Journal of the Association for Information Systems
JAIS

Special Issue

A Comprehensive Review and Synthesis of Open Source Research

Altay Aksulu
Schulich School of Business, York University
aaksulu@schulich.yorku.ca

Michael Wade
Schulich School of Business, York University
mwade@schulich.yorku.ca

Abstract

The open source movement has grown steadily and matured in recent years, and this growth has been mirrored by a rise in open source related research. The objective of this paper is to pause and reflect on the state of the field. We start by conducting a comprehensive literature review of open source research, and organize the resulting 618 peer-reviewed articles into a taxonomy. Elements of this taxonomy are defined and described. We then draw on a number of existing categorization schemes to develop a framework to situate open source research within a wider nomological network. Building on concepts from systems theory, we propose a holistic framework of open source research. This framework incorporates current research, as represented by the taxonomy, identifies gaps and areas of overlap, and charts a path for future work.

Keywords: *Open Source Software (OSS), Open Source Research (OSR), OSR Literature, OSR Taxonomies, OSR Frameworks.*

* Kevin Crowston was the accepting senior editor. This article was submitted on October 27, 2009 and went through two revisions.

Volume 11, Special Issue, pp. 576-656, *November* 2010

1. Introduction

While many of the concepts behind the open source movement, like peer production, shared code, and software as a public good have been around since the beginning of the computing era, use of the term "open source" is a relatively recent phenomenon (see Weber, 2004 for a chronological history). According to most accounts, the term was first used in February 1998 as a consequence of the decision by Netscape to allow free access to its browser's source code (Raymond, 2001a; Searls, 2005). The term was subsequently appropriated by the Open Source Initiative, in part to counter the lingering misconceptions about the Free Software Foundation.[1] While there is no single definitive definition of open source, it is generally accepted to mean software that allows for the modification of source code, is freely distributed, is technologically neutral, and grants free subsidiary licensing rights (Perens, 1999). In many respects, the term open source is seen as a certification mark (Neumann, 1999) requiring free, independent, and indiscriminate redistribution of software, source code and reuse licenses.[2] However, the open source phenomenon has come to represent more than merely a process for managing software development projects. Indeed, the term has been used to describe a wide range of collaborative ventures well beyond software development (Butcher, 2009; Pénin and Wack, 2008; Stanford and Mikula, 2008; Watson et al., 2008b; Hutchinson, 2008; Pitt et al., 2006; Shah, 2005). As with any new and fast developing topic area, it is useful to pause and reflect on the progress it has made. The purpose of this paper is to present a comprehensive taxonomy of existing open source research, to develop a framework to organize this research, and to chart a course for future work.

We believe that open source research (OSR) has advanced considerably over the last decade and despite the field's ever-changing nature, a snapshot to determine the "state of the field" can add substantial value. With many top-tier journals publishing OSR, a large body of knowledge has already been accumulated (see Crowston et al., 2010 for a recent review). We believe that the time is right to examine the extent of this research and organize it into a taxonomy. A research taxonomy can provide several potential benefits. First, it can provide an organized repository of the existing literature. This repository allows interested researchers to quickly and efficiently zoom in on particular articles or subcategories. Second, it can present a clear picture of the breadth and depth of an emerging field. This picture can help to identify research trends as well as any potential gaps in the literature. Finally, a taxonomy can provide a stepping stone towards the establishment of a comprehensive theory or framework, one that can help to explain and predict current trends and guide future research. As Vogel and Wetherbe (1984) put it, "taxonomies help to focus research, clarify representation in the literature, define standards, and spot trends or gaps in the research. By categorizing research efforts, taxonomies help provide a measure of order that would go wanting in their absence." (Vogel and Wetherbe, 1984, p. 4).

2. Building a taxonomy of open source research

Our first objective was to conduct an extensive search of open source research across different academic areas. Building on Vogel and Wetherbe (1984), we sought to ensure that our taxonomy was comprehensive, parsimonious and useful. These three standards have been used to evaluate previous taxonomy schemes, including information systems research (Järvinen, 2000), operations research education (Reisman, 2004), and supply chain management (Capar et al., 2004).

In order to be comprehensive, a taxonomy should cover the breadth and depth of a field's high quality work in an unbiased fashion. To be parsimonious, a taxonomy must avoid unnecessary categories. Nonetheless, in practice this goal may not be easy to achieve since there exists a notable tension

1 Free Software Foundation is a United States-based donor supported charity founded in 1985 to promote computer user freedom and to defend the rights of all free software users. More information can be found at http://www.fsf.org/.
2 The complete criteria can be found at http://www.opensource.org/docs/osd. For the purposes of our research, any software project that cannot be classified into one of more than sixty open source licenses listed by the open source initiative (http://www.opensource.org/licenses) is considered to be proprietary software.

between comprehensiveness and parsimony. The more comprehensive a taxonomy becomes, the more compromises have to be made around parsimony. Thus, a delicate balance has to be maintained to provide meaningful and reasonably distinct categories. Finally, to be useful, taxonomy categories should be both near mutually exclusive and collectively exhaustive, and offer reasonably distinct and meaningful categorizations of the literature to prevent confusion and to facilitate widespread use.

We are aware of two existing OSR bibliographies. These resources provide lists of open source research, but do not attempt to organize the resulting work into a taxonomy. The first bibliography is maintained by Joseph Keller and appears on the University College Cork website. This resource includes 316 entries and is current up to the end of 2006. The second source, the Massachusetts Institute of Technology's (MIT) Free/Open Source Community lists and hosts 227 OSR studies, most of which are working papers. This resource provides coverage up to the beginning of 2009. A third resource, hosted by the Vienna University of Economics and Business Administration and maintained by Stefan Koch, is no longer available.

While we were not able to identify a published taxonomy of OSR during our initial review, a recent literature review (presently in press) focusing on empirical OSS papers has been provided by Crowston et al. (2010). This study relied on papers that were collected in two waves. In the first wave, paper collection involved the above-mentioned MIT repository, special journal issues, conference tracks, document databases and key article reference lists whereas the second wave focused on peer-reviewed journals. Wave one produced 586 papers, less than half of which were journal articles, and only 138 were considered to be empirical. Wave two resulted in an additional 55 empirical articles from peer-reviewed journals, bringing the total number of empirical articles that were reviewed to 193.

2.1. Research methodology

Our data collection procedure was unbiased to the extent that it was not guided by an a priori framework (although a number of such frameworks exist as we will demonstrate later), nor was it restricted to certain academic disciplines or journals. We wanted to conduct a thorough search of OSR and then organize the resulting data into a taxonomy. It was not our intent at this stage to normatively determine gaps or areas of duplication, or conduct any forward-looking analysis. We merely intended to provide a snapshot of the current state of OSR. In the sections below, we briefly elaborate on the guiding principles that shaped the data collection and analysis processes. In particular, the data collection section talks about the selection of our data sources, assessment of their comprehensiveness, as well as the criteria for inclusion and exclusion. The data analysis section provides detailed information on our coding and refinement processes, including how codes were affixed to articles as well as the identification of common themes and patterns.

2.1.1. Data collection

Our preliminary mode of data gathering involved examining (Wolcott, 1994) major research archives. We selected ProQuest as our primary research portal. As the world's largest repository of academic research, ProQuest provides archives of sources such as newspapers, periodicals, dissertations, and aggregated databases of many types. Its content is estimated at 125 billion digital pages and is accessible through most university library Internet gateways. Our original intention was to capture academic research on the open source phenomenon including, but not limited to, OSS. Nonetheless, our initial search efforts using such terms as "open phenomenon" or "open paradigm" uncovered few results. We therefore had to rely on commonly used keywords like "open source" and "open systems" that may have biased the results towards a software focus.

Using ProQuest's advanced search functionality, we created a query that searched for documents where the subject included the terms "open source software" or "open systems" and the document abstract had the term "open source." We selected all available databases under the multiple databases option, which includes ABI/INFORM Global, ABI/INFORM Trade & Industry, ProQuest European/Asian Business, and ProQuest Research Library, and did not limit the search to a specific time period. We only limited search results to documents published in English and where publication

type was scholarly journals. As of June 9, 2009 this initial search returned 524 articles that appeared in more than 190 journals. Each document was captured and, in aggregate, constituted the core raw material for our analysis.

Despite the comparatively high number of journals covered, the ProQuest multiple database archives appeared to have omitted a few key journals that frequently publish OSR. In an effort to provide additional coverage and develop a more thorough sample, we used a randomly selected sample of OSR articles and conducted a backward and forward citation analysis (Webster and Watson, 2002). For the backward tracking, we looked at the references provided in the sample set and searched for journal omissions. For the forward tracking, we used Google Scholar to identify articles that cited the sample set and investigated the journal coverage. Through this quality check, we were able to identify a few additional journals that were omitted from the initial pool. For example, the addition of one such journal, *First Monday*, resulted in around 70 additional OSR articles. Following this exercise, we were able to expand the data pool to 618 articles. This number is substantially larger than previous OSR bibliographies, and comparable to reviews and bibliographies in related fields.

2.1.2. Data analysis – coding, refining, patterning

Our main aim in analyzing the data was to discover the underlying concepts and look for overarching themes to organize these into a taxonomy. To accomplish this goal, we selectively borrowed techniques from qualitative analysis methodology and followed a systematic process of interpretation and analysis. This process involved conceptualization and reduction of data, elaboration of categorical properties and dimensions, and semantic filtering through prepositional statements. We followed a multistage content analysis process (Glasser and Strauss, 1967; Miles and Huberman, 1984) that is appropriate for a research area at the ad-hoc classification level (Webster and Watson, 2002). The particular process we followed is depicted in Figure 1. We believe that OSR can benefit from a taxonomy in advance of any serious grounded theory efforts. We use inductive analysis to mean that the descriptive codes, interpreted categories and patterns came from the data rather than being imposed by theory prior to data collection and analysis (Patton, 1980).

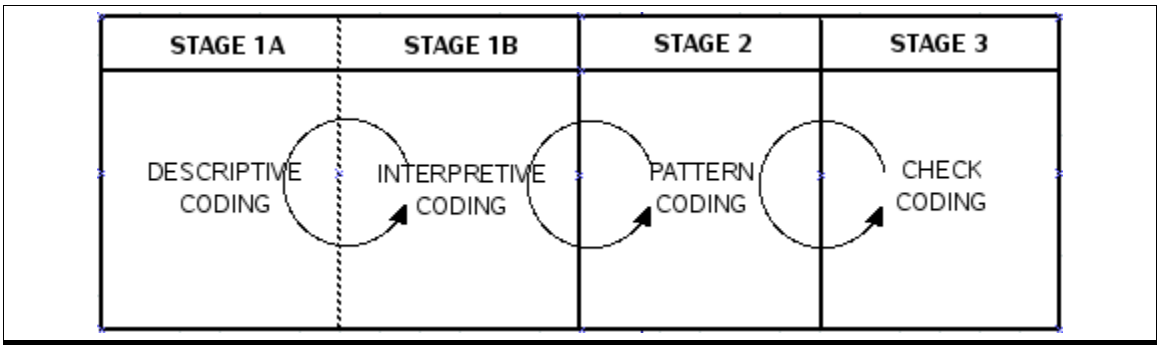

Figure 1: Multi-Stage, Iterative Coding Process

In order not to bias the results, we did not begin the coding process with a pre-defined list of categories, instead allowing the categories to emerge and evolve throughout the analysis (Glasser and Strauss, 1967). We felt that this emergent process would be more suited to our intended approach.

Stage 1A – Descriptive coding

This multistage and highly iterative process started with one researcher reviewing the entire data pool. In an effort to take advantage of the more specialized nature of newer articles, the articles were reviewed in reverse-chronological order, starting with the most recent and moving backwards in time. Each paper's abstract was reviewed first, before the paper was scanned. When scans were not sufficient in giving clues about the topical content, papers had to be read in their entirety. In the first pass, our aim was to highlight recurring content classes and themes. As each paper was reviewed, we asked ourselves "What is this paper about?" and "What are the fundamental concept or concepts

that are being addressed in this paper?"

This early process involved little or no interpretation as we simply affixed descriptive labels to papers such as "Developer Motivations," "OSS Licensing," or "OSS Reliability." Nonetheless, instead of linking these descriptive codes to small segments of text, we attached them to complete studies focusing on the totality of the paper as opposed to line-by-line or segment-by-segment coding. Several factors, including the title of the study, the publishing journal, the ProQuest abstract, the abstract of the original article (if different from the ProQuest abstract or when the article originated from a supplemental source), as well as the primary author's other known work, affected what code or codes were assigned to each article.

Stage 1B – Interpretive coding

The coding process was highly iterative. When existing codes were expanded or merged, this resulted in a re-categorization of all previous articles where the same codes were utilized. At this point, we ventured beyond descriptive codes into interpretive coding. For example, while we originally had different categories such as "Collaboration," "Knowledge Sharing," and "Code Reuse," later on we noticed that all these codes were conceptually similar and generally appeared together. We then went back to all articles where those codes were used to check the validity of this assumption at its source. Following this process, we created a "Collaboration and Knowledge Sharing" code to accommodate them (the higher level pattern was not created until the next stage). Similarly, it was not until such descriptive codes as "OSS Reliability," "OSS Usability," "OSS Maintainability," and "OSS Performance" were in place that we noticed they were different aspects of an overall quality discussion, and we created the "Software Quality" code after reassessing all those articles to make sure they fit into this unifying view.

In some cases, we created additional codes. For example, under the "Software Quality" umbrella, it became clear to us that articles addressing the topics of software testing and security were conceptually different enough to deserve their own labels but not to deserve a separate high level code. We therefore created the "Testing and Bug Fixes" and the "OSS Security" sub-categories under the "Software Quality" code. Due to the emergent and descriptive nature of this iterative process, the pace of new code generation was very high in the beginning but slowed down as the existing code base became larger. Saturation was achieved about half way through the coding process, after which point few new codes were required. A total of 111 labels were identified after one pass through the complete article set.

Stage 2 – Pattern coding

In the next stage, we organized the existing labels into emergent patterns. During this stage, we were able to identify seven explanatory patterns. These patterns are: conceptual; performance metrics; legal and regulatory; OSS production; OSS applications; OSS diffusion; and beyond software (a description of each category is provided in Appendix A). The process of assigning codes to patterns was highly iterative. For example, the "Legal and Regulatory" pattern code grouped such labels as "OSS Licensing," which investigated and compared various OSS license types; "OSS Intellectual Property Rights," which looked into diverse intellectual property issues such as patents, trademarks and copyrights; "OSS Legal Issues," which assessed legal issues and risks concerning OSS in general; as well as "OSS Standards and Regulation," which took a closer look into the interactions between standards and regulation as well as their impact on OSS community evolution and diffusion.

At this stage, using the higher level of abstraction provided by the pattern codes, we were also able to further consolidate the labels. For instance, creation of the "OSS Applications" pattern, which grouped articles that were written on discipline or area-specific OSS applications, allowed us to bundle a number of existing labels. Hence, we were able to combine such labels as "Information Management" and "Knowledge Management," "Imaging" and "Plotting," "Planning" and "Optimization," as well as "Programming Languages," "Scripting Languages," "Modelling Languages" and "Markup Languages" to create natural groupings that were not as obvious prior to this stage. Once all similar labels had been identified and merged, the total number of descriptive codes was reduced to 88 and each code

belonged to one of the 7 pattern codes.

