lock-in	1

The three main motives for companies participating in OSS projects are to:

(1) reduce development costs

(2) attract developers to make better software

(3) reduce pre-sales costs

5 DISCUSSION OF RESULTS

This chapter uses the results in chapter 4 to answer the three research questions. The chapter is organized into four sections. The first section answers the first research question: What structure does an OSS company use to generate sales from the OSS project that it sets up? The second section answers the second research question: What are the risks that an OSS company may face by becoming dependent on OSS? The third section answers the third research question: Are the motives companies have for establishing OSS projects different than the motives companies have to participate in OSS projects? The fourth section identifies a set of variables that may be related to the sales generated by OSS companies. These variables have been identified for the purpose of facilitating future studies in this area.

5.1 Structure OSS companies use to generate sales

The first research question was: What structure does an OSS company use to generate sales from the OSS project that it sets up? Figure 1 in Section 4.2 illustrates a model for the structure that OSS companies use to generate sales from the OSS projects they set up. This model shows what is necessary for an OSS company to generate sales.

Four value creation processes can be identified in the model illustrated in Figure 1: (i) OSS community management; (ii) Operations management; (iii) Customer management; and (iv) Innovation management. These value creation processes are analogous to those discussed in Kaplan and Norton (2004).

Key activities of the OSS community management process include:

- Set up (e.g., decide on the OSS license) and maintain (e.g., define OS tree and roadmap, provide infrastructure) OSS project
- Attract, retain and grow relationships with many skilled OSS developers who are distributed worldwide
- Manage two networks of developers: (1). Network of those who are paid by the company and (2). Network of developers that volunteer
- Act on the feedback from OSS community
- Certify OSS developers
- Manage risks of OSS project dependence
- Hire and motivate partners and customers to hire OSS developers
- Attract and retain top management team seen as credible by OSS developers

The operations management value creation process refers to the daily operations of an OSS company. For an OSS company, the key activities of this process include:

- Produce and deliver packaged products
- Attract, retain and grow relationships with many credible and experienced partners and resellers with heterogeneous skills that are distributed worldwide
- Grow the network of partners and resellers
- Deliver partner certification programs (e.g., certificates)
- Test for product interoperability and provide certificates
- Organize and deliver conferences

The model in Figure 1 suggests that the interactions between an OSS company and customers may take place through various channels, such as direct customer service, customer service through partners or resellers, or through OSS communities. Customers also may directly contribute to the bug fixing and new feature requests by directly access OSS product tree. Such new form of interactions between customers and companies bring new opportunities and challenges to OSS companies in customer management. In general, the customer management value creation process in an OSS company includes:

- Offer products and services that customers value over competitors' products and services
- Manage interactions between customers and OSS community and act on customers' feedback and requests
- Jointly offer products and services with partners that complement companies' offers
- Attract, retain and grow relationships with many customers who are distributed worldwide
- Undertake joint promotion activities with partners and resellers
- Manage cooperation and conflict among partners and resellers
- Attract and retain top management team seen as credible by customers

The innovation management process in an OSS company includes:

- Manage R&D
- Design and develop new products and services

- Bring new products and services to market

5.2 Risks an OSS company faces by depending on an OSS project

The second section answers the second research question: What are the risks that an OSS company may face by becoming dependent on OSS? Table 9 organizes the ten risks identified in this study into four categories: OSS project dynamics, partners and support, competition, and development effectiveness.

The risk organization in Table 9 seemed to be more suitable for OSS companies than the one proposed by Child (1987) and the one used by Watson et al. (2005) to examine the Jboss case. Child (1987) organized strategic risks into three categories: demand risks, innovation risks, and inefficiency risks. Watson et al. (2005) added one additional risk to three identified by Child (1987): scaling risks.

Table 9 in section 4.4 identified ten risks that an OSS company faces, eight of which are fully or partially controllable by the company. For each of the eight risks than an OSS company can control, Table 12 provides approaches that can be used to mitigate these risks. The intent is to illustrate the usefulness of knowing which are the risks that an OSS company faces by showing the approaches it can use to mitigate these risks.

Table 12: Approaches for mitigating risks in OSS companies

Risks identified in Table 9	Approach to mitigate risk
Fully controllable risks	
Control over the OSS tree, version plan and priority setting is lost	Strong leader respected by OSS developers and customers controls the OSS source code tree and project roadmap Allocate the right company personnel into the OSS project Provide employment or income to the top OSS developers
Failure to manage balance between code company releases and code it keeps	Communicate company's strategies and objectives clearly to OSS community
Failure to treat customers and developers properly	Provide employment, income opportunities and monetary rewards programs to the top OSS developers
Company can not innovate fast enough to keep up with OSS releases	Allocate the right company personnel into the OSS project Provide employment, income opportunities and monetary rewards programs to the top OSS developers
Partially controllable risks	
Company objectives and project objectives become incompatible	Strong leader respected by OSS developers and customers controls the OSS source code tree and project roadmap Allocate the right company personnel into the OSS project Provide employment, income opportunities and monetary rewards programs to the top OSS developers Communicate company's strategies and objectives clearly to OSS community

Developers do not contribute code to OSS project	Allocate the right company personnel into the OSS project Provide employment, income opportunities and monetary rewards programs to the top OSS developers Set interesting technical challenges
Company can not grow network of partners and resellers	Set up attractive partnership program which provides Win-Win situations for company and its partners
Difficult to resolve conflicts arise with partners and resellers	Set up attractive partnership program which provides Win-Win situations for company and its partners
Risks not controllable by OSS company	
Support requirements become too large and profits from providing it become too low	
Company faces increased competition	

5.3 Motivations to set up and participate in OSS projects

The third research question was: Are the motives companies have for establishing OSS projects different than the motives companies have to participate in OSS projects?