Stage 3 – Check coding

In the final stage, the codes and patterns were independently assessed by two naive coders. Two doctoral students were trained in the coding framework (Miles and Huberman, 1994) and then given identical samples of raw data in the form of all article abstracts and were also provided with a one-page summary sheet that included the 88 descriptive codes and the 7 patterns. In other words, the emergent coding scheme that was the result of the preceding analysis stages became the provisional "start list" of codes for the co-analysts.

The coders were then asked to go through the raw data and decide which code or codes best described the content of each article by asking themselves the same questions that guided our earlier analysis: "What is this paper about?" and "What are the fundamental concept or concepts that are being addressed in this paper?" The co-analysts were told they were not restricted to the start list of codes and if they felt an article required a new code or a number of new codes they were free to expand the list. We also asked them to report on whether they thought patterns grouped similar codes (to validate internal consistency) and whether each pattern was reasonably distinct (to validate discreteness). During the validation process, we refrained from giving any feedback to co-analysts in order not to bias the results. Once all the raw data were coded, we grouped the results in a spreadsheet and calculated intercoder reliability (Miles and Huberman, 1994). The initial reliability figures for the two coders were 68 percent and 69 percent respectively. These results were very close to Miles and Huberman's upper limit of 70 percent for pre-resolution reliability benchmark.

We then followed a structured approach to resolve differences. We organized codes under their category patterns and for each pattern we compared the assigned codes. In cases where there were disagreements between the original coding scheme and the two validity checks, we followed a majority rules approach. In a small number of cases, none of the coders were in agreement. Each of these cases was resolved by re-checking the codes against the original subject article(s). On occasions when an additional code (or codes) provided better content clarity of the article, we added that code (or codes) to the list of codes associated with the article. During the resolution process, we also had an opportunity to further refine the codes by combining those that were not sufficiently distinct as manifested by repeated disagreements caused by the same set of codes (suggesting they were confusingly similar). For example, we merged the "content management" and "information and knowledge management" codes, and combined "Programming, scripting, modeling and markup languages," "Object oriented software," and "Integrated development environments" codes under the "Software Development and Engineering" code, among many others. As a result of the validation process, we were able to reduce the number of codes from 88 to 57, which are reflected in Table 1. The table shows the groupings and the categories, along with the number of instances within each category. The total number of counts or instances was 1,355, which is greater than the total number of articles, 618. This difference is accounted for by the fact that many papers contained topics that fell into multiple categories. A detailed description of each pattern and category along with the complete list of articles included within the category is provided in Appendix A.

Table 1: A Taxonomy of Open Source Research

PATTERN	CODE	COUNT
CONCEPTUAL	OSS DESCRIPTIVE	41
	OSS BENEFITS/DRAWBACKS	21
	OSS VISION/ROADMAP	8
	OSS RESEARCH CATEGORIZATION / RESEARCH AGENDA	16
	OSS VERSUS PROPRIETARY	62
	BUSINESS/ECONOMIC MODELS&STRATEGIES/POLICIES FOR OSS	68
	PATTERN SUB-CATEGORY TOTAL	**216**
PERFORMANCE METRICS	SOFTWARE QUALITY	56
	SOFTWARE QUALITY – TESTING and BUG FIXES	16
	SOFTWARE QUALITY – OSS SECURITY	9
	SOFTWARE DEVELOPMENT – OSS CODE EFFICIENCIES	29
	DEVELOPMENT TEAM PERFORMANCE	14
	OSS SUCCESS	13
	PATTERN SUB-CATEGORY TOTAL	**137**
LEGAL AND REGULATORY	OSS LICENSING	54
	OSS INTELLECTUAL PROPERTY RIGHTS	57
	OSS LEGAL ISSUES	27
	OSS STANDARDS AND REGULATION	24
	PATTERN SUB-CATEGORY TOTAL	**162**
OSS PRODUCTION	PROCESS	33
	COMMUNITIES	47
	TEAM FORMATION	13
	GOVERNANCE	34
	TEAM/PROJECT LEADERSHIP	10
	INDIVIDUAL AND TEAM LEARNING	6
	INNOVATION	19
	ROLE OF VOLUNTEER USERS / DEVELOPERS	13
	COLLABORATION AND KNOWLEDGE SHARING	37
	USER AND DEVELOPER MOTIVATIONS	42
	ROLE OF COMMERCIAL CORPORATIONS	31
	SOFTWARE DEVELOPMENT – USE OF OSS COMPONENTS	21
	OSS PRODUCTION – ROLE OF LICENSING AND IP	12
	SELF-ORGANIZATION (PRODUCT AND COMMUNITY EVOLUTION)	20

Table 1: A Taxonomy of Open Source Research		
	PATTERN SUB-CATEGORY TOTAL	**338**
OSS APPLICATIONS	TELECOMMUNICATIONS, NETWORKING AND ARCHITECTURE	11
	EDUCATION	37
	LIBRARIES, ARCHIVES, DATABASES AND REPOSITORIES	56
	CONTENT, INFORMATION&KNOWLEDGE MANAGEMENT SYSTEMS	32
	IMAGING, PLOTTING AND VISUAL	10
	SECURITY AND CYBERCRIME	8
	SUPPLY CHAIN MANAGEMENT AND OPTIMIZATION	9
	DESKTOP AND SERVER OPERATING SYSTEMS	27
	GAMING AND SIMULATIONS	5
	SOFTWARE DEVELOPMENT AND ENGINEERING	34
	ACADEMIC AND COMMERCIAL RESEARCH	22
	BIOMEDICAL AND HEALTH SCIENCES	25
	BUSINESS, PROFESSIONAL AND SOCIAL SCIENCES	9
	NATURAL SCIENCES	10
	PUBLIC SECTOR AND E-GOVERNMENT	9
	PATTERN SUB-CATEGORY TOTAL	**304**
OSS DIFFUSION	OSS ADOPTION – GENERAL	16
	OSS ADOPTION – BARRIERS	13
	OSS ADOPTION – DECISION FACTORS	15
	OSS IMPLEMENTATION – GENERAL	14
	OSS IMPLEMENTATION – IMPLEMENTATION COMMUNITIES AND NETWORKS	8
	OSS IMPLEMENTATION – GOVERNMENTS / NATIONS	22
	PATTERN SUB-CATEGORY TOTAL	**88**
BEYOND SOFTWARE	OPEN PARADIGM	31
	OPEN INNOVATION	28
	OPEN KNOWLEDGE FLOWS	25
	OPEN STANDARDS	8
	OPEN EDUCATION	12
	USER OR CO-PRODUCTION OF GOODS AND CONSUMER IMPLICATIONS	6
	PATTERN SUB-CATEGORY TOTAL	**110**
	GRAND TOTAL	**1355**

2.2. Evolution of open source research

During the coding process, we discovered some insights into the development of the field. For instance, we noticed that much of the early OSR was exploratory in nature. While some studies

provided a general overview in a largely descriptive manner (O'Reilly, 1999; Blau, 1999; Cass, 2001; Bretthauer, 2002, Krishnamurthy; 2003), other studies looked at various isolated topics ranging from potential benefits or advantages of open source software (Kogut and Metiu, 2001; Torvalds and Diamond, 2001; Fuggetta, 2003; Ringle, 2004) compared to proprietary software (Neumann, 1999; Raymond, 2001b; West, 2003; Fuggetta, 2003; Paulson et al., 2004), to quality (Bollinger et al., 1999; Neumann, 1999; McConnell, 1999; Zhao and Elbaum, 2003; Huntley; 2003; Samoladas et al., 2004), and to lessons and strategies for traditional enterprises (O'Reilly, 1999; Ousterhout, 1999; Gannon, 2000; West, 2003; Hawkins, 2004).

As the field started to mature, specific knowledge islands started to emerge. Certain topic areas began to garner a substantial amount of attention and interest within the field, most notably licensing (Välimäki and Borsalino, 2003; de Laat, 2004; Wacha, 2005; Gandel and Wheeler, 2005; Lerner, 2005; Carver, 2005; Gambardella and Hall, 2006), developer motivations (Hertel et al., 2003; Bonaccorsi and Rossi, 2003; Zeitlyn, 2003; Bitzer and Schröder, 2005; Bagozzi and Dholakia, 2006; Shah, 2006), open innovation (Kogut and Metiu, 2001; von Hippel, 2001; von Krogh et al. 2003; von Hippel et al., 2003; Grand et al., 2004), and open source governance (Franck and Jungwirth, 2003; Bonaccorsi and Rossi, 2003; Demil and Lecocq, 2006; Shah, 2006). As can be seen in the taxonomy, these areas constitute some of the more popular categories of OSR.

While it is useful to assess the progress of a field's development, a research taxonomy is silent about whether or not the extant research is appropriate or productive. The taxonomy tells us only where the field is, not where it should be, or where it needs to go next. It can perhaps provide an indication of areas of overlap, but it says little about gaps. The categories may be mutually exclusive or near exclusive, but there is no way to know if they are appropriate, or exhaustive. To address these normative issues, it is necessary to develop a framework or roadmap of where the field should go, and then evaluate the taxonomy in light of this framework. A number of organizing frameworks for open source research have been put forward in the literature. In the following section, we will critically evaluate these frameworks in light of the taxonomy.

3. Open source research frameworks

We identified nine attempts to provide OSR frameworks or research agendas in the literature aiming to define and direct future research efforts. They are: Feller and Fitzgerald (2000), Lerner and Tirole (2001 and 2005), Rossi (2004), Nelson et al. (2006), Niederman et al. (2006a,b), von Krogh and von Hippel (2006), Scacchi (2007) and Jin et al. (2007). While the objectives of these papers varied, to some degree they all sought to categorize extant research and propose an agenda for OSR. In Appendix B, we have interpreted each of these classification schemes in light of the taxonomy. This cross-mapping exercise involved in-depth evaluation of reference articles to match the paper's categories with the taxonomy codes based on detailed content analysis (Holsti, 1969; Krippendorff, 1980).

A summary of this analysis is presented in Table 2. The table shows that existing frameworks and reviews have provided a strong and valuable level of insight on particular aspects of the field and addressed certain niche areas within OSR well. The table also shows that the previously proposed research agendas helped with the progress of OSR as they successfully guided the research efforts in the field. The research guidance provided by these agendas likely has encouraged and directed research efforts and resulted in actual research, as exemplified by the diverse content categories of the proposed OSR taxonomy. However, Table 2 makes it clear that none of these past categorization schemes covered the totality of the field. To be fair, most of these papers were written with a different purpose in mind. Nevertheless, and with the exception of Crowston et al. (2010) which focuses on empirical OSS papers, we are not aware of any published work that attempts to capture the depth and breadth of open source research in a taxonomy, nor one that offers an over-encompassing research framework to guide future research efforts.

While it could be argued that the taxonomy presented in this paper is comprehensive, it does not have the prescriptive or explanatory quality of the frameworks. It also lacks the level of parsimony

required to make a framework useful on a practical level. Thus, in the following section, we propose a holistic framework to organize and guide open source research.

Table 2: Taxonomy Codes And Previous Research Categorizations

TAXONOMY PATTERN AND CATEGORY CODES		Feller and Fitzgerald (2000)	Lerner & Tirole (2001)	Rossi (2004)	Lerner & Tirole (2005)	von Krogh & von Hippel (2006)	Nelson et al. (2006)	Niederman et al. (2006a,b)	Scacchi (2007)	Jin et al. (2007)
CONCEPTUAL	OSS DESCRIPTIVE	√		√					√	
	OSS BENEFITS/DRAWBACKS	√			√					
	OSS VISION/ROADMAP				√					
	OSS RESEARCH CATEGORIZATION / RESEARCH AGENDA	√	√		√	√	√	√		√
	OSS VERSUS PROPRIETARY	√		√	√	√	√	√		
	BUSINESS/ECONOMIC MODELS AND STRATEGIES/POLICIES FOR OSS		√	√	√	√	√	√	√	
PERFORMANCE METRICS	SOFTWARE QUALITY	√		√	√				√	
	SOFTWARE QUALITY – TESTING and BUG FIXES	√						√		
	SOFTWARE QUALITY – OSS SECURITY	√						√		
	SOFTWARE DEVELOPMENT – OSS CODE EFFICIENCIES	√		√	√	√	√	√		
	DEVELOPMENT TEAM PERFORMANCE		√							
	OSS SUCCESS		√				√			
LEGAL AND REGULATORY	OSS LICENSING	√	√	√	√			√	√	
	OSS INTELLECTUAL PROPERTY RIGHTS		√	√	√					
	OSS LEGAL ISSUES		√	√	√					
	OSS STANDARDS AND REGULATION	√		√	√		√		√	
OSS PRODUCTION	PROCESS	√		√		√	√	√	√	√
	COMMUNITIES	√	√	√	√	√	√	√	√	√
	TEAM FORMATION	√				√	√		√	

Table 2: Taxonomy Codes And Previous Research Categorizations

	GOVERNANCE	√	√	√		√	√	√	√	√
	TEAM/PROJECT LEADERSHIP		√	√						
	INDIVIDUAL AND TEAM LEARNING								√	√
	INNOVATION			√		√			√	√
	ROLE OF VOLUNTEER USERS / DEVELOPERS	√					√	√	√	√
	COLLABORATION&KNOWLEDGE SHARING	√		√		√	√	√	√	√
	USER AND DEVELOPER MOTIVATIONS	√	√	√	√	√	√	√	√	√
	ROLE OF COMMERCIAL CORPORATIONS	√	√	√	√	√	√	√	√	
	SOFTWARE DEVELOPMENT – USE OF OSS COMPONENTS		√		√			√	√	
	ROLE OF LICENSING AND IP						√	√		
	SELF-ORGANIZATION (PRODUCT AND COMMUNITY EVOLUTION)		√			√			√	√
APP	OSS APPLICATIONS – (all sub-categories)	√								
OSS DIFFUSION	OSS ADOPTION – GENERAL			√			√			√
	OSS ADOPTION – BARRIERS						√	√		
	OSS ADOPTION – DECISION FACTORS						√	√		
	OSS IMPLEMENTATION – GENERAL						√			√
	OSS IMPLEMENTATION-IMPLEMENTATION COMMUNITIES AND NETWORKS					√	√	√	√	√
	OSS IMPLEMENTATION – GOVERNMENTS / NATIONS			√	√		√	√	√	
BEYOND SOFTWARE	OPEN PARADIGM			√	√			√		
	OPEN INNOVATION			√	√	√				
	OPEN KNOWLEDGE FLOWS				√					
	OPEN STANDARDS									
	OPEN EDUCATION				√					
	USER OR CO-PRODUCTION OF GOODS AND CONSUMER IMPLICATIONS									

4. Proprietary and open source systems through the lens of systems theory

Over the last decade, the term "open source systems" has become widely used in both academia and industry. Today, research on OSS commonly appears in respected journals, and has started to make its way into the college and university curricula. Furthermore, demand for OSS practitioners is on the rise. As our taxonomy has shown, open source research bridges many different topics and disciplines. Our literature review covered 618 papers published in more than 190 journals across multiple academic disciplines. Hence, we believe the time is right to establish a comprehensive framework to define and direct future research efforts in what has become an increasingly diversified field of inquiry.

In order to build an appropriate guiding framework, we turned to Nolan and Wetherbe who faced a similar task in the late 1970s when they set out to categorize the emerging management information systems field (Nolan and Wetherbe, 1980). They decided to draw on systems theory, primarily for its ability to cope with high levels of ambiguity and complexity. We believe that systems theory represents a valid starting point in tackling open source research. In this section, we start with a brief introduction of systems theory before presenting a stylized view of proprietary and open systems using this theoretical lens. Considering a variety of possible interactions among these cases and using a hybrid systems approach that makes up most real world systems, we will then propose a holistic framework for OSR.