The literature has not identified the motivations software companies have for setting up OSS projects. There has been work undertaken to identify the motives for companies participating in OSS projects.

Table 10 provides the motives for companies setting up OSS projects and Table 12 provides the motives for companies participating in OSS projects that were identified

in this research. Table 10 shows that the two most frequently cited motives for a software company to establish an OSS project are to:

(1) attract developers in order to make better software

(2) seed the market for a new company and accelerate product acceptance in a new market

Table 12 shows that the three main motives for software companies participating in OSS projects are to:

(1) reduce development costs

(2) attract developers to make better software

(3) reduce pre-sales costs

Table 13 provides a comparison between the motives for setting up an OSS project and the motives for participating in OSS projects

Table 13: Comparison of company motives for setting up an OSS project and participating in OSS projects

Motives for company setting up OSS project	Motives for company participating in OSS project
Attract developers to make better software Satisfy and retain customers and partners	
Seed the market for a new company and accelerate product acceptance in a new market	Increase market share of existing products Set standard
Solve advanced problems	Reduce development costs and pre-sales costs Enhance product capability
Provide alternatives to customers and address low end market needs	Increase diversity and quality of feedback on company's products

The comparison in Table 13 suggests that attracting developers to make better software and satisfying and retaining customers and partners motivate companies to establish OSS projects as well as participate in OSS projects.

The comparison in Table 13 also suggests that the motives for companies to set up OSS projects pertain more to issues relevant to newness such as entering new markets and/or introducing new products while the motives for participating in OSS projects pertain more to the efficiency of what exists such as reduce costs, enhance product capability, and obtain better feedback.

Bonaccorsi and Rossi (2003) and Henkel (2003) identify lowering development and maintenance costs as main motivators for companies to participate in OSS projects.

The results of this research support these results and add one interesting finding. Companies also participate in OSS projects to reduce their costs of pre-sales. OSS companies in the sample explicitly pointes the large number of free downloading of the OSS products and source code as a means to reduce their pre-sales costs.

Compared to the extant literature, two new and unique findings in this thesis about the motivations for companies to participate in OSS projects are: to increase market share of existing product; and to satisfy and retain partners and customers. The first one reflects the fact that open source can be used as a strategy to promote existing products. The second one reflects that the fact that wide adoption of OSS by partners and customers may have strong influence on software vendors' move to open source their software products.

5.4 Variables for further study of structure to generate sales

Open source commercialization is still a new phenomenon. There is not a comprehensive set of variables or metrics for the measurement related to sales generation or value appropriation. Along with the development of model of structures for generating sales of OSS companies, this research has identified a set of variables which can be useful to the people who are interested in knowing the metrics of sales generation. This set of variables can also be used for the empirical studies in the future.

Table 14 shows the set of variables that are related to sales generation of OSS companies. These variables can be categorized into: (1) general, related to a company's background information; (2) product related; (3) service related; (4) license related, which is unique in studying OSS related business models; (5) OSS development related; and (6) partner related.

Table 14: Variables that may be related to the sales generated by an OSS company

Category	Variable
General	Number of years operating as an OSS company Number of locations where the company has offices Number of VCs invested Number of downloads of the OSS product Number of customers paying for using products and services
Product Related	Number of OSS projects established Number of OSS projects participating in Number of commercial software products relying on OSS projects Number of other commercial products relying on OSS projects Number of types of other commercial products related to OSS projects
Service Related	Number of services provided relying on OSS projects Number of services provided directly by the company Number of services provided by the OSS community Number of services provided by partners
License Related	Number of types of licenses Number of commercial licenses Number of commercial licenses provided by other companies on the same OSS project
OSS Development Related	Number of volunteer developers in the OSS community Number of core developers Number of employed developers in the company Number of employed developers working on OSS projects Number of features proposed by the company that have been accepted and/or implemented in the OSS product Number of features proposed by the company that have been rejected by the OSS community Number of types of communication mechanisms established in the OSS community by the company
Partner Related	Number of partners Number of types of partners Number of geographical locations where partners locate Number of open source partners Number of incumbent partners in industry Number of benefit programs provided to partners (e.g., co-marketing, sale leads generation and access to company's knowledge base.)

5.5 Discussion about the OSS licenses

Table 8 shows that the fourteen OSS projects in the sample used seven different open source licenses. There are three reasons why a variety of OSS licenses exist: (i) motivation to make the OSS license commercially friendly; (ii) historical reasons; and (iii) specific objectives pursued by OSS companies.

First, OSS licenses can be distinguished based on whether or not they are commercially friendly. The GPL license requires those who use the source code in their commercial products to make their own code available as open source. For this reason, the GPL license is not perceived as being commercially friendly. The LPGL, MPL and Adjusted MPL, BSD and Adjusted BSD, and MIT licenses are considered to be commercially friendly OSS licenses. They allow limited use of the source code in commercial products without requiring the release of the product's proprietary code.

The LGPL license allows the use of open source code in proprietary products without triggering a general source code release clause. The Adjusted MPL license is a minor modification of, the MPL license. The MPL and Adjusted MPL licenses allow the source code to be combined with proprietary code in a proprietary program. Thus, a proprietary version of an MPL open source program may be released.

The Adjusted BSD is a minor modification of the BSD license. The Adjusted BSD and BSD licenses allow third parties to package the source code of the OSS product

into their own products, either open source or proprietary, without having to open their own source code.

The MIT license more explicitly states the rights given to the end-user, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell the software.[12]

OSS companies need to choose a proper OSS licenses when they set up OSS projects by considering various commercial friendliness and flexibility of OSS licenses.

Second, historical reasons also account for the use of a particular OSS license. For example, the open source project Sendmail originated as part of the BSD Unix project. Therefore, the use of the BSD license was natural for Sendmail. The Bizgres Project of company Greenplum is an open source project focused on making PostgreSQL –an open source database- for business intelligence. While PostgreSQL adopted BSD license, it is necessary and convenient for Bizgres to use BSD license as well. Therefore, choosing OSS licenses is also driven by the history of the OSS projects.

The third reason that explains OSS license variety is that OSS companies may create their own OSS licenses to suit their own objectives. For example, Ping Identity uses its own open source license for the purpose of free downloading OSS but not allowing using the OSS in any third-party software.

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[12] http://www.opensource.org/licenses/mit-license.php

6 CONCLUSIONS, LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

6.1 Conclusions

The objective of this research was to answer three questions:

- What structure does an OSS company use to generate sales from the OSS project that it sets up?
- What are the risks that an OSS company may face by becoming dependent on OSS?
- Are the motives companies have for establishing OSS projects different than the motives companies have to participate in OSS projects?

Information on 14 OSS companies was used to answer these three questions.

While previous studies focused on the use of OSS projects to reduce development costs and shorten development time, this research focused on how to use OSS projects to generate sales. This research provides a model of a structure that OSS companies use to generate sales from the OSS projects they set up. The model suggests that OSS companies are service intensive, and heavily depend on external networks of partners and resellers to collaboratively provide services to customers.

Service is one of the major sources of OSS companies' revenues. OSS pushes software companies up in the value chain.

An OSS company needs to manage many-to-many interactions in a network comprised of heterogeneous OSS developers, users, partners and resellers. It has to effectively manage and leverage various resources in such a network to deliver software products and services to customers to realize the value proposition. OSS companies, even though mostly service-oriented, are able to direct and influence all the players in the value chain to realize the values.

Four key value creation processes have been identified in the model that illustrates how OSS companies generate sales: (1) OSS community management; (2) operations management; (3) customer management; and (4) innovation management. The OSS community management is the new element not considered in the Kaplan and Norton's framework (2004).

Considering the four factors that define competitive context of a company (Porter and Kramer, 2002), OSS companies improve their competitive context by changing input conditions (e.g., skillful OSS developers), demand conditions (e.g., the offer and the experience of interacting with OSS community are both valuable), rules to compete (e.g., sell services, not products), and related and supporting industries (e.g., hardware that embeds OSS products). This helps OSS companies gain certain competitive advantages over their competitors that sell proprietary software products.

Ten major risks an OSS company faces when generating sales based on OSS projects were identified. These risks can be categorized into: OSS project dynamics, partners

and support, competition, and development effectiveness. These four categories provide a framework that can be used to identify the approaches most suitable to reduce them.

This research also suggests ways that OSS companies may use to mitigate the risks they face. To reduce risks, an OSS company would better to develop a good relationships with OSS developers, customers, partners, and resellers; grow and maintain a large network of OSS developers, users, customers, partners and resellers; align company's and OSS community's goals and objectives; assign key personnel into the OSS project.

The literature has reported companies' motivations in participating in OSS projects (Bonaccorsi and Rossi, 2003). However, no previous study has examined companies' motivations for establishing an OSS project and compared company motivations for establishing and participating in OSS projects.

Companies set up and participate in OSS projects to attract developers to make better software and satisfy and retain customers and partners. Companies set up OSS projects to deal with newness related issues while they participate in OSS projects to deal with efficiency issues. For example, reducing development and pre-sales costs is an important motive for companies to participate in OSS projects but not to set them up.

6.2 Limitations

This study has at least three limitations. The first limitation lies that this research relied on mostly on secondary materials (e.g., information on companies' websites, articles written by industry analysts, interviews of company executives conducted by recognized magazines and published case studies. These materials are good for investigating objective subjects, such as number of products, partnership programs, etc. However, they have limitations in addressing subjective topics, such as motivations and potential risks.

The second limitation is that managers from only five of the fourteen companies in the sample responded to the emails sent to them. Of these five, only three respondents identified the risks they perceive for their companies using OSS projects to generate sales. Such result of this survey may partly due to the nature of the topic it covers and the design of the questionnaire. More incentive mechanisms may be needed to encourage companies to respond in the future studies.

The third limitation is due to the fact that OSS commercialization is still a relatively new phenomenon, and the number of companies that can be studied is not large. There is no list with the names of known OSS companies that can be used for research purposes.

6.3 Suggestions for future research

This section identifies three suggestions for future research. First, future research can use the propositions identified in chapter 4 to develop and then test hypotheses. Testing the relationship between internal and external factors and OSS company's sales we will be able to gain a better understanding of how these companies work.

Second, the relationship between the risks identified in this research and the value of OSS companies can be examined empirically.

Third, the performance of OSS companies that have received venture capital funding can be compared with the performance of OSS companies that have not been funded by venture capital firms.