4.1. Systems Theory

Systems theory was proposed in the 1930s by Ludwig von Bertalanffy (1934, 1950, 1962, 1968, 1972) as a counterpoint to the dominant reductionist approach of the day. Instead of considering entities as being made up of parts that can be analyzed and interpreted in isolation, systems theory argues that entities should be seen holistically in relation to interactions among the parts and their relationship within the whole. Systems theory attempts to incorporate the complexity inherent in most relationships in such a way that the whole can be greater than the sum of the parts. The theory has been developed and extended over time by several prominent scholars, such as Kenneth Ewart Boulding (1956), William Ross Ashby (1947, 1962), Charles West Churchman (1968), and Fremont Ellsworth Kast and James E. Rosenzweig (1972).

According to systems theory, all systems, whether they are mechanical, biological, or social, are composed of interrelated parts or elements that are referred to as subsystems or components (Kast and Rosenzweig, 1972, p. 450). Thus, a system can be defined as "a set of elements standing in interrelation among themselves and with the environment." (von Bertalanffy, 1972 p. 417). Whereas systems are made up of lower-order subsystems, they themselves are parts of higher-order "supra-systems" in a hierarchy.

Systems can be considered as either open or closed. Open systems have permeable boundaries allowing them to exchange information, energy, or material with their environments. Such exchanges are restricted in closed systems that tend to have impermeable or barely permeable boundaries (Kast and Rosenzweig, 1972, p. 450). Von Bertalanffy defined open systems as, "...systems exchanging matter with the environment as every 'living' system does" (von Bertalanffy, 1972, p. 412). This definition makes it possible to view systems as dynamic transformational models taking various inputs from their environment and transforming them into outputs, that are, in turn, transported back into the environment. Systems theory posits that closed systems are subject to positive entropy changes over time, resulting in eventual failure due to lack of resource transformation. The theory views open systems as capable of positive as well as negative entropy changes, making it possible for the system to attain a dynamic equilibrium or steady state, raising the chances of survival.

4.2. Proprietary and Open Source Systems

In systems theory terminology, both proprietary and open source systems can be viewed as open systems. These systems, which may also be conceptualized as different ends of a software development continuum, take multiple inputs from the environment, transform them into outputs, and

reintegrate those outputs into the environment. In the case of software development projects, the inputs include human effort, process know-how, and information technologies (IT). These inputs become part of a sub-system with the purpose of creating outputs such as human development and growth, elevated process knowledge, and software applications, all under the influence of the surrounding environment. This multi-dimensional transformation relies on effective interactions among the people, processes and the technology sub-system, set within a larger organizational system context consisting of management issues, development methodologies, project activity planning, scheduling, process standards and metrics, resource management, continuous learning, and a host of other contingent variables (Nambisan and Wilemon, 2000).[3]

When we talk about people in the context of proprietary and open source systems, we are referring to the commitment of human participants in a project, including all explicit and tacit knowledge applied within the project's context. Processes are written descriptions of explicit knowledge. They may represent strategies, policies, procedures, rules and regulations, as well as standards. Finally, technology refers to a product or a module of a product such as a system component or a piece of software.

4.2.1. Proprietary systems

At one end of the continuum lie proprietary systems. While proprietary systems are open systems, since they interact with the external environment, the majority of the activity happens within the boundaries of the system, which in turn exists within the boundaries of the firm. This occurs mainly because proprietary systems are designed for a specific, well-defined purpose, such as to produce a marketable technology product that is then sold on the open market. While people and process inputs are measured and tracked in most proprietary system environments, the same cannot be said for outputs, which are rarely monitored (Mayo, 2001). The main purpose of a proprietary system is to create a technology output, and all other outputs – like enhanced technology skills of the developers or new processes – while desirable, are subsidiary to the technology output. Figure 2 shows a graphical representation of a proprietary system environment.

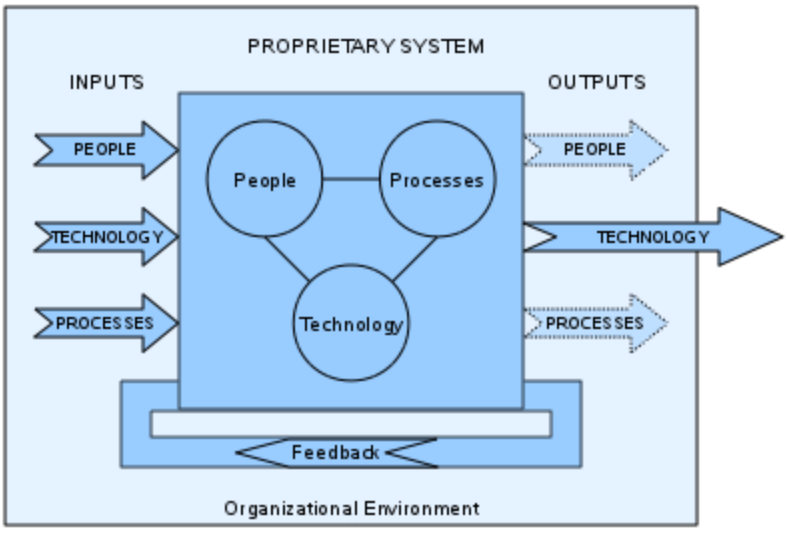

Figure 2: Proprietary System

3 While Nambisan and Wilemon (2000) define people, processes and technology as dimensions, we prefer the term 'subsystem' to maintain a link to systems theory.

There are several characteristics of proprietary systems that are worthy of note. These systems tend to be externally defined, have artificial lifespans, operate largely within organizational environments, and are tied to predefined constraints, such as limitations in scope, time, and cost (Brooks, 1995; Royce, 1998; Bittner and Spence, 2006). Once they outlive their design purpose, for example when a system's technology outputs no longer produce sufficient financial rewards, proprietary systems are often terminated, and their subsystems discarded or reallocated (Seacord et al., 2003).

The Interaction between a proprietary system and its environment is relatively limited (Alexy and Henkel, 2007 and 2009). Indeed, its immediate environment is defined by organizational boundaries. Such organizational boundaries are generally fixed and rigidly defined. However, as open systems, proprietary systems permit both negative and positive feedback loops, although the timing and frequency of these recursive factors is often predetermined (Lehman et al., 1996). In the case of positive feedback, this usually corresponds to major output milestones and is transmitted intermittently; whereas negative feedback is generally tied to deviations from a prescribed project trajectory (Bittner and Spence, 2006).

Proprietary transformation subsystems (people, processes and technology) are purposefully held together for the duration of a project. Thus, even under suboptimal conditions, the transformation subsystem will be required to produce a technology output through external organizational pressure.

Finally, the adoption of technology outputs of a proprietary system typically occurs outside the organizational boundaries. Since neither people nor process outputs are as closely measured or tracked, any possible adoptions within the organization would be very hard to measure (Battisti and Stoneman, 2005).

4.2.2. Open source systems

At the other end of the continuum lie open source systems. Unlike proprietary systems that are designed for well-defined purposes, the objectives of open source systems are often loosely defined and allow contributors great freedom to work on areas they find interesting (Lerner and Tirole, 2005). While there may be specifically stated objectives at the outset, these systems tend to mature over time in an unpredictable manner, reflecting and representing the changing objectives of system participants (Nakakoji et al. 2002; Lee and Davis, 2003; Shah, 2006). As a direct consequence of this change, open source systems are not fixated on technology outputs only, and typically produce people and process outputs with equal emphasis. For example, it is not unusual for a contributor within an open source project to be motivated by personal development potential, even if there is no tangible code contribution.

Open source systems also differ from proprietary systems in that they typically do not have an externally defined lifespan. Rather, an open source system survives as long as at least one actor/person is able and willing to maintain it (Shah, 2006). In addition to flexible lifespans, open source systems tend to have permeable boundaries that allow for rapid expansion or contraction. Whereas proprietary systems operate primarily within one organizational environment, open source systems operate under multiple environmental layers, allowing for numerous opportunities for multi-level interactions between the system and the surrounding environment. We have graphically represented an open source system in Figure 3. The inner layer concerns the core system where the bulk of the technology transformation occurs. Within this layer, the human component includes a core team of user-developers who are associated with a specific open source system (that usually manifests itself as an open source project). In contrast with the relatively uniform and stable organizational environment associated with a proprietary system, the core project environment in an open source system usually allows for more diversity and creative instability, allowing much higher levels of interaction and contributing to elevated levels of innovation (Kogut and Metiu, 2001; David and Rullani, 2008; Vujovic and Ulhøi, 2008). Freedom from temporal and spatial input limitations, physical conformity requirements, adherence to hierarchical processes and strictly enforced technology policies, and lack of standards and regulations, all contribute to this flexibility. It also provides better support for an environment that is bound by ideology, communication and trust,

resulting in innovative communities that can achieve high levels of effectiveness (Mockus et al. 2002; Stewart and Gosain, 2006; Kidane and Gloor, 2007; Hossain and Zhu, 2009).

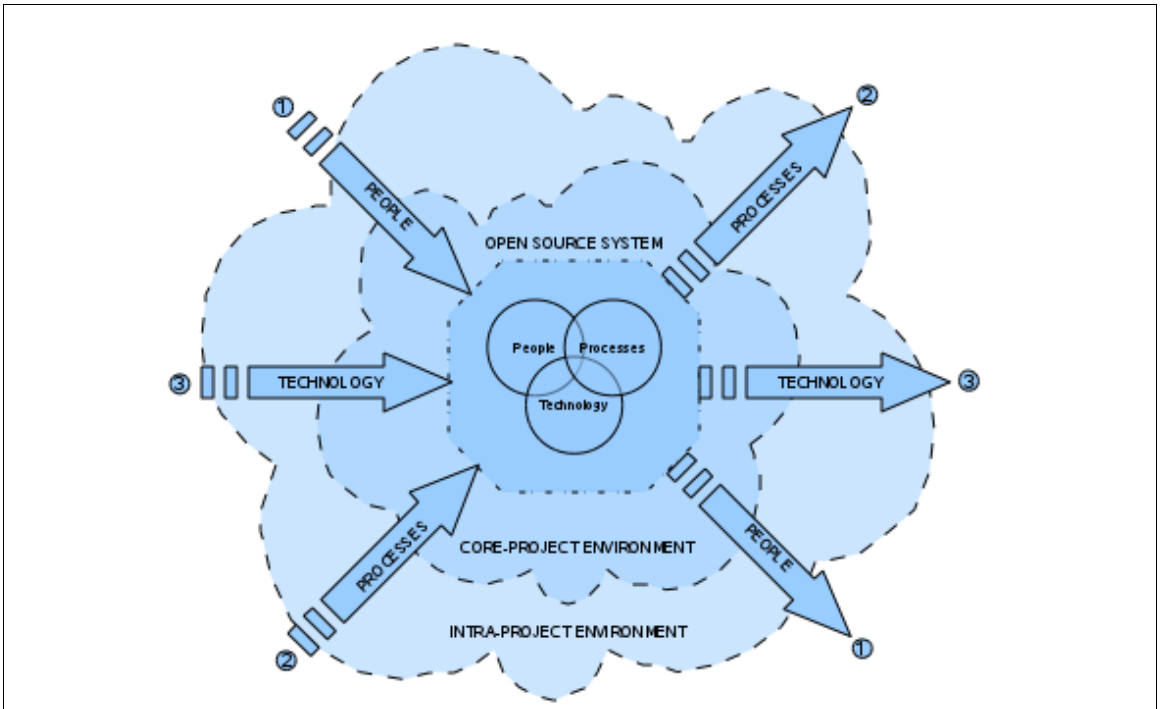

Figure 3: Open Source System

Furthermore, open source systems operate under one additional environmental layer that would normally be absent from traditional proprietary systems. This layer, which we call the intra-project environment, includes a project's wider developer and user communities. Unlike core developers, code contributions by user-developers within this layer may be relatively rare (Mockus et al. 2000; Kogut and Metiu, 2001; Mockus et al., 2002). In fact, the contribution of many users in the intra-project environment may be limited to testing and bug reporting only. Indeed, the majority of user-developers may offer no contribution other than promoting the use of project outputs. Note that the expanded open source system involving the intra-project environment operates under the same system rules as the core open source system. In other words, it also contributes people, technology and process inputs that would be transformed through relevant subsystems into corresponding system outputs.

Few of the traditional operational constraints hold an influence over open source systems. Scope, time and cost factors, which largely drive proprietary system development efforts, are mostly absent from open source systems, rendering Brooks's Law insufficient (Koch, 2004). Factors contributing to failure of proprietary software projects, including inaccurate estimation techniques and assumptions, poor progress monitoring, or ineffective project management become less relevant in open source systems where massive parallel development, lack of time pressure, and frequent releases reduce the incidence of development problems (Brooks, 1995). However, open source projects are not a panacea. When assessed with traditional development metrics, due to the lack of project structure and redundant development efforts, the output of an open source system may be less efficient and more time-consuming than for a proprietary system (Johnson, 2001; Gasser and Ripoche, 2003). Indeed, a reliable and useful technology output may never be produced. It is worth reiterating,however, that the output of an open system includes people and processes in addition to technologies, such that even if the system fails to produce a tangible technology output, it may still enhance the skills of the people involved and/or produce a process advancement or innovation.

Like proprietary systems, open source systems permit negative as well as positive feedback loops (Raymond, 1999; Järvensivu et al., 2006). However, instead of producing positive feedback at well-defined intervals corresponding to major project milestones or negative feedback on predefined system deviations, open source systems produce constant and near real-time feedback, both positive and negative, on subsystem activity in a highly iterative fashion (Schmidt and Porter, 2001; Bonaccorsi and Rossi, 2003; Zhao and Elbaum, 2003). System outputs from one subsystem may become immediate inputs into another system. In Figure 3, we have attempted to model this permeable, iterative, and flexible structure.

In an open source system, the concept of adoption is not limited to technology outputs that occur outside the system's boundaries. Adoption of technology, people or process outputs can occur both inside as well as outside the core project environment.

While pure proprietary and open source systems serve illustrative purposes well, most real world systems fall between the two extremes, in what can be described as hybrid forms. The idea of hybrid forms, especially as alternative business models, has already generated some interest in the academic community (West, 2003; Fitzgerald, 2006; Shah, 2006). Table 3 presents a description of proprietary and open source systems as endpoints along a continuum, across a number of different dimensions.

Table 3: Proprietary, Open Source and Hybrid Systems

System	Pure Proprietary	◄Hybrid Forms►	Pure Open Source
Purpose	Well-defined from the start. Later changes usually indicate lack of planning or changing external environment. Main purpose is to produce a technological output. People and process outputs are treated as secondary only.	**◄◄ Continuum ►►**	Loosely defined at project start. Matures over time in an unpredictable manner. System represents varied objectives to different participants resulting in equal weighting of people, process and technology outputs.
Lifespan	Artificially and externally determined. Often financially bound. System will die as soon as it fails to serve its intended purpose.	**◄◄ Continuum ►►**	Organic and internally determined. System lives on as long as it serves a purpose or maintains involvement by developer-users.
Boundaries	Fixed and meticulously defined. Expansions or contractions possible but due to "unforeseen circumstances."	**◄◄ Continuum ►►**	Flexible and undefined. Expansions and contractions are possible and expected.
Operational Constraints	Multiple factors. Operates under triangle of constraints: scope, cost, time.	**◄◄ Continuum ►►**	Few if any. Traditional project management practices are insufficient.
Feedback	Possible and desired, but intermittent. Usually after major milestones or upon deviations from preset limits only.	**◄◄ Continuum ►►**	Highly iterative. Constant and real time. Outputs become immediate inputs within the system, and externally.

Subsystems	Organizationally connected and held together.	◄◄ **Continuum** ►►	Collaboratively connected and held together.
Adoption	Adoption happens outside the system's immediate environment (normally the organization).	◄◄ **Continuum** ►►	Adoption happens both inside and outside the system's layered environments (core & intra).
Performance Metrics	One dimensional and usually fixated on the ratio of technology outputs to all inputs. Nonetheless, such common metrics make system comparisons easier.	◄◄ **Continuum** ►►	Potentially equal to the number of system stakeholders. However, comprehensive and commercially friendly metrics are lacking.
Environmental Layer	Organizational	**Inter-Project**	Core/Intra-project

4.3. A holistic framework for open source research

Even though Table 3 is a useful portrayal of ideal types and hybrid forms as a collection of composite attributes, it only shows an end state and does not explain how hybrid forms come into existence operationally. In this section, we develop a holistic, multi-dimensional framework to help explain the inner workings of real world hybrid systems.

While there are tangible differences between pure proprietary and open systems, as we have suggested above, linkages exist between and among all types of systems, and it is through these linkages that hybrid forms emerge. Open source systems tend to have more permeable boundaries, and thus interact to a greater degree with other systems than proprietary systems (Alexy and Henkel, 2007 and 2009). However, both types of systems co-exist in a highly interactive inter-project environment. This "network of systems" constitutes the basis of a unifying framework for OSR.

Three dimensions define the main elements of this framework: First, there are four environmental layers consisting of organizational, core-project, intra-project, and inter-project components; second, there is an iterative procedural stage, consisting of inputs, transformational activities, and outputs; and finally, there is the transformation subsystem consisting of people, processes, and technology.

Within each environmental layer, the subsystems of people, processes and technology guide the iterative input-transformation-output procedure. These elements, along with all possible combinations of multi-way interactions make up the proposed holistic framework. While a great many potential interactions can be conceptualized, for illustrative purposes we only focus on a few here to show how hybrid systems emerge.

First, the people input into an open source system can be provided by a proprietary system (Figure 4) or another open source system. In the case of a proprietary system, this input can come in the form of a formal commitment, for example, when a commercial company participates in an open source project (O'Mahony, 2007; Dahlander, 2007; Dahlander and Wallin, 2006; Lerner et al., 2006; Mustonen, 2005; Edelsohn et al., 2005; Grand et al., 2004; de Joode, 2004), or it can be informal, such as when a commercial developer spends part of his or her paid work time contributing to an open source project (Lakhani and Wolf, 2005). For example, Oracle Corporation is involved either directly or indirectly in more than 700 open source community projects.[4] Similarly, IBM reports that more than 600 of its developers work on open source community projects.[5]

4 http://oss.oracle.com/
5 http://www-03.ibm.com/linux/ossstds/oss/ossindex.html

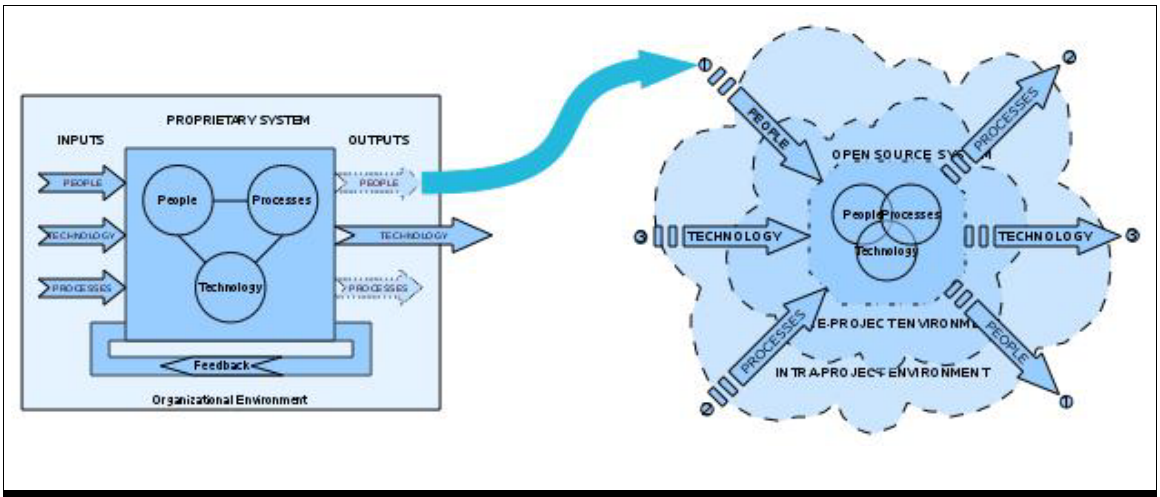

Figure 4: Inter-Project Environment (Hybrid people subsystems)

Second, the people input into a proprietary system can be provided by an open source system (Figure 5). This can happen when a developer proves his or her ability on an open source project and subsequently receives an employment offer from a proprietary company. In fact, job market signaling as an extrinsic open source developer motivation factor has been extensively studied in the literature (Lerner and Tirole, 2000; Kogut and Metiu, 2001; Lerner and Tirole, 2002; Bonaccorsi and Rossi, 2003).

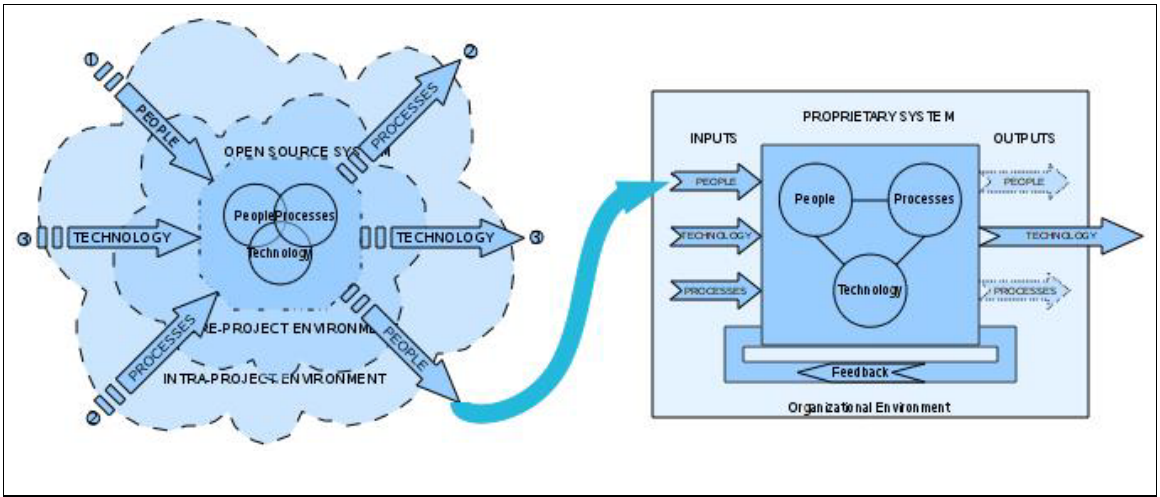

Figure 5: Inter-Project Environment (Hybrid people subsystems)

Third, a proprietary system can receive process inputs from an open source system (Figure 6). Sharing of best practices has always been common among open source projects (Johnson, 2006; Hemetsberger and Reinhardt, 2006; Haefliger et al., 2008). Recently, however, there has been an increase in the number of proprietary systems taking in process outputs of open source systems as inputs into their own processes (Riehle et al., 2009). Having seen the success of the open source software development life cycle, many proprietary companies have started considering adaptation of this methodology into their production processes (Ajila and Wu, 2007). For example, borrowing concepts from the process of open source development, Amazon's "Mechanical Turk" website[6] is built on the premise that an on-demand, flexible and scalable workforce can be assembled from among millions of online user developers.

6 http://www.mturk.com

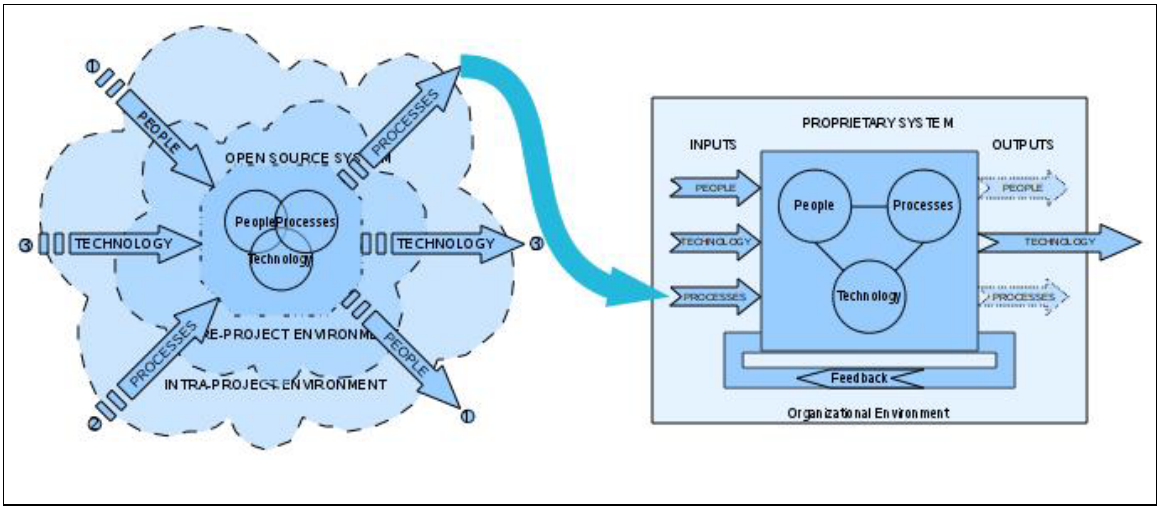

Figure 6: Inter-Project Environment (Hybrid process subsystems)

Fourth, a technology output from an open source system can become a technology input into either a proprietary system (O'Reilly, 1999; Stone, 2002; Voth, 2003) or another open source system (Obrenovic and Gasevic, 2007; Haefliger et al., 2008). In the case of another open source system, this may show itself in the form of code module or component reuse; whereas in the case of a proprietary system (Figure 7), it may be modules of code or a complete software application. The former scenario is very common and well-researched in the open source literature (Ajila and Wu, 2007; Obrenovic and Gasevic, 2007; Haefliger et al., 2008). For example, Haefliger et al. (2008) identified 55 reused components comprising 2,975 reuse incidents in a sample of six open source projects, signifying that code reuse is extensive among OSS projects. The latter scenario is also common when proprietary companies create a business model around enhancement and support of commercially promising open source projects. For example, both Novell Inc. and Canonical Ltd. provide commercial services and enhancements on SuSE and Ubuntu Linux operating system distributions respectively (Lohr, 2003; Hastings, 2005).

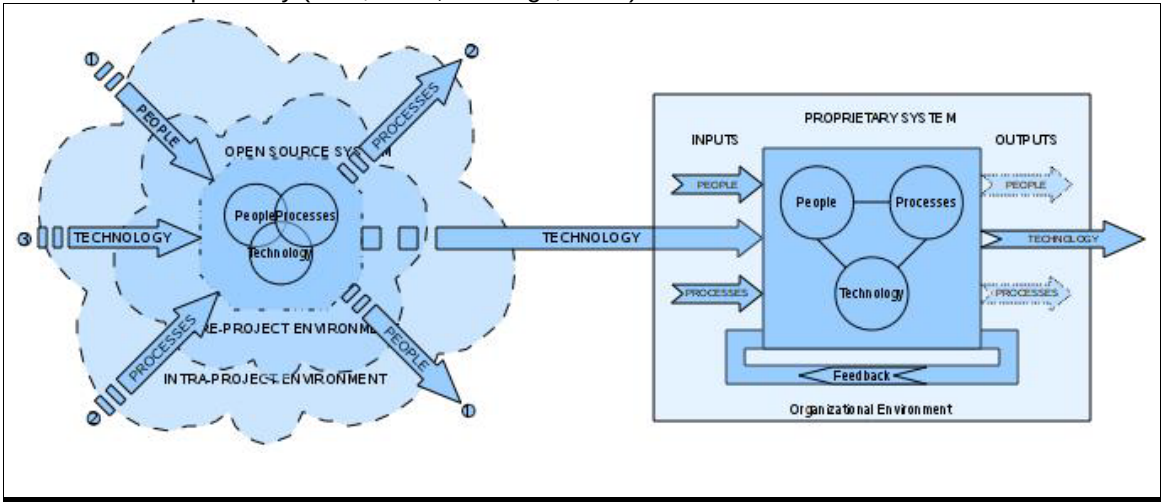

Figure 7: Inter-Project Environment (Hybrid technology subsystems)

Fifth, a technology output from a proprietary system can become a technology input into an open source system (Capek et al., 2005; Hawkins, 2004). This can occur when a large piece of proprietary code is opened up by the owner of the software, as in the case where IBM released Eclipse, resulting in the creation of the Eclipse Foundation, or when Sun Microsystems made the source code for Star

Office Suite available, leading to the emergence of OpenOffice.org (Vaughan-Nichols, 2003; Müller-Prove, 2007). Figure 8 illustrates such a scenario.

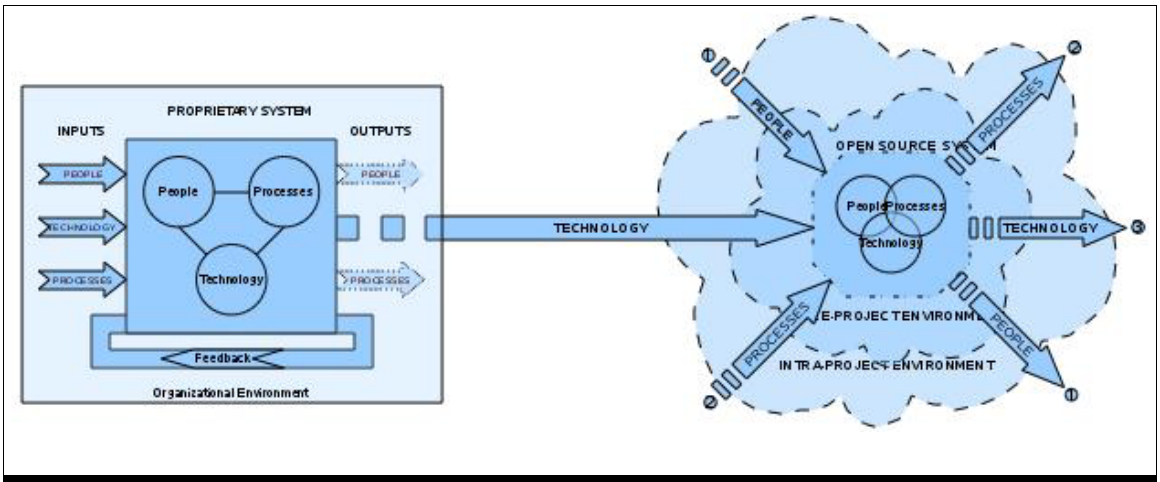

Figure 8: Inter-Project Environment (Hybrid technology subsystems)

Although we focused on very simplified examples for illustrative purposes and only showed a few sample interactions involving one subsystem at a time and happening at a selected environmental layer (inter-project), real world systems would likely include interactions at several environmental layers (organizational, core, intra or inter-project), involve many transformation subsystems (people, processes and technology), and concern a variety of procedural stages (input, transformation, output). Indeed, the value of the framework lies in its capability to conceptualize these multi-level interactions (Table 4).