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APPENDICES

Appendix A: Company background information

A1. Background information of the 6 cases in the first wave

Distinguishing dimension	Pingtel Corp.	Digium Inc.	eZ system AS.	Alkacon software GmbH	SugarCRM Inc.	ComPiere Inc.
Year company was founded	1999	1999	1999	2002	2004	2001
Country where company was founded	USA	USA	Norway	Germany	USA	USA
Country where company operates	USA	USA	Norway, Ukraine, Germany	Germany	USA	USA
Birth of the company	From proprietary to open source	Born as open source	Born as open source	Born as open source	Born as open source	Born as open source
Product market	VoIP PBX	TDM/VoIP PBX	CMS	CMS	CRM	ERP
TMT as of September 2005	Professionals who did not create the OSS project	CEO=Founder of OSS project =Founder of the company	CEO is one of the 4 founders Founder of project is also one of the 4 founders of company	CEO=Founder of OSS project =Founder of the company	CEO is one of the 3 founders of company as well as founders of project	CEO=Founder of OSS project =Founder of the company
Number of employees	N/A	40+	45+	N/A	55	10-
Obtained VC funding	No	No	No	No	Yes.	No
open source software	sipX	Asterisk	eZ publish	OpenCms	SugarCRM	Compiere
OSS License	LGPL	GPL	GPL	LGPL	SPL[13]	CPL[14]
Year open source project was set up	2004	1999	2000	2000	2004	1999
Sponsors of open source projects	Company is one of 8 partners that set up the non-for-profit	Company has set up all projects	Company has set up all projects	Company has set up all projects	Company has set up all projects	Company has set up all projects

[13] SugarCRM Public License: modification of MPL
[14] Compiere Public License: modification of MPL

	foundation responsible for OSS projects					
Number of developers	N/A	N/A	N/A	N/A	2440+	50+
Number of downloads	N/A	20,000+/month	1,400,000+	N/A	500,000+	930,000+
Infrastructure for project that company provides	Community is on non-profit organization: SIPfoundry.org	Forums, mailing lists	Forums, mailing lists, blogs etc.	Forums, mailing lists, blogs etc.	Forums, mailing lists, blogs etc.	Community is on Sourceforge.net

A2. Background information of the 4 cases in the second wave

Distinguishing dimension	Open-Xchange Inc.	Liferay	Greenplum	Jboss
Year company was founded	1996	2000	2000	2001
Country where company was founded	Germany	USA	USA	USA
Country where company operates as of September 2005	USA	USA	USA	USA and other countries
Birth of the company	From proprietary to open source	Born as open source	Born as open source	Born as open source
Product market	Groupware	Portal	Business Intelligence	Enterprise middleware system
TMT as of September 2005	One of two founders is the founder of the OSS project	Founder created the OSS project. Four other TMT members have diverse technological and professional backgrounds.	One of two founders created the OSS project. Others (four) are professionals.	Two founders created the OSS project. Other seven TMTs are professionals.
Number of employees as of September 2005	N/A	N/A	N/A	N/A
Obtained VC funding	No	No	Yes (4)	Yes (4)
Name of open source software	Open-Xchange	Liferay Portal	Bizgres	Jboss Application Server
OSS License	GPL	MIT	BSD	LGPL
Year open source project was set up	2004	2000	2005	1999
Sponsors of open source projects	Open-Xchange	Liferay	Greenplum	Jboss
Number of developers	11 core developers	61	N/A	50+ core developers
Number of downloads	N/A	215,378 from sourceforge.net	N/A	N/A
Infrastructure for project that company provides	Forum, Wiki, mailing list, etc.	Forum and mailing list.	Forum, Blog, mailing list.	Jboss Network, training, support, Wiki, forum, Blog, mailing list, etc.

A3. Background information of the 4 cases in the third wave

Distinguishing dimension	MySQL AB	Ping Identity Corporation	JasperSoft	Sendmail Inc.
Year company was founded	1995	2002	2001	1998
Country where company was founded	Sweden	USA	USA	USA
Country where company operates as of September 2005	Sweden, USA and other countries.	USA	USA	USA
Birth of the company	Born as open source	Born as open source	Born as open source	Born as open source
Product market	Database	Identity Management	Operational reporting solution	Internet messaging solution
TMT as of September 2005	Founders of projects are founders of company and also TMT members of the company	Founder = CEO + Chairman, founder with another TMT member created the OSS. Nine other TMT members are professionals with technology and business backgrounds.	One of two founders created the OSS project. Other four TMTs are professionals	CTO, one of the founders was the creator of the OSS project. Other TMTs are professionals.
Number of employees as of September 2005	175+	20+	N/A	N/A
Obtained VC funding	Yes (10)	Yes (5)	Yes (3)	Yes (6)
Name of open source software	MySQL	SourceID	JasperReports	Sendmail
OSS License	GPL	SourceID Open Source License	LGPL	Sendmail License
Year open source project was set up	1995	2001	2001	1981
Sponsors of open source projects	MySQL AB.	Ping Identity	JasperSoft	Sendmail
Number of developers	N/A	N/A	N/A	N/A
Number of downloads	Over 10 million in 2004	N/A	460,000+	N/A
Infrastructure for project that company provides	Forum, mailing list, blogs, user groups etc.	Dedicated website, mailing list	OSS community is on sourceforge.net.	Website, Usenet News and mailing list