Table 4: Holistic OSR Framework

HYBRID FORMS		Transformation Subsystem								
		People			Processes			Technology		
		Iterative Procedural Stage								
		Input	Transform	Output	Input	Transform	Output	Input	Transform	Output
Environmental Layer	Organizational									
	Core-project									
	Intra-project									
	Inter-project									

5. Application of the open source research taxonomy to the holistic framework

The holistic framework of OSR outlined above represents an attempt to use systems theory to capture the depth and breadth of open source research. This framework is purely conceptual in that it presents a normative view of the field – the role of the open source movement within the larger environmental context. The taxonomy presented earlier, on the other hand, is a comprehensive summary of existing OSR. In a sense, the framework describes where the field should be, while the taxonomy describes where the field is today. Thus, there is significant utility in comparing one with the other. In the following section, we attempt to provide examples of how the taxonomy codes fit in the framework and identify gaps where research may be lacking.

For purposes of clarity and brevity, we only describe in detail the cross-mapping of a subset of taxonomy codes onto the framework. For the selected subset of codes, we looked at each of the articles identified with those codes and re-assessed them in light of the three dimensions of the framework. We then marked all interactions where evidence was present (Table 5).

For example, the "OSS Production – Team/Project leadership" code (Case 1) had been partly created to capture studies investigating skills required to assume leadership positions in open source projects. Since project leaders are selected from among core project teams, these studies focused on core project teams and evaluated individual inputs to arrive at skills that mattered for leadership. Thus, we marked the interactions at the *core-project environmental* layer alongside the *people transformation subsystem* at the *input* stage with "C1." Similarly, when the "OSS Production – User and developer motivations" code (Case 2) was assessed, we considered the characteristics of research concerning the motivations of open source community participants and noted that such studies investigated individual motivations shaping *people inputs* at *core*, *intra* as well as *inter-project environments*. Thus, the *people transformation subsystem* at the *input* stage was marked for three relevant *environmental layers with "*C2."

Evaluation of articles under each of the three sub-categories of the "Software quality" code (Case 3) showed that despite addressing many attributes of quality in all environmental layers, those articles used a very narrow definition of quality that is restricted to *technology outputs* mostly in the form of completed OSS applications. We therefore marked interactions at all four environmental layers as well as one concerning outputs at the *technology transformation subsystem* level with "C3." Finally, articles slotted in the "OSS Production – Individual and team learning" code (Case 4) focused on *core* (for developer learning) as well as *intra* (mainly for user learning) *environmental layers* and concerned the event of learning involving human *inputs*, how those inputs are *transformed* and manifested in the form of changed behavior (human *outputs*). Hence, interactions at two environmental layers and at all three procedural stages of people subsystems were marked with "C4."

Table 5: Sample OSR Taxonomy Code Cross-Mappings

HYBRID FORMS		Transformation Subsystem								
		People			Processes			Technology		
		Iterative Procedural Stage								
		Input	Transform	Output	Input	Transform	Output	Input	Transform	Output
Environmental Layer	Organizational									C3
	Core-project	C1 C2 C4	C4	C4						C3
	Intra-project	C2 C4	C4	C4						C3
	Inter-project	C2								C3
C1-C4: Illustrative cases that are based on actual articles behind the taxonomy codes.										

We extended the process described above to include each taxonomy code such that all the codes were individually mapped on to the OSR framework. One important outcome of this process was that we were able to identify a number of gaps within the present OSR literature.

At a general level, three of the environmental layers – organization, core project, and intra-project – are reasonably well covered in the literature. The fourth environmental layer – inter-project – however, has been less thoroughly examined. When it comes to the iterative procedural stage, inputs and outputs have been covered more extensively than transformations. Finally, within the transformational subsystem level, people and technology have been researched more often than processes. These results are perhaps not surprising, since the areas that have not received as much research attention are those that are inherently complex, longitudinal, and multivariate. For example, research examining the inter-project environment must make observations or collect data from multiple projects; and at the iterative procedural stage, inputs and outputs are much easier to observe and measure than transformations. We can conclude from this analysis that much of the low-hanging fruit of OSR has been picked. What remains to be conducted is more challenging, yet arguably more valuable research. Below, we identified a number of specific areas that appear to be under-researched based on our analysis of current OSR.

System performance and project success

Most OSR has focused on technology outputs (e.g. level and frequency of code contributions). Development of multi-dimensional frameworks involving all transformation subsystems and covering all procedural stages would likely lead to the emergence of better performance indicators. This is an area that may have important implications for the future of open source projects. As noted in Table 3, traditional performance metrics may under-represent the value of open source projects as they overlook people and processual outputs. Furthermore, when it comes to inputs, most OSR focuses on people (e.g. number of developer or user participants that are then linked to factors affecting

participation, like type of licenses). As a result, many open source projects are deemed to be inefficient at best, or failures at worst. Consideration of other procedural stages for all transformation subsystems would help construct more comprehensive success criteria. For example, a project that has failed to produce a technology output may not be seen as a failure if its participants developed skills helping them to create future successes, or if the project managed to create reusable process improvements.

Software licensing and intellectual property rights

The present body of OSR mostly covers two endpoints of the intellectual property rights spectrum: licensing of end products (technology outputs), and the effect of licensing and the strength of intellectual property regimes on community participation (people inputs). However, we argue that many areas that fall between these two extremes are worthy of consideration. For example, patenting of processes and methods is a relatively recent phenomenon and its potential impacts on the future of open source may provide an interesting research topic. Business methods and processes patent applications have grown by more than 2,000% over the past decade, yet we know very little about how this change might affect the open source movement (O'Mahony and Ferraro, 2004, p.6).

The effect of standards on outcome variables of interest

The open source movement has evolved, developed, and thrived in a relatively flexible and unstructured environment. Open source development projects have been characterized by far fewer standards and fixed methodologies than proprietary projects. This unstructured environment has allowed the open source community to produce a huge number of useful outputs. However, the lack of standards and structure can also be damaging. For example, certain best practices may never become widely accepted standards as they tend to stick with the originator and be seen as a collection of personal idiosyncrasies. Similarly, it may be hard to assess a certain developer skill set without any certification standard. There is evidence that this situation is changing. For example, open source certification standards are being developed, and are starting to spread within the open source community. Nevertheless, the open source community lags far behind the proprietary community in this regard. For example, there is currently no open source equivalent to ITIL or ITSM. There is very little research on this issue.

Adoption and implementation

The majority of the current OSR has focused on software development, and the ecosystem that surrounds it. By contrast, there is a paucity of research on what happens after an open source product or service has been produced. Yet, adoption, acceptance, use, continuance behavior, and discontinuance are important topics, particularly in organizational research. In other words, the current research is missing a great swath of the traditional IS life cycle. The present open source adoption research is very preliminary and narrowly focused on external adoption of technology outputs by end users, either at the individual or organizational level. There is almost no OSR on internal adoption of technology, people or process outputs. For example, we know very little about the adoption of processes in the form of best practices, or about the factors affecting and shaping the intensity of code reuse. Similarly, our knowledge is lacking on the adoption of people in the form of personnel movements between and among organizational forms. We also know little on the structure, inner workings, or impacts of OSS implementation communities and networks.

This is an important area of research since the unidimensional view of adoption of open source products and services by organizations projects a misleading picture of OSS adoption. This view shows that OSS adoption is still far behind the adoption of proprietary systems, except in a few niche areas, such as web server or other, behind-the-scenes infrastructure software. The proposed multidimensional view of adoption covering all transformation subsystems at all environmental layers will likely present a more realistic view of OSS embeddedness in various organizational forms.

6. Limitations and conclusions

No piece of research is perfect and this paper is no exception. While we attempted to conduct a

comprehensive search of the research literature for instances of OSR, it is possible that we missed important contributions. For example, not all academic research is indexed by ProQuest, and despite our attempts to expand this source, some contributions may not have been captured by our search string. We did not collect work presented at conferences, that might have provided an important source of new ideas. We also did not capture dissertations, non-peer reviewed papers, or research that was not published in English. All these factors may have led to coverage error. However, we argue that the 618 research articles that we collected and analyzed in the paper constitute a representative and useful list of extant open source research. Through a systematic and iterative reduction of taxonomy categories, we also believe we were able to establish a proper balance between comprehensiveness of content and parsimoniousness of the taxonomy.

The processes of summarizing, coding, and categorizing the articles is inherently subjective, and may be influenced by researcher bias. While we took a number of precautions, and followed a systematic and structured process, it is possible that the codes and categories that we developed may not be consistent across the population of open source researchers. For example, the reliance on a single coder during the early stages of the research may have led to a bias. However, a number of checks and balances, including the introduction of independent coders later in the process, may have alleviated this concern. Similarly, the optimum point at which to mark the end of the iterative reduction of taxonomy categories is, at its root, a subjective judgment. On the one hand, further reduction of taxonomy categories would result in an ever more parsimonious taxonomy. On the other hand, this reduction process risks creating overlapping categories that could be questioned on the basis of non-exclusivity.

We propose that the taxonomy presented here along with the categorization schemes and the holistic framework represent a starting point for a future conversation about the value, direction, and efficacy of open source research. In the spirit of the open source movement, we intend to share our database of articles and categories with the open source community, so that it can become a living resource. We hope that this resource can grow in size as new research is conducted and added to the dataset. We also hope that this work can become increasingly valuable to the open source research community, as codes and categories are refined.

The open source movement has grown rapidly since its inception a little over ten years ago. Open source research has also grown and proliferated across many different research areas and disciplines. Due to this proliferation across multiple domains, it has become difficult to grasp the totality of what has been done, where the gaps are, and generally what the form and character of the field is. As OSR grows, it is useful to take a snapshot of how the field has developed, and, if necessary, to guide its future growth.

In this paper, we conducted an unbiased and comprehensive review of current open source research. This review resulted in the collection of 618 peer-reviewed research articles that we organized into a taxonomy. This taxonomy consisted of 57 code categories organized into 7 higher-level groupings. In total, we categorized 1,355 unique instances of each code from the full article set. This taxonomy represented our analysis of the current OSR state-of-the-field. We then drew on existing conceptual work and systems theory to develop a holistic framework to situate open source research within the larger environmental context. Finally, we overlayed the taxonomy on to the framework in order to propose a sample list of gaps and areas of overlap that can guide future work in OSR. In summary, we feel that open source research has evolved into a vibrant and productive field that has a great deal to offer both research and practice. By summarizing the field and offering a guiding conceptual framework, we hope to continue this trend into the future.

References

Aberdour, M. (2007) "Achieving Quality in Open Source Software", *IEEE Software,* 24(1), pp. 58-64.

Acello, R. (2008) "Opening Up to Open Source", *ABA Journal,* 94(6), pp. 32-34.

Ågerfalk, P.J. and B. Fitzgerald (2008) "Outsourcing to an unknown workforce: exploring opensourcing as a global sourcing strategy", *MIS Quarterly,* 32(2), pp. 385-409.

Ajila, S.A. and D. Wu (2007) "Empirical study of the effects of open source adoption on software development economics", *The Journal of Systems and Software,* 80(9), pp. 1517-1529.

Al Marzouq, M. L. Zheng, G. Rong and V. Grover (2005) "Open Source: Concepts, Benefits, and Challenges", *Communications of the Association for Information Systems,* 16, Article 37.

Aldous, K.J. and A.B. Lintott (2007) "Applying web technologies to capture and exchange complex documents", *International Journal of Product Development,* 4(3/4), pp. 330-340.

Alexy, O. and J. Henkel (2007) "Promoting the penguin: Who is advocating open source software in commercial settings?" In G. T. Solomon, editor, Proceedings of the Sixty-Sixth Annual Meeting of the Academy of Management (CD).

Alexy, O. and J. Henkel (2009) "Promoting the Penguin: Intraorganizational Implications of Open Innovation," SSRN, accessible at http://ssrn.com/abstract=988363 (current Sep. 9, 2009).

Alonso, A., L. Casas, C. Castro and F. Solís (2004) "Research, Development, and Innovation in Extremadura: A GNU/LINUX Case Study", *Philosophy Today: Toward a Philosophy of Science Policy: Approaches and Issues,* 48, pp. 16-22.

Alonso, A. and C. Mitcham (2004) "Software Libre 2004", *Ethics and Information Technology,* 6(1), pp. 65-67.

Alpern, B., S. Augart, S.M. Blackburn, M. Butrico, A. Cocchi, P. Cheng, J. Dolby, S. Fink, D. Grove, M. Hind, K.S. McKinley, M. Mergen, J.E.B. Moss, T. Ngo, V. Sarkar and M. Trapp (2005) "The Jikes Research Virtual Machine project: Building an open-source research community", *IBM Systems Journal,* 44(2), pp. 399-417.

Alvord, W.G., J.A. Roayaei, O.A. Quiñones, and K.T. Schneider (2007) "A microarray analysis for differential gene expression in the soybean genome using Bioconductor and R", *Briefings in Bioinformatics,* 8(6), pp. 415-31.

Ampatzoglou, A. and A. Chatzigeorgiou (2007) "Evaluation of object-oriented design patterns in game development", *Information and Software Technology,* 49(5), pp. 445-454.

Anderson, M. (2008) "Open-Source Voting", *IEEE Spectrum,* 45(10), pp.13-14.

Angster, E. (2004) "SDP-city against a vicious circle!", *First Monday*, 9(12), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1195/1115 (current Feb.14, 2010).

Anselin, L., Y.W. Kim, and I. Syabri (2004) "Web-based analytical tools for the exploration of spatial data", *Journal of Geographical Systems,* 6(2), pp. 197-218.

Appavoo, J., M. Auslander, M. Butrico, D.M. da Silva, O. Krieger, M.F. Mergen, M. Ostrowski, B. Rosenburg, R.W. Wisniewski, and J. Xenidis (2005) "Experience with K42, an open-source, Linux-compatible, scalable operating-system kernel", *IBM Systems Journal,* 44(2), pp. 427-440.

Applewhite, A. (2003) "Should governments go open source?" *IEEE Software,* 20(4), pp. 88-91.

Ashby, W. R. (1947) 'Principles of the Self-organizing Dynamic System', *Journal of General Psychology*, 37, pp. 125-128.

Ashby, W. R. (1962) 'Principles of the Self-organizing System', in H. Von Foerster and G. W. Zopf, Jr. (eds.), *Principles of Self-Organization: Transactions of the University of Illinois Symposium.* London:Pergamon Press.

Au, Y.A., D. Carpenter, X. Chen and J.G. Clark (2009) "Virtual organizational learning in open source software development projects", *Information & Management,* 46(1), pp. 9-15.

Awazu, Y. and K.C. Desouza (2004). "Open knowledge management: Lessons from the open source revolution", *Journal of the American Society for Information Science and Technology,* 55(11), pp. 1016-1019.

Ayewah, N., D. Hovemeyer, J.D. Morgenthaler, J. Penix and W. Pugh (2008) "Using Static Analysis to Find Bugs", *IEEE Software,* 25(5), pp. 22-29.

Azoulay, P., A. Stellman, and J.G. Zivin (2006) "Publication Harvester: An open-source software tool

for science policy research", *Research Policy,* 35(7), pp. 970-974.
Bagozzi, R.P. and U.M. Dholakia (2006) "Open Source Software User Communities: A Study of Participation in Linux User Groups", *Organization Science,* 52(7), pp. 1099-1115.
Baldi, S., H. Heier, and A. Mehler-Bicher (2003) "Open courseware and open source software", *Association for Computing Machinery. Communications of the ACM,* 46(9), pp. 105-107.
Baldwin, C.Y. and K.B. Clark (2006) "The Architecture of Participation: Does Code Architecture Mitigate Free Riding in the Open Source Development Model?" *Organization Science,* 52(7), pp. 1116-1127.
Balka, K., C.Raasch and C.Herstatt (2009) "Open source enters the world of atoms: A statistical analysis of open design", *First Monday*, 14(11), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2670/2366 (current Feb.14, 2010).
Banerjee, A., M. Faloutsos, and L. Bhuyan (2008) "The P2P war: Someone is monitoring your activities", *Computer Networks,* 52(6), pp. 1272-1280.
Barbrook, R. (2005) "The High-Tech Gift Economy", *First Monday*, Special Issue 3, accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1517/1432 (current Feb.14, 2010).
Bärwolff, M. (2006) "Tight prior open source equilibrium: The rise of open source as a source of economic welfare", *First Monday*, 11(1), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1309/1229 (current Feb.14, 2010).
Battisti, G. and P. Stoneman (2005) "The intra-firm diffusion of new process technologies", *International Journal of Industrial Organization*, 23(1-2), pp. 1-22.
Bayersdorfer, M. (2007) "Managing a Project with Open Source Components", *Interactions,* 14(6), pp. 33-34.
Bayrak, C. and C. Davis (2003) "The Relationship between Distributed Systems and Open Source Development", *Association for Computing Machinery. Communications of the ACM,* 46(12), pp. 99-102.
Becking, J., S. Course, G. van Enk, H.T. Hangyi, J.J.M. Lahaye, D. Ockeloen, R. Peters, H. Rosbergen, R. van Wendel de Joode (2005) "MMBase: An open-source content management system", *IBM Systems Journal,* 44(2), pp. 381-397.
Beckman, D. and D. Hirsch (2006a) "Costly Freebies", *ABA Journal,* 92(1), p. 61.
Beckman, D. and D. Hirsch (2006b) "A lot for a little", *ABA Journal,* 92, p. 60.
Beecher, K., A. Capiluppi, and C. Boldyreff (2009) "Identifying exogenous drivers and evolutionary stages in FLOSS projects", *The Journal of Systems and Software,* 82(5), pp. 739-750.
Belcher, E. and E. Sexton (2008) "Digitizing criminals: web delivery of a century on the cheap", *OCLC Systems and Services,* 24(2), pp. 116-132.
Bellifemine, F., G. Caire, A. Poggi and G. Rimassa (2008) "JADE: A software framework for developing multi-agent applications. Lessons learned", *Information and Software Technology,* 50(1/2), pp.10-21.
Benkler, Y. (2001) "The battle over the institutional ecosystem in the digital environment", *Association for Computing Machinery. Communications of the ACM,* 44(2), pp. 84-90.
Bennett, C. and R.T. Watson (2006) "Renewable Student Projects: A Learning Strategy", *Communications of the Association for Information Systems,* 17, Article 13.
Benoit-Barne, C. (2007) "Socio-Technical Deliberation about Free and Open Source Software: Accounting for the Status of Artifacts in Public Life", *The Quarterly Journal of Speech,* 93(2), pp. 211-235.
Benton, H.P., D.M. Wong, S.A. Trauger and G. Siuzdak (2008) "XCMS^2: Processing Tandem Mass Spectrometry Data for Metabolite Identification and Structural Characterization", *Analytical Chemistry,* 80(16), pp. 6382-6389.
Bergquist, M. and J.Ljungberg (2001) "The Power of Gifts: Organising Social Relationships in Open Source Communities", *Information Systems Journal*, 11(4), pp. 305-320.
Berry, D.M. (2004) "Internet research: privacy, ethics and alienation: an open source approach", *Internet Research,* 14(4), pp. 323-332.
Berry, D.M. and G. Moss (2006a) "Free and open-source software: Opening and democratising e-government's black box", *Information Polity,* 11(1), pp. 21-34.

Berry, D.M. and G.Moss (2006b) "The politics of the libre commons", *First Monday*, 11(9), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1403/1321 (current Feb.14, 2010).
Bezroukov, N. (1999a) "A second look at the Cathedral and the Bazaar", *First Monday*, 4(12), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/708/618 (current Feb.14, 2010).
Bezroukov, N. (1999b) "Open source software development as a special type of academic research: Critique of vulgar Raymondism", *First Monday*, 4(10), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/696/606 (current Feb.14, 2010).
Biagioli, M. (2007) "Bringing peer review to patents", *First Monday*, 12(6), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1868/1751 (current Feb.14, 2010).
Bieber, C. and W. Schweibenz (2005) "Images of Italian art on the web – the database of the Photo Library of the German Art Institute in Florence", *New Library World,* 106(9/10), pp. 430-440.
Bisson, C. (2006) "Tech Watch", *EDUCAUSE Review,* 41(3), pp. 6-8.
Bisson, C., J. West, and R. Ebby (2007a) ""Free," "Free," and "Open Source?"", *Library Technology Reports,* 43(3), pp. 13-15.
Bisson, C., J. West, and R. Ebby (2007b) "Building Open Source", *Library Technology Reports,* 43(3), pp. 36-39.
Bisson, C., J. West, and R. Ebby (2007c) "No-Brainer", *Library Technology Reports,* 43(3), pp. 5-6.
Bisson, C., J. West, and R. Ebby (2007d) "Using Open Source", *Library Technology Reports,* 43(3), pp. 28-35.
Bittner, K. and I. Spence (2006). *Managing Iterative Software Development Projects.* Boston: Addison Wesley Professional
Bitzer, J.and P.J.H. Schröder (2005) "Bug-fixing and code-writing: The private provision of open source software", *Information Economics and Policy,* 17(3), pp. 389-406.
Bitzer, J., W. Schrettl, and P.J.H. Schröder (2007) "Intrinsic motivation in open source software development", *Journal of Comparative Economics,* 35(1), pp. 160-169.
Bitzer, J. and P.J.H. Schröder (2007) "Open Source Software, Competition and Innovation", *Industry and Innovation,* 14(5), pp. 461-476.
Blau, J. (1999) "Software firms face game-changing technology", *Research Technology Management,* 42(5), pp. 6-7.
Bleasby, A. (2004) "Editorial: Stable funding for open source software?" *Briefings in Bioinformatics,* 5(4), p. 312.
Bollinger, T., R. Nelson, S.J. Turnbull and K.M. Self (1999) "Open-source methods: Peering through the clutter", *IEEE Software,* 16(4) pp. 8-11.
Bonaccorsi, A. and C. Rossi (2003) "Why open source software can succeed", *Research Policy,* 32(7), pp. 1243-1258.
Bonaccorsi, A. and C. Rossi (2004) "Altruistic individuals, selfish firms? The structure of motivation in Open Source software", *First Monday*, 9(1), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1113/1033 (current Feb.14, 2010).
Bonaccorsi, A., S. Giannangeli, and C. Rossi (2006) "Entry Strategies Under Competing Standards: Hybrid Business Models in the Open Source Software Industry", *Organization Science,* 52(7), pp. 1085-1098.
Boulanger, A. (2005) "Open-source versus proprietary software: Is one more reliable and secure than the other?" *IBM Systems Journal,* 44(2), pp. 239-248.
Boulding, K. (1956) "General Systems Theory – The Skeleton of the Science", *Management Science*, 2(3), pp. 197-208.
Bowen, J. (2008) "Metadata to Support Next-Generation Library Resource Discovery: Lessons from the eXtensible Catalog, Phase 1", *Information Technology and Libraries* 27(2),1, 2008pp. 6-19.
Brabham, D.C. (2008) "Moving the crowd at iStockphoto: The composition of the crowd and motivations for participation in a crowdsourcing application", *First Monday*, 13(6), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2159/1969 (current

Feb.14, 2010).
Breeding, M. (2002) "The open source ILS: Still only a distant possibility", *Information Technology and Libraries,* 21(1), pp. 16-18.
Breeding, M. (2008a) "Conclusions and Observations", *Library Technology Reports,* 44(8), p.32.
Breeding, M. (2008b) "Major Open Source ILS Products", *Library Technology Reports,* 44(8), pp. 16-31.
Breeding, M. (2008c) "Open Source Library Automation: Overview and Perspective", *Library Technology Reports,* 44(8), pp. 5-10.
Breeding, M. (2008d) "The Commercial Angle", *Library Technology Reports,* 44(8), pp. 11-15.
Bretthauer, D. (2002) "Open source software: A history", *Information Technology and Libraries,* 21(1), pp. 3-10.
Brooks Jr, F.P. (1995) *The mythical man-month (anniversary ed.)*. Addison-Wesley Longman Publishing Co., Inc. Boston, MA, USA
Bruce, G.L., J.P. Wittgreffe, J.M.M. Potter and P. Robson (2005) "The potential for open source software in telecommunications operational support systems", *BT Technology Journal,* 23(3), pp. 79-95.
Bruce, G., P. Robson, and R Spaven (2006) "OSS opportunities in open source software -- CRM and OSS standards", *BT Technology Journal,* 24(1), pp. 127-140.
Brydon, M. and A.R. Vining (2008) "Adoption, Improvement, and Disruption: Predicting the Impact of Open Source Applications in Enterprise Software Markets", *Journal of Database Management* , 19(2), pp. 73-94.
Buliung, R.N. and T.K. Remmel (2008) "Open source, spatial analysis, and activity-travel behaviour research: capabilities of the aspace package", *Journal of Geographical Systems,* 10(2), pp. 191-216.
Burk, D.L. (2007) "Intellectual property and cyber infrastructure", *First Monday*, 12(6), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1870/1753 (current Feb.14, 2010).
Butcher, M.P. (2009) "At the foundations of information justice", *Ethics and Information Technology,* 11(1), pp. 57-69.
Calero, J.M.A, G.L. Millán, G.M. Péerez and A.F.G. Skarmeta (2009) "Towards the homogeneous access and use of PKI solutions: Design and implementation of a WS-XKMS server", *Journal of Systems Architecture,* 55(4), pp. 289-297.
Câmara, G. and F. Fonseca (2006) "Information policies and open source software in developing countries", *Journal of the American Society for Information Science and Technology,* 58(1), pp. 121-132.
Campbell-Kelly, M. (2008) "Historical Reflections Will the Future of Software be Open Source?", *Association for Computing Machinery. Communications of the ACM,* 51(10), pp. 21-23.
Capar, I., F. Ulengin and A. Reisman (2004) "A Taxonomy for Supply Chain Management Literature", accessible at SSRN http://ssrn.com/abstract=531902 (current Sep.26, 2009).
Capek, P.G., S.P. Frank, S.Gerdt and D.Shields (2005) "A history of IBM's open-source involvement and strategy", *IBM Systems Journal,* 44(2), pp. 249-257.
Capra, E., C. Francalanci, and F. Merlo (2008) "An Empirical Study on the Relationship Between Software Design Quality, Development Effort and Governance in Open Source Projects", *IEEE Transactions on Software Engineering,* 34(6), pp. 765-782.
Carillo, K. and C. Okoli (2007) "The open source movement: a revolution in software development", *The Journal of Computer Information Systems,* 49(2), pp. 1-9.
Carla, C. J., M. Millar, C.J. Choi, E.T. Russell and J-B Kim (2005) "Open source communities: an integrally informed approach", *Journal of Organizational Change Management,* 18(3), pp. 259-268.
Carletta, J., S. Evert, U. Heid and J. Kilgour (2005) "The NITE XML Toolkit: Data Model and Query Language", *Language Resources and Evaluation,* 39(4), pp. 313-334.
Carrasco-Muñoz, J. (2003) "The open code market", *First Monday*, 8(11), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1099/1019 (current Feb.14, 2010).
Carver, B.W. (2005) "Share and Share Alike: Understanding and Enforcing Open Source and Free Software Licenses", *Berkeley Technology Law Journal,* 20(1), pp. 443-481.

Casadesus-Masanell, R. and P. Ghemawat (2006) "Dynamic Mixed Duopoly: A Model Motivated by Linux vs. Windows", *Organization Science,* 52(7), pp. 1072-1084.
Cass, S. (2001) "The hidden revolution", *IEEE Spectrum,* 38(3), pp. 78-80.
Cassell, M. (2008) "Why governments innovate: adoption and implementation of open source software by four European cities", *International Public Management Journal,* 11(2), pp. 193-213.
Castelluccio, M. (2000) "Can the enterprise run on free software?" *Strategic Finance,* 81(9), pp. 50-55.
Castelluccio, M. (2006) "An Open Source Summer", *Strategic Finance,* 88(2), p. 57.
Castelluccio, M. (2008) "Enterprise Open Source Adoption", *Strategic Finance,* 90(5), pp. 57-58.
Cedergren, M. (2003) "Open content and value creation", *First Monday*, 8(8), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1071/991 (current Feb.14, 2010).
Cerri, D. and A. Fuggetta (2007) "Open standards, open formats, and open source", *The Journal of Systems and Software,* 80(11), pp. 1930-1937.
Cervone, F. (2003) "Guest editorial: Open source software: what can it do for your library?" *The Electronic Library,* 21(6), pp. 526-527.
Cetin, G. and M. Gokturk (2007) "Usability in Open Source: Community", *Interactions,* 14(6), pp. 38-40.
Chadwick, A. (2003) "Bringing e-democracy back in: Why it matters for future research on E-governance", *Social Science Computer Review,* 21(4), pp. 443-455.
Chan, B.C.B., J.C.F. Lau, and J.C.S. Lui (2005) "OPERA: An open-source extensible router architecture for adding new network services and protocols", *The Journal of Systems and Software,* 78(1), pp. 24-36.
Checkland, P. (1981) *Systems Thinking, Systems Practice*. Wiley, Chichester, UK.
Cheliotis, G. (2009) "From open source to open content: Organization, licensing and decision processes in open cultural production", *Decision Support Systems,* 47(3), pp. 229-244.
Choi, C.J., J-B. Kim, and T. Eldomiaty (2005) "The role of social conventions in the diffusion of open source software: Implications for service industries", *The Service Industries Journal,* 25(6), pp. 789-801.
Christou, I.T. and S. Ponis (2009) "A hierarchical system for effective coordination of available-to-promise logic mechanisms", *International Journal of Production Research,* 47(11), pp. 3063-3078.
Chudnov, D., J. Barnett, R. Prasad and M. Wilcox (2005) "Experiments in academic social book marking with Unalog", *Library Hi Tech,* 23(4), pp. 469-480.
Chumney, W.M. and Z. Zhou (2008) "Legal and Business Perspectives of Open Source Education Software", *Journal of American Academy of Business,* 13(1), pp. 208-214.
Churchman, C.W. (1968) *The Systems Approach*. Delacorte Press, New York, NY, USA.
Ciffolilli, A. (2003) "Phantom authority, self-selective recruitment and retention of members in virtual communities: The case of Wikipedia", *First Monday*, 8(12), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1108/1028 (current Feb.14, 2010).
Ciffolilli, A. (2004) "The economics of open source hijacking and the declining quality of digital information resources: A case for copyleft", *First Monday*, 9(9), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1173/1093 (current Feb.14, 2010).
Coffin, J. (2006) "An analysis of open source principles in diverse collaborative communities", *First Monday*, 11(6), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1342/1262 (current Feb.14, 2010).
Colazo, J. and Y. Fang (2009) "Impact of license choice on Open Source Software development activity", *Journal of the American Society for Information Science and Technology,* 60(5), pp. 997-1011.
Coleman, G. (2004) "The Political Agnosticism of Free and Open Source Software and the Inadvertent Politics of Contrast", *Anthropological Quarterly,* 77(3), pp. 507-519.
Colyer, A. and A. Clement (2005) "Aspect-oriented programming with AspectJ", *IBM Systems Journal,* 44(2), pp. 301-308.