Appendix B : Companies' offerings to customers

Dimension	Pingtel	Digium	eZ system	Alkacon	SugarCRM	Compiere	Open-Xchange	Liferay	Greenplum	Jboss	MySQL AB	Ping Identity	JasperSoft	Sendmail
Products														
OSS + hardware	√	√			√									
OSS + document						√								
OSS + document + support	√						√	√		√	√	√		
OSS + commercial license			√								√			
OSS + commercial license + support + more functionalities		√			√		√		√		√	√	√	√
Add-on Apps + commercial licenses		√	√		√		√						√	√
Services														
Consultancy	√	√	√	√	√	√		√	√	√	√	√	√	√
Training/ workshops	√	√	√	√	√	√		√	√	√	√	√	√	√
Support (installation, maintenance, trouble-shooting, update)	√	√	√	√	√		√	√	√	√	√	√	√	√
Customization services	√	√	√	√	√	√	√	√	√	√	√	√		√
Services package (yearly-subscriber based)			√				√			√	√	√	√	
Certificates														
Interoperability tests	√	√								√	√			
Training on open source software competence		√				√				√	√			
License														
Commercial license		√	√		√		√				√	√	√	√
Monopoly over CL		√	√		√		√				√	√	√	√

Appendix C: Companies' linkages to partners

C1. Linkages to partners (cases in first wave)

Distinguishing dimension	Pingtel	Digium	eZ system	Alkacon software GmbH	SugarCRM	Compiere
Number of partners	14	12	43	50+	50+	50+
Company-partner anchors	Tests for interoperability To offer highly integrated, SIPxchange based and complete solution to customers	Value-added solutions and services. Tests for interoperability Promote Digium- and Asterisk-related products.	Promotion Solutions Strategies Glue customers, solution providers and market leaders together	Solutions and service based on OpenCms Local presence	Solutions and consulting Local presence	Customer support Local presence
Large partners	Polycom (SIP phones)	Intel (telephony cards) Polycom (IP phones)	IBM, Siemens	No.	Oracle (support database), Jboss	Oracle
Complementary solutions	Yes	Yes, e.g., call centers, VoIP test equipments,	Yes	Yes	Yes	Yes
Contract fee	N/A	N/A	Required for business partners	Free	Yes. $1,500-2,500/year	Yes
Partner programs	Different categories of partners in terms of functionalities: Phone partners; Media gateway partners; Applications partners; Other partners.	Three levels of partners in terms of different benefits and requirements: Partners; Interoperability partners; Premier partners.	Three categories of partners: Reference partners; Business partners (4 tiers in terms of different benefits and requirements); Strategic partners;	A list of OpenCms solution providers is maintained by Alkacon on community's website, which aims to end users looking for a local partner who can help in the implementation of an OpenCms project.	Small business partner and premier business partner with different benefits and requirements.	Different categories of partners in terms of functionalities: Application Solution Providers Value Added Resellers System Implementers Consultants /Trainers
Promotion and	Listed on	Listed on	Listed on	Listed on	Sales and	Listed on

strategies	Pingtel's website. Pingtel provides document and TAC support. Co-author press release. Products are recommended as part of Pingtel's solution	Digium's website. Access to Digium's sales channels. Use Digium and Asterisk's logo on their websites. Premier partner can participate in the joint marketing programs.	eZ's website. Opportunity for commission, project referrals and joint project. Promotion via eZ system marketing channels together. Access to sales channels. Access to private bug report and advanced roadmap Strategic participation	Opencms community's website. Partners are required to place a prominent link to the OpenCms website on their companies websites.	marketing support. Reselling and referrals Discount for using licenses and products	comPiere's website. Presales Support Project Support First level support to customers Stragetic development participation
Interoperability tests	Yes. Test of the interoperability of the OSS with partner's hardware or software	Yes. Test of the interoperability of the OSS with partner's hardware or software	No.	No.	No.	No
Products certificates	Certify the different levels of interoperability of partner's products with Pingtel's OSS products	Option to have products or services Asterisk-Certified by Digium	No.	No.	No.	No
Training certificates	No	Not required	No.	No.	No.	Yes, required for partners.
Conferences for pay	No	Twice a year, partners, customers and users	Once a year, partners, customers and users	No	No	Partners only

C2. Linkages to partners (cases in second wave)

Distinguishing dimension	Open-Xchange	Liferay	Greenplum	Jboss
Number of partners	Unknown	4	Unknown	60+
Company-partner anchors	To offer integrated bundled enterprise solution, e.g., this product and SUSE Linux Server	To offer professional services and support. To offer OS, application server, etc., platform level technology	Greenplum is building relationships with market-leading partners that possess expertise in Business Intelligence and provide complementary skills to enhance the value proposition of the Bizgres product line.	A network of solution, technology and service providers to enhance the proliferation and quality of deployments based on Jboss' products
Large partners	Novell, Red Hat	Novell	Sun	CA, HP, Novell, Microsoft, Unisys, etc.
Complementary solutions	No	No	Yes	Yes
Contract fee	N/A	N/A	N/A	N/A
Partner programs	Three categories: VAR System Integrator ISV, IHV or Linux Developers	Service partners Technology partners	Four categories: Hardware Technology System integrator Solution provider	Four categories: Certified solution partner Certified technology partner Certified system integrator Authorized service partner
Promotion and strategies	Joint Marketing and Sales Lead generation Co-branded material Attractive discount model	Listed on Liferay's website Be verified by the partner (Novell) for proven technology on certain platform	Listed on Greenplum's website	Listed on Jboss' website Co-marketing Sales bonus Certified solutions are recommended by Jboss
Interoperability tests	Yes	Yes	Yes	Yes
Products certificates	No	Certified service partner	Yes	Yes

Training certificates	No	No	No	Yes
Conferences for pay	No	No	No	Yes

C3. Linkages to partners (cases in third wave)