Comino, S. and F.M.Manenti (2005) "Government Policies Supporting Open Source Software for the Mass Market", *Review of Industrial Organization,* 26(2), pp. 217-240.
Comino, S., F.M. Manenti, and M.L. Parisi. (2007) "From planning to mature: On the success of open source projects", *Research Policy,* 36(10), pp. 1575-1586.
Cook, I. and G. Horobin (2006) "Implementing eGovernment without promoting dependence: open source software in developing countries in Southeast Asia", *Public Administration & Development,* 26(4), pp. 279-289.
Cooke, M. and N. Buckley (2008) "Web 2.0, social networks and the future of market research", *International Journal of Market Research,* 50(2), pp. 267-292.
Cornford, T., C. Ciborra, and M. Shaikh (2005) "Do penguins eat scallops?" *European Journal of Information Systems,* 14(5), pp. 518-521.
Coyle, K. (2002) "Open source, open standards", *Information Technology and Libraries,* 21(1), pp. 33-36.
Coyle, K. (2007) "Identity Crisis", *Journal of Academic Librarianship,* 33(4), pp. 512-514.
Cribari-Neto, F., and S.G. Zarkos (1999) "R: Yet another econometric programming environment", *Journal of Applied Econometrics,* 14(3), pp. 319-329.
Cromie, J. and M. Ewing (2008) "Squatting at the digital campfire: Researching the open source software community", *International Journal of Market Research,* 50(5), pp. 631-653.
Cromie, J.G. and M.T. Ewing (2009) "The rejection of brand hegemony", *Journal of Business Research,* 62(2), pp. 218-230.
Crowston, K. (2005) "Future research on FLOSS development", *First Monday*, Special Issue 2, accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1465/1380 (current Feb.14, 2010).
Crowston, K., J. Howison, C. Masango, U.Y. Eseryel (2007a) "The Role of Face-to-Face Meetings in Technology-Supported Self-Organizing Distributed Teams", *IEEE Transactions on Professional Communication,* 50(3), pp. 185-203.
Crowston, K., Q. Li, K. Wei, U.Y. Eseryel and J. Howison (2007b) "Self-organization of teams for free/libre open source software development", *Information and Software Technology,* 49(6), pp. 564-575.
Crowston, K. and B. Scozzi (2008) "Bug Fixing Practices within Free/Libre Open Source Software Development Teams", *Journal of Database Management,* 19(2), pp. 1-30.
Crowston, K., K. Wei, J. Howison and A. Wiggins (2010) "Free/Libre Open Source Software Development: What We Know and What We Do Not Know", ACM Computing Surveys, in press. See also: http://crowston.syr.edu/system/files/Free%20Libre%20Open%20Source%20Software%20Development.pdf (current Jul 11, 2010).
Cullen, K.F. (2002) "PHP: An open source solution for Web programming and dynamic content", *Information Technology and Libraries,* 21(3), pp. 116-120.
Currie, C. (2005) "The Open Source Congress", *EDUCAUSE Review,* 40(4), pp. 80-81.
Curtis, D. and K.A. Funderburg (2003) "States estimate work zone traffic delay using QuickZone", *Institute of Transportation Engineers. ITE Journal,* 73(6), pp. 40-43.
Cusumano, M.A. (2004) "Reflections on Free and Open Software", *Association for Computing Machinery. Communications of the ACM,* 47(10), pp. 25-27.
Dahlander, L. and M.G. Magnusson (2005) "Relationships between open source software companies and communities: Observations from Nordic firms", *Research Policy,* 34(4), pp. 481-493.
Dahlander,L.and M. Mckelvey (2005) "Who is not developing open source software? non-users, users, and developers", *Economics of Innovation and New Technology,* 14(7), pp. 617-635.
Dahlander, L. and M.W. Wallin (2006) "A man on the inside: Unlocking communities as complementary assets", *Research Policy,* 35(8), pp. 1243-1259.
Dahlander, L. (2007) "Penguin in a new suit: a tale of how de novo entrants emerged to harness free and open source software communities", *Industrial and Corporate Change,* 16(5), pp. 913-943.
Dahlander, L. and M. Magnusson.(2008) "How do Firms Make Use of Open Source Communities?", *Long Range Planning,* 41(6), pp. 629-649.
David, S. (2004) "Opening the sources of accountability", *First Monday*, 9(11), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1185/1105 (current

Feb.14, 2010).
David, P.A. and F. Rullani (2008) "Dynamics of innovation in an "open source" collaboration environment: lurking, laboring, and launching FLOSS projects on SourceForge", *Industrial and Corporate Change,* 17(4), pp. 647-710.
David, P.A. and J.S. Shapiro (2008) "Community-based production of open-source software: What do we know about the developers who participate?", *Information Economics and Policy,* 20(4), pp. 364-398.
de Joode, R.V.W. (2004) "Managing Conflicts in Open Source Communities", *Electronic Markets,* 14(2), pp. 104-113.
de Laat, P.B. (2004) "Evolution of Open Source Networks in Industry", *Information Society,* 20(4), pp. 291-299.
de Laat, P.B. (2005) "Copyright or copyleft? An analysis of property regimes for software development", *Research Policy,* 34(10), pp. 1511-1532.
de Laat, P.B. (2007) "Governance of open source software: state of the art", *Journal of Management & Governance,* 11(2), pp. 165-177.
Dedeke, A. (2009) "Is Linux Better than Windows Software?", *IEEE Software,* 26(3), pp. 103-104.
Del Grosso, C., G. Antoniol, E. Merlo and P. Galinier (2008) "Detecting buffer overflow via automatic test input data generation", *Computers & Operations Research,* 35(10), pp. 3125-3143.
Demil, B. and X. Lecocq (2006) "Neither Market nor Hierarchy nor Network: The Emergence of Bazaar Governance", *Organization Studies,* 27(10), pp. 1447-1466.
Dempsey, B.J., D. Weiss, P. Jones and J. Greenberg (2002) "Who is an open source software developer?" *Association for Computing Machinery. Communications of the ACM,* 45(2), pp. 67-72.
den Besten, M., J-M. Dalle, and F. Galia (2008) "The allocation of collaborative efforts in open-source software", *Information Economics and Policy,* 20(4), pp.316-322.
De Paoli, S., M.Teli and V.D'Andrea (2008) "Free and open source licenses in community life: Two empirical cases", *First Monday*, 13(10), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2064/2030 (current Feb.14, 2010).
Dera, J.D. (2006) "Free Software for Your Practice", *Family Practice Management,* 13(2), pp. 56-58.
Determann, L.(2007) "Dangerous Liaisons – Software Combinations as Derivative Works? Distribution, Installation and Execution of Linked Programs under Copyright Law, Commercial Licenses and the GPL", *Berkeley Technology Law Journal,* 21(4), pp. 1421-1498.
Deuze, M. (2001) "Online journalism: Modelling the first generation of news media on the World Wide Web", *First Monday*, 6(10), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/893/802 (current Feb.14, 2010).
De Valk, G. and B.Martin (2006) "Publicly shared intelligence", *First Monday*, 11(9), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1397/1315 (current Feb.14, 2010).
Di Giacomo, M. (2005) "MySQL: Lessons Learned on a Digital Library", *IEEE Software,* 22(3), pp. 10-13.
Dinh-Trong, T.T. and J.M. Bieman (2005) "The FreeBSD Project: A Replication Case Study of Open Source Development", *IEEE Transactions on Software Engineering,* 31(6), pp. 481-494.
Donnellan, B., B. Fitzgerald, B. Lake, J. Sturdy (2006) "Implementing an Open Source Knowledge Base", *IEEE Software,* 22(6), pp. 92-95.
Dorman, D. (2008) "The potential of metasearching as an "open" service", *Library Hi Tech,* 26(1)pp. 58-67.
Dueñas, J.C., H.A. Parada G, F. Cuadrado, M. Santillán and J.L. Ruiz (2007) "Apache and Eclipse: Comparing Open Source Project Incubators", *IEEE Software,* 24(6), pp. 90-98.
Duguid, P. (2006) "Limits of self-organization: Peer production and "laws of quality", *First Monday*, 11(10), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1405/1323 (current Feb.14, 2010).
Dykstra-Erickson, E. and Y. Cheri (2007) "Open Source: A Primer", *Interactions,* 14(6), pp. 30-32.
Ebert, C. (2007) "Open Source Drives Innovation", *IEEE Software,* 24(3), pp. 105-109.

Ebert, C. (2008) "Open Source Software in Industry", *IEEE Software,* 25(3), pp. 52-53.
Ebert, C. (2009) "Guest Editor's Introduction: How Open Source Tools Can Benefit Industry", *IEEE Software,* 26(2), pp. 50-51.
Economides, N., and E. Katsamakas (2006) "Two-Sided Competition of Proprietary vs. Open Source Technology Platforms and the Implications for the Software Industry", *Organization Science,* 52(7), pp. 1057-1071.
Edelsohn, D., W. Gellerich, M. Hagog, D. Naishlos, M. Namolaru, E. Pasch, H. Penner, U. Weigand,and A. Zaks (2005) "Contributions to the GNU Compiler Collection", *IBM Systems Journal,* 44(2), pp. 259-278.
Edwards, K. (2000) "When beggars become choosers", *First Monday*, 5(10), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/795/704 (current Feb.14, 2010).
Egyedi, T.M. And R.W. de Joode (2004) "Standardization and Other Coordination Mechanisms in Open Source Software", *International Journal of IT Standards & Standardization Research,* 2(2), pp. 1-17.
Ellaway, R., J. Dalziel, and B. Dalziel (2008) "Learning design in healthcare education", *Medical Teacher,* 30(2), pp. 180-184.
Ellaway, R. and R.D. Martin (2008) "What's mine is yours-open source as a new paradigm for sustainable healthcare education", *Medical Teacher,* 30(2), pp. 175-179.
Elliott, M.S. and W. Scacchi (2008) "Mobilization of software developers: the free software movement", *Information Technology & People,* 21(1), pp. 4-33.
Endres, M.L., S.P. Endres, S.K. Chowdhury and I. Alam (2007) "Tacit knowledge sharing, self-efficacy theory, and application to the Open Source community", *Journal of Knowledge Management,* 11(3), pp. 92-103.
Evans, P. (2005) "The New Commons vs. The Second Enclosure Movement: Comments on an Emerging Agenda for Development Research", *Studies in Comparative International Development,* 40(2), pp. 86-94.
Falcioni, J.G. (2005) "open to change", *Mechanical Engineering,* 127(9), p. 4.
Falzone, C., A. Chan, E. Lusk and W. Gropp (2007) "A Portable Method for Finding User Errors in the Usage of MPI Collective Operations", *The International Journal of High Performance Computing Applications,* 21(2), pp. 155-172.
Fayle, K. (2007) "Open Source Software Survives Antitrust Challenge", *Law Technology ,* 39(4), pp. 5-6.
Federman, M. (2006) "The Penguinist Discourse: A Critical Application of Open Source Software Project Management to Organization Development", *Organization Development Journal,* 24(2), pp. 89-100.
Feher, J. and T. Sondag (2008) "Administering an Open-Source Wireless Network", *Information Technology and Libraries,* 27(3), pp. 44-54.
Fei, Q. and D.L. Olson (2007) "Web services composition strategy in enterprise systems", *Human Systems Management,* 26(1), pp. 53-61.
Feigenbaum, L., S.Martin, M.N. Roy, B. Szekely and W.C. Yung (2007) "Boca: an open-source RDF store for building Semantic Web applications", *Briefings in Bioinformatics,* 8(3), pp. 195-200.
Feller, J. and B. Fitzgerald (2000) "A framework analysis of the open source software development paradigm", Proceedings of the twenty first international conference on Information systems, pp. 58-69.
Feller, J., P. Finnegan, B. Fitzgerald and J. Hayes (2008) "From Peer Production to Productization: A Study of Socially Enabled Business Exchanges in Open Source Service Networks", *Information Systems Research,* 19(4), pp. 475-493.
Feller, J., P. Finnegan and J. Hayes (2008) "Delivering the 'Whole Product': Business Model Impacts and Agility Challenges in a Network of Open Source Firms", *Journal of Database Management,* 19(2), pp. 95-108.
Fershtman, C. and N. Gandal (2007) "Open source software: Motivation and restrictive licensing", *International Economics and Economic Policy,* 4(2), pp. 209-225.
Field, D., B. Tiwari, T. Booth, S. Houten, D. Swan, N. Bertrand and M. Thurston (2006) "Open software for biologists: from famine to feast", *Nature Biotechnology,* 24(7), pp. 801-804.
Fielding, R.T (1999) "Shared leadership in the Apache Project", *Association for Computing Machinery.*

Communications of the ACM, 42(4), pp. 42-43.
Filby, M. (2007) "Big Crook in Little China: The Ramifications of the Hong Kong BitTorrent Case on the Criminal Test of Prejudicial Effect", *International Review of Law, Computers & Technology* 21(3), pp. 275-283.
Filippov, I.V. and M.C. Nicklaus (2009) "Optical Structure Recognition Software To Recover Chemical Information: OSRA, An Open Source Solution", *Journal of Chemical Information and Modeling,* 49(3), pp. 740-743.
Fisher, R.T., L.P. Kadanoff, D.Q. Lamb, A. Dubey, T. Plewa, A. Calder, F. Cattaneo, P. Constantin, I. Foster, M.E. Papka, S.I. Abarzhi, S.M. Asida, P.M. Rich, C.C. Glendenin, K. Antypas, D.J. Sheeler, L.B. Reid, B. Gallagher, S.G. Needham (2008) "Terascale turbulence computation using the FLASH3 application framework on the IBM Blue Gene/L system", *IBM Journal of Research and Development,* 52(1/2), pp. 127-136.
Fitzgerald, B. and J.Feller (2001) "Open source software: investigating the software engineering, psychosocial and economic issues", *Information Systems Journal*, 11(4), pp. 273-276.
Fitzgerald, B. and J.Feller (2002) "A further investigation of open source software: community, co-ordination, code quality and security issues", *Information systems Journal*. 12(1), pp.3-5.
Fitzgerald, B. and T. Kenny (2004) "Developing an information systems infrastructure with open source software", IEEE Software, 21(1), pp. 50-55.
Fitzgerald, B. (2006) "The transformation of open source software", *MIS Quarterly,* 30(3), pp. 587-598.
Flaten, A. and A.Gill (2008) "Ashes2Art: Collaboration and Community in the Humanities", *First Monday*, 13(8), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2203/2021 (current Feb.14, 2010).
Fleisher, C.S. (2008) "Using open source data in developing competitive and marketing intelligence", *European Journal of Marketing,* 42(7/8), pp. 852-866.
Forge, S. (2006) "The rain forest and the rock garden: the economic impacts of open source software", Info : *the Journal of Policy, Regulation and Strategy for Telecommunications, Information and Media*, 8(3), pp. 12-31.
Forte, D. (2008) "An overview of the best known virtual solutions", *Network Security,* 10, pp. 16-18.
Fosfuri, A., M.S. Giarratana, and A. Luzzi (2008) "The Penguin Has Entered the Building: The Commercialization of Open Source Software Products", *Organization Science,* 19(2), pp. 292-305.
Fox, J. (2006) "Teacher's Corner: Structural Equation Modeling With the SEM Package in R", *Structural Equation Modeling,* 13(3), pp. 465-486.
Fox, R. (2006) "The digital library in the bazaar", *OCLC Systems and Services,* 22(2), pp. 100-106.
Franck, E. and C. Jungwirth (2003) "Reconciling Rent-Seekers and Donators – The Governance Structure of Open Source", *Journal of Management & Governance,* 7(4), pp. 401-421.
Frank, J. (2008) "Harness networked innovation", *Marketing Management,* 17(5), p. 7.
Freedman, W. (2005) "VIRTUAL SPEECH: AT THE CONSTITUTIONAL CROSSROADS", *Santa Clara Computer and High Technology Law Journal,* 21(4), pp. 629-643.
Fuggetta, A. (2003) "Open source software – An evaluation", *The Journal of Systems and Software,* 66(1), pp. 77-90.
Gacek, C. and B.Arief (2004) "The many meanings of open source", *IEEE Software*, 21(1), pp. 34-40.
Gallaway, T. and D. Kinnear (2004) "Open Source Software, the Wrongs of Copyright, and the Rise of Technology", *Journal of Economic Issues,* 38(2), pp. 467-474.
Gallivan, M.J. (2001) "Striking a Balance between Trust and Control in a Virtual Organization: A Content Analysis of Open Source Software Case Studies", *Information Systems Journal*, 11(4), pp. 277-304.
Gambardella, A. and B.H. Hall (2006) "Proprietary versus public domain licensing of software and research products", *Research Policy,* 35(6), pp. 875-892.
Gandel, P.B. and B. Wheeler (2005) "Of Birkenstocks and Wingtips: Open Source Licenses", *EDUCAUSE Review,* 40(1), pp. 10-11.
Gannon, J.C. (2000) "Strategic use of open source information: A corporate strategy that leverage the best practices", *Vital Speeches of the Day,* 67(5), pp. 153-157.
Gasser, L. and G. Ripoche (2003) "Distributed Collective Practices and Free/Open-Source Software Problem Management: Perspectives and Methods", Proceedings of the Conference on

Cooperation, Innovation and Technologie (CITE'03), Troyes, France.
Geppert, L. (2003) "Battle of the Xs", *IEEE Spectrum,* 40(8), pp. 16-17.
Ghalimi, I. (2008) "SaaS 2.0 onward! Business process management as an on-demand capability--Interview with Ismael Ghalimi of Intalio", *Journal of Digital Asset Management,* 4(5), pp. 52-259.
Ghosh, R.A. (2003a) "Clustering and dependencies in free/open source software development: Methodology and tools", *First Monday*, 8(4), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1041/962 (current Feb.14, 2010).
Ghosh, R.A. (2003b) "Licence fees and GDP per capita: The case for open source in developing countries", *First Monday*, 8(12), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1103/1023 (current Feb.14, 2010).
Gilles, S-P. (2005) "To What Extent Should Less-Developed Countries Enforce Intellectual Property Rights?" *World Economics,* 6(3), pp. 175-196.
Giuri, P., F. Rullani, and S. Torrisi (2008) "Explaining leadership in virtual teams: The case of open source software", *Information Economics and Policy,* 20(4), pp. 305-315.
Glance, D., J.Kerr and A.Reid (2004) "Factors affecting the use of open source software in tertiary education institutions", *First Monday*, 9(2), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1121/1041 (current Feb.14, 2010).
Glance, D. (2004) "Release criteria for the Linux kernel", *First Monday*, 9(4), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1136/1056 (current Feb.14, 2010).
Glass, R.L. (2000) "The sociology of open source: Of cults and cultures", *IEEE Software,* 17(3), pp. 104-105
Glass, R.L. (2003) "A sociopolitical look at open source", *Association for Computing Machinery. Communications of the ACM,* 46(11), pp. 21-23.
Glass, R.L. (2004) "A Look at the Economics of Open Source", *Association for Computing Machinery. Communications of the ACM,* 47(2), pp. 25-27.
Glasser, B.G. and A.L. Strauss (1967). *The discovery of grounded theory: Strategies for qualitative research.* Chicago: Aldine.
Goh, D. H-L., A. Chua, D.A. Khoo, E.B-H Khoo, E.B-T Mak and M. W-M Ng (2006) "A checklist for evaluating open source digital library software", *Online Information Review,* 30(4), pp. 360-379.
Goldsborough, R. (2005a) "Is It Time to Switch to Open Source Software?" *Tech Directions,* 65(2), p. 12.
Goldsborough, R. (2005b) "Is It Time to Switch to Open-Source Software?" *Black Issues in Higher Education,* 22(10), p. 33.
Gonzalez-Barahona, J.M., G. Robles, R. Andradas-Izquierdo and R.A. Ghosh (2008) "Geographic origin of libre software developers", *Information Economics and Policy,* 20(4), pp. 356-363.
Goode, S. (2005) "Something for nothing: management rejection of open source software in Australia's top firms", *Information & Management,* 42(5), pp. 669-681.
Görling, S. (2007) "Open source athletes", *First Monday*, 12(4), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1770/1650 (current Feb.14, 2010).
Gosain, S. (2003) "Looking through a Window on Open Source Culture: Lessons for Community Infrastructure Design", *Systèmes d'Information et Management,* 8(1), pp. 11-42.
Goth, G. (2001) "The open market woos open source", *IEEE Software,* 18(2), p. 104-107.
Goth, G. (2005a) "Open Source Business Models" Ready for Prime Time", *IEEE Software,* 22(6), pp. 98-100.
Goth, G. (2005b) "Beware the March of This IDE: Eclipse Is Overshadowing Other Tool Technologies", *IEEE Software,* 22(4), pp. 108-111.
Goth, G. (2005c) "Enter the protectionist dragon?" *IEEE Software,* 22(2), pp. 83-87.
Goth, G. and T. Costlow (2007) "Currents", *IEEE Software,* 24(2), pp. 94-98.
Goth, G. (2007) "Sprinting toward Open Source Development", *IEEE Software,* 24(1), pp. 88-91.

Graham, S.J.H. and D.C. Mowery (2005) "The Use of USPTO "Continuation" Applications in the Patenting of Software: Implications for Free and Open Source", *Law & Policy,* 27(1), pp. 128-151.

Grand, S., G. von Krogh, D. Leonard and W. Swap (2004) "Resource allocation beyond firm boundaries: A multi-level model for Open Source innovation", *Long Range Planning,* 37(6), pp. 591-610.

Greco, J.F. (2007) "The commercialisation of bioinformatics and the threat of open-source software", *Journal of Commercial Biotechnology,* 13(3), pp. 183-194.

Grewal, R., G.L. Lilien, and G. Mallapragada (2006) "Location, Location, Location: How Network Embeddedness Affects Project Success in Open Source Systems", *Organization Science,* 52(7), pp. 1043-1056.

Gruber, O., B.J. Hargrave, J. McAffer, P. Rapicault and T. Watson (2005) "The Eclipse 3.0 platform: Adopting OSGi technology", *IBM Systems Journal,* 44(2), pp. 289-299.

Gruber, M. and J. Henkel (2006) "New ventures based on open innovation ¿ an empirical analysis of start-up firms in embedded Linux", *International Journal of Technology Management,* 33(4), pp. 356-372.

Guha, R., M.T. Howard, G.R. Hutchison, P. Murray-Rust, H. Rzepa, C. Steinbeck, J. Wegner and E.L. Willighagen (2006) "The Blue Obelisk-Interoperability in Chemical Informatics", *Journal of Chemical Information and Modeling,* 46(3), pp. 991-998.

Gutsche, J. (2005) "The Evolution of Open Source Communities", *Topics in Economic Analysis & Policy,* 5(1), Article 2.

Guttikonda, A. and S.Gutam (2009) "Prospects of open access to Indian agricultural research: A case study of ICAR", *First Monday*, 14(7), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2488/2238 (current Feb.14, 2010).

Guy, M. (2005) "Lessons and outcomes from the Subject Portals Project", *VINE,* 35(1/2), pp. 58-63.

Gyimothy, T., R. Ferenc, and I. Siket (2005) "Empirical Validation of Object-Oriented Metrics on Open Source Software for Fault Prediction", *IEEE Transactions on Software Engineering,* 31(10), pp. 897-910.

Haefliger, S., G. von Krogh, and S. Spaeth. (2008) "Code Reuse in Open Source Software", *Management Science,* 54(1), pp. 180-193.

Hagan, D., O. Watson, and K. Barron (2007) "Ascending into order: A reflective analysis from a small open source development team", *International Journal of Information Management,* 27(6), pp. 397-405.

Hahn, J., J.Y. Moon, and C. Zhang (2008) "Emergence of New Project Teams from Open Source Software Developer Networks: Impact of Prior Collaboration Ties", *Information Systems Research,* 19(3), pp. 369-391.

Hamel, M.P. and C.M.Schweik (2009) "Open source collaboration: Two cases in the U.S. public sector", *First Monday*, 14(1), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2313/2065 (current Feb.14, 2010).

Han, Y. and A.Rawan (2007) "Afghanistan Digital Library Initiative: Revitalizing an Integrated Library System", *Information Technology and Libraries,* 26(4), pp. 44-46.

Hancock, B. (2000), "White House supporting open source code", *Computers & Security,* 19(7), pp. 577-578.

Hand, E. (2008) "No star left behind", *Nature, 453*(7194), p. 437.

Hansen, M., K. Kohntopp, and A. Pfitzmann (2002) "The Open Source approach – Opportunities and limitations with respect to security and privacy", *Computers & Security,* 21(5), pp. 461-471.

Harrison, W., H. Ossher, S. Sutton and P. Tarr (2005) "Supporting aspect-oriented software development with the Concern Manipulation Environment", *IBM Systems Journal,* 44(2), pp. 309-318.

Haruvy, E., S.P. Sethi and J. Zhou (2007) "Open Source Development with a Commercial Complementary Product or Service", *Production and Operations Management,* 17(1), pp. 29-43.

Hassler, V. (2005) "Open Source Libraries for Information Retrieval", *IEEE Software,* 22(5), pp. 78-82.

Hassler, S. (2008) "The Future Of Code, Digital And Genetic", *IEEE Spectrum,* 45(9), p. 9.

Hastings, S. R. (2005) "Reviews: Ubuntu Linux 5.04", *Linux Journal,* 136, p. 12.
Haughwout, M. (2006) "A reflecting and/or refracting Pool: When a local community becomes autonomous online", *First Monday*, 11(4), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1322/1242 (current Feb.14, 2010).
Hawkins, R.E. (2004) "The economics of open source software for a competitive firm :Why give it away for free?", *Netnomics : Economic Research and Electronic Networking,* 6(2), pp. 103-117.
Hedgebeth, D. (2007) "Gaining competitive advantage in a knowledge-based economy through the utilization of open source software", *VINE* 37(3), pp. 284-294.
Hemetsberger, A. (2004) "Creative Cyborgs: How Consumers Use the Internet for Self-realization", *Advances in Consumer Research,* 32, pp. 653-660.
Hemetsberger, A. (2005) "When David Becomes Goliath: Ideological Discourse in New Online Consumer Movements", *Advances in Consumer Research,* 33, pp. 494-500.
Hemetsberger, A. and C. Reinhardt (2006) "Learning and Knowledge-building in Open-source Communities: A Social-experiential Approach", *Management Learning,* 37(2), pp. 187-214.
Henkel, J. (2006) "Selective revealing in open innovation processes: The case of embedded Linux", *Research Policy,* 35(7), pp. 953-969.
Hepburn, G. (2004) "Seeking an educational commons: The promise of open source development models", *First Monday*, 9(8), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1165/1085 (current Feb.14, 2010).
Hertel, G., S. Niedner, and S. Herrmann (2003) "Motivation of software developers in open source projects: An Internet-based survey of contributors to the Linux kernel", *Research Policy,* 32(7), pp. 1159-1177.
Hertel, G. (2007) "Motivating job design as a factor in open source governance", *Journal of Management & Governance,* 11(2), pp. 129-137.
Hess, D.J. (2005) "Technology- and Product-Oriented Movements: Approximating Social Movement Studies and Science and Technology Studies", *Science, Technology & Human Values,* 30(4), pp. 515-535.
Hewson, C. (2007) "Web-MCQ: A set of methods and freely available open source code for administering online multiple choice question assessments", *Behavior Research Methods,* 39(3), pp. 471-481.
Hicks, C. and D. Pachamanova (2007) "Back-propagation of user innovations: The open source compatibility edge", *Business Horizons,* 50(4), pp. 315-324.
Highsmith, A., M. Jordan, E. Llona, P.E. Murray and E. Summers (2002) "MARC it your way: MARC.pm", *Information Technology and Libraries* 21(1), pp. 19-25.
Higo, Y., T. Kamiya, S. Kusumoto and K. Inoue (2007) "Method and implementation for investigating code clones in a software system", *Information and Software Technology,* 49(9/10), pp. 985-998.
Hill, B.M. (2005) "Reflections on free software past and future", *First Monday*, Special Issue 2, accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1468/1383 (current Feb.14, 2010).
Hoepman, J-H. and B. Jacobs (2007) "Increased security through open source", *Association for Computing Machinery. Communications of the ACM,* 50(1), pp. 79-83.
Holsti, O. (1969) C*ontent analysis for the social sciences and humanities*. Don Mills: ON: Addison-Wesley.
Holtgrewe, U.(2004) "Articulating the speed(s) of the Internet: The case of open source/freee software", *Time & Society,* 13(1), pp. 129-146.
Hossain, L. and D. Zhu (2009) "Social networks and coordination performance of distributed software development teams", *Journal of High Technology Management Research,* 20(1), pp.52-61.
Houser, J. (2009a) "An Introduction to the Case Studies", *Library Technology Reports,* 45(3), pp. 18-20.
Houser, J. (2009b) "Architectural Comparison", *Library Technology Reports,* 45(3), pp. 25-27.
Houser, J. (2009c) "Case Studies in Detail", *Library Technology Reports,* 45(3), pp. 28-34.
Houser, J. (2009d) "Current Open Source Software Products", *Library Technology Reports,* 45(3), pp.

11-17.
Hrastnik, P. (2004) "Execution of business processes based on web services", *International Journal of Electronic Business,* 2(5), pp. 550-556.
Huntley, C.L. (2003) "Organizational Learning in Open-Source Software Projects: An Analysis of Debugging Data", *IEEE Transactions on Engineering Management,* 50(4), pp. 485-493.
Hutchinson, H. (2008) "ASME Launches Open-Source Project", *Mechanical Engineering* 130(2), p. 8.
Huysmans, P., K.Ven and J.Verelst (2008) "Reasons for the non-adoption