Distinguishing dimension	MySQL AB	Ping Identity Corporation	JasperSoft	Sendmail
Number of partners	70+	5	7	13+
Company-partner anchors	MySQL certified services and products To offer integrated bundled enterprise solution. To offer services to global customers.	Help system integrators and resellers to increase sales and customer satisfaction in federated identity market.	Better integration with other open source or commercial products. Support open source business application development.	Incorporate with other technologies, and solutions
Large partners	Dell, Novell, SAP, NEC.	No.	MySQL, JBoss, Eclipse, IBM, Sun, Oracle, BEA	HP, Intel
Complementary solutions	Yes	Yes	Yes	Yes
Contract fee	Annual fee is required and varied in 4 levels ($595/yaer-$4995/year).	N/A	N/A	N/A
Partner programs	Technology Partners (ISVs, IHVs) and Consulting Partners (SIs, consultants…) in four certified levels.	Federation Partner Program for system integrators and resellers.	Open Source Partners: commit to open source development Technology Integrations partners: offer integrated solution to customers	Three categories: Resellers and distributors Technology Alliance
Promotion and strategies	Listed on MySQL's website Certified by MySQL to have credibility to offer MySQL related products or services Offer the integrated solutions to customers together with MySQL Share the sales channels	Sales, marketing, and training support Referral and reseller opportunities generate additional revenue Invitations to special marketing events Early access to new Ping Identity products and training Listed on the website	Listed on JasperSoft's website. Provide integrated solution.	Listed on Sendmail Inc.'s website Integrated solution with other complementary products
Interoperability tests	Yes	No	Yes	Unknown

Products certificates	Yes	No	No.	No
Training certificates	Not required.	No	No.	Unknown
Conferences for pay	Yes (users conference)	Yes (user conference)	No	No

Appendix D: Motives, risks and their references

Companies	Motivation for setting up the OSS projects	Motivation for participating in OSS project	Risks of depending on open source project
Pingtel	Established the OSS project for the purpose of using the open source model to address the needs of the emerging SIP market[15]	Opportunity to increase share of IP PBX market.[16] Improve the interoperability between products[17] More product options and lower maintenance cost[18]	Claimed no risks identified that have been identified by the researcher
Digium	Mark Spencer created the OSS project to meet the telephony needs of his own Linux service company in 1999[19]	Make better and less expensive software[20],[21] Benefit from a broad active community[22]	Can't keep up with the need to constantly innovate that arises because the time between when software is released and when it can be obtained decreases to minutes[23] Face increased competition[24]
eZ system	eZ system, at the time a Linux consultancy company, after satisfying a customer's need for an e-commerce solution in 1999, established the OSS project and released the proprietary code for eZ publish as open source in 2000.[25]	No technology lock-in and less risks An open development process Superior software, and superior user value [26] Strong feed back from large number of active developers[27],[28]	"We don't hold the keys to any secret, we're just careful about how we treat our customers and our community"[29]
Alkacon software GmbH	The core business of the company for which	Provide a cost effective, professional solution to	No response and data is not available

[15]From FAQs (frequently asked questions) document provided by Pingtel, available at: http://www.pingtel.com/upload/library/corporatefaq.pdf
[16]From FAQs (frequently asked questions) document provided by Pingtel, available at: http://www.pingtel.com/upload/library/corporatefaq.pdf
[17] http://www.pingtel.com/page.php?id=70&view=28
[18] http://www.eweek.com/article2/0,1895,1560625,00.asp
[19] http://www.linux-mag.com/content/view/2119/
[20] http://www.tmcnet.com/usubmit/2005/sep/1187731.htm
[21] http://searchopensource.techtarget.com/originalContent/0,289142,sid39_gci1081911,00.html
[22] http://searchopensource.techtarget.com/originalContent/0,289142,sid39_gci1081911,00.html
[23] http://news.com.com/Is+the+telephone+industry+ready+for+open+source/2008-1082_3-5737703.html
[24] http://news.com.com/Is+the+telephone+industry+ready+for+open+source/2008-1082_3-5737703.html
[25] http://www.sitepoint.com/article/bard-farstad-ez-systems
[26] First three points from http://ez.no/company
[27] http://ez.no/company
[28] http://www.sitepoint.com/article/bard-farstad-ez-systems
[29] Derived from the answer of email survey

	Alexander Kandzior worked was not software development. He decided to establish an OSS project and released the proprietary code for openCms as open source in 2000.[30]	customers[31]	
SugarCRM	Tired of the inefficiencies of developing proprietary CRM software and wishing to own their own company, three employees set up an OSS project to develop SugarCRM's as well as their own company in 2004.[32, 33]	Save development and pre-sale cost[34, 35] Focus more on development to make better software[36] Benefit from community of developers from all over the world[37]	Balance the contributions to the OSS code and gaining competitive advantage to competitors by keeping some "key" source code[38]
ComPiere	Jorg Janke started the project to improve the performance of a bespoke application software while he worked in Oracle in 1999.[39]	Save pre-sale cost as 50-70% of the cost is pre-sales related in a typical software company[40] Make better software[41, 42]	Steering group takes over the open source tree and setting project priorities[43] Enormous support needs and low profit margin.[44] Project and company objectives become incompatible[45] Conflicts with channel partners arise[46]
Open-Xchange Inc.	To provide customers an alternative to proprietary products[47] Also partly driven by the partners, like Novell[48]	To gain greater innovation and better integration with other products.[49] Leverage the unbreakable and innovative drive of the open source community	No response and data is not available

[30] http://www.opencms.org/opencms/en/support/faq.html
[31] http://www.alkacon.com/alkacon/en/company/shownews.html?id=688
[32] http://www.oetrends.com/news.php?action=view_record&idnum=420
[33] http://news.com.com/Breaking+the+rules+with+open+source/2100-7344_3-5290983.html
[34] http://www.destinationcrm.com/articles/default.asp?ArticleID=5021
[35] http://news.zdnet.com/2100-3513_22-5566775.html
[36] http://news.com.com/Breaking+the+rules+with+open+source/2100-7344_3-5290983.html
[37] http://www.crm-daily.com/story.xhtml?story_title=SugarCRM-Opens-Doors-to-Developer-Community&story_id=31241
[38] http://webservices.dhts.duke.edu/modules/staff/index.php?id=4
[39] http://www.compiere.com/about/team.html
[40] http://www.compiere.com/about/openSource.html
[41] http://www.compiere.com/about/openSource.html
[42] http://www.compiere.com/about/whyfree.html
[43] Derived from the answer of email survey
[44] Derived from the answer of email survey
[45] Derived from the answer of email survey
[46] http://www.compiere.org/partner/whyPartners.html

		to retain the customers and partners[50]	
Liferay	To provide non-profit organizations with a free portal as a means to help these organizations collaborate on the Internet.[51],[52]	For wider adoption by technology community. Development of an expert user base. Acceptance as a standard portal platform. Increasing robustness of the product.[53]	No response and data is not available
Greenplum	To improve the PostgreSQL database system.[54] To utilize resources from both companies and individuals.[55] To provide cost-effective alternative to proprietary products.[56]	To increase the adoption of PostgreSQL. To accelerate and extend the development of features of its commercial product. To follow Red Hat's way of transforming market for Linux OS to transform market for open source BI product.[57]	No response and data is not available
JBoss Inc.	To develop a new software to manage Java applications which is different from what big company offered, e.g., Sun.[58] To get more support and resource from community[59]	To explore next generation open source development model – Professional Open Source[60] To provide a true alternative to pricey, monolithic proprietary software stacks, that gives users more flexibility and technology choice.[61],[62] To leverage open standards and the innovation from open source community[63]	Scaling risks. Services business are difficult to scale because of the large labor intensity, which requires a big network of services providers and channel partners.[64]

[47] http://www.eweek.com/article2/0,1895,1630115,00.asp
[48] http://www.eweek.com/article2/0,1895,1630115,00.asp
[49] http://www.openexchange.com/EN/news/press.html
[50] http://www.openexchange.com/misc/novell_netline_os_server_strategy_en.pdf
[51] http://blogs.zdnet.com/open-source/?p=431
[52] https://www.dev.java.net/files/documents/1654/9082/bc.html
[53] http://www.liferay.com/web/guest/company
[54] http://www.bizgres.org/pages.php?pg=about%7Chistory
[55] http://www.bizgres.org/pages.php?pg=about%7Chistory
[56] http://www.greenplum.com/_files/docs/GP_Corp_Overview.pdf
[57] All four points from http://www.greenplum.com/prod_why_os.html
[58] Watson, R., Wynn, D. and Boudreau, M., 2005. JBoss: the evolution of professional open source software. MIS Quarterly Executive, 4(3): 329-341.
[59] http://www.jboss.com/pdf/JDJSkokInterview.pdf
[60] http://www.jboss.com/company/pos

MySQL AB.	To increase the performance of an existing software at that time to meet their own needs[65]	Make superior and affordable software Subscribe to the Open Source philosophy Be a virtual company and network with others in the whole world. Be a key part of LAMP (Linux, Apache, MySQL, PHP), a fast growing enterprise OSS stack and set database standard[66]	No response and data is not available
Ping Identity Corp.	Accelerate the acceptance of the product on the emerging market[67]	Accelerate the acceptance of the product on the emerging market[68] Promote the product to be integrated with other applications by other vendors.[69],[70]	Claimed no risks that have been identified by the researcher
JasperSoft Corp.	To solve an advanced software problem and gain support from community[71]	Believe in that the open source is a complete and encompassing business philosophy.[72] Provide cost-effective solution for customers.[73] Leverage open source developer community, build up relationships with partners and customers[74]	No response and data is not available
Sendmail Inc.	Originated as part of BSD Unix to solve a local problem, then became open source to contribute to the internet	Commit to the long tradition of working with open Source community.[77]	the community may lose interest in a given project[80]

[61] http://www.jboss.com/company/index
[62] http://www.businessweek.com/technology/content/jul2005/tc2005078_5465_tc121.htm
[63] http://www.jboss.com/company/index
[64] Watson, R., Wynn, D. and Boudreau, M., 2005. JBoss: the evolution of professional open source software. MIS Quarterly Executive, 4(3): 329-341.
[65] http://sunsite.mff.cuni.cz/MIRRORS/ftp.mysql.com/doc/en/History.html
[66] All four points from http://www.mysql.com/company/
[67] Derived from the telephone interview (Oct. 30,2005)
[68] Derived from the telephone interview (Oct. 30,2005)
[69] Derived from the telephone interview (Oct. 30,2005)
[70] http://www.worthwhilemag.com/entry/2004/05/28/interview_andre_durand_ceo_pingidentity.php
[71] http://www.orangecrate.com/article.php?sid=968
[72] http://www.jaspersoft.com/faq.php#wjs
[73] http://www.jaspersoft.com/downloads/jspressrelease/JasperSoftCompanyRelease.pdf
[74] http://www.jaspersoft.com/downloads/jspressrelease/JasperSoftProductRelease.pdf
[75] http://linux.omnipotent.net/article.php?article_id=12508

	and gain profit[75],[76]	To continue promote innovation and reliability of the open source product, drive the development and adoption of new Internet standards, and fuel the continuing innovation in the commercial product.[78],[79]	

[76] http://www.sendmail.com/pdfs/datasheets/opensource_faq.pdf
[77] http://www.sendmail.com/pdfs/datasheets/opensource_faq.pdf
[78] http://www.sendmail.com/pdfs/datasheets/opensource_faq.pdf
[79] http://www.sendmail.com/pdfs/datasheets/ds_corp_background.pdf
[80] http://www.seul.org/pub/oss_conference_interop.html

Appendix E: Key words for categorization of motives and risks

E1. Key words for categorization of risks

Risks that OSS companies face	Key words
Company objectives and project objectives become incompatible	Company objectives and project objectives become incompatible
Control over the OSS tree, version plan and priority setting is lost	Steering group, take over,
Failure to manage balance between code company releases and code it keeps	Open source code, proprietary code, open source projects, commercial licensed code, release, balance, holdback, keep
Developers do not contribute code to OSS project	Community lost interests, developers , move to, swing to, new projects
Failure to treat customers and developers properly	Careful about, treat customers and community
Company can not grow network of partners and resellers	Partners, resellers, network, can't grow, develop
Support requirements become too large and profits from providing it become too low	Support requirements large, profits low
Difficult to resolve conflicts arise with partners and resellers	Conflicts with partners
Company can not innovate fast enough to keep up with OSS releases	Constantly innovate, decreased time to adoption, can't keep up with
Company faces increased competition	Increase competition, face, meet, have

E2. Key words for categorization of motives for setting up OSS projects

Motives for setting up OSS projects	Key words
Attract developers to make better software	Need, build, develop, better way, better software, more developers, technical assistance, superior software, working together, professional software
Seed the market for a new company and accelerate product acceptance in a new market	Release as open source, broad acceptance, more users, increase market share, fast adoption, increased visibility
Provide customers an alternative to proprietary software	Alternative to proprietary, replacing proprietary, option to proprietary
Solve an advanced problem for existing software	Designed to handle, develop software to allow, to solve, problem, improve, inefficiencies, delay, instead of
Maintain product that is not core to the	Core business was not software

existing business	development, decided to publish
Satisfy and retain partners and customers	let customers and partners download the code for free, customers calling for, partners recognized the value of open source
Meet needs of non-for profit and small business organizations	build for church, messianic aspect to open source

E3. Key words for categorization of motives for participating in OSS projects

Motives for participating in OSS projects	**Key words**
Reduce development costs	Several projects, collaboration, cost-effective, inexpensive way, sharing, affordable, low-cost development
Attract developers to make better software	Need, build, develop, better way, better software, more developers, technical assistance, superior software, working together, professional software
Reduce pre-sales costs	Save, reduce, pre-sales cost, do the pre-sales effort yourself
Increase market share of existing product	Increase market share
Obtain feedback from diverse communities	Active community of developers and users, demand for customization, share information, feedback, a lot of feedback, response
Offer more options and features faster	Extended features
Improve product interoperability	Improve interoperability, interoperate with other products, assurances
Set standard	Standard, common, set, apply
Accelerate the exploration of new ways of doing things	Open development process, explore next generation model, POS, Commercial open source, open dialogue
Accelerate the incorporation of innovation into product	Gain, accelerate, access, increase, innovative ideas, innovations, innovative feedback, various ideas
Satisfy and retain partners and customers	Customers and partners, drive, call for, ask for, need, value of open source, source code
Develop expert user base	Develop expert user base
Reduce risk of technology lock-in	No technology lock-in

Appendix F: List of candidate OSS projects for identifying the second wave of OSS companies

OSS project	Project market	Project website
Agila	Business intelligence	http://incubator.apache.org/projects/agila
Bizgres	Business intelligence	http://www.bizgres.org
Pentaho	Business intelligence	http://www.pentaho.org
Mambo	CMS	http://www.mamboserver.com
OpenLDAP	Directory services	http:// www.openldap.org
TUTOS	ERP	http://www.totos.org
webERP	ERP	http://www.weberp.org
Iona Celtix	ESB	http://www.iona.com/celtix
Mule	ESB	http://mule.codehaus.org
Open-Xchange	Groupware	http://www.openxchange.org
JOSSO	Identity management	http://www.josso.org
Shibboleth	Identity management	http://shibboleth.internet2.edu
Jboss	Middleware system	http://www.jboss.org
jPOS	Point of sale	http://www.jpos.org
Liferay	Portals	http://www.liferay.com
RadioActive Foundation	RFID	http:// www.radioactivehq.org
Bayonne	VoIP PBX	http://www.gnu.org/software/bayonne/bayonne.html
Yate	VoIP PBX	http://yate.null.ro

Appendix G: List of candidate OSS projects for identifying the third wave of OSS companies

OSS project	Project market	Project website
MySQL	Database	http://www.mysql.com
Sleepycat	Database	http://www.sleepycat.com
Sendmail	Email infrastructure	http://www.sendmail.org
SourceID	Identity management	http://www.sourceid.org
Perl	Programming language	http://www.perl.org
JasperReports	Reporting system	http:// jasperreports.sourceforge.net
Trolltech	Software development tools	http://www.trolltech.com
Apache	Web server and related	http://www.apache.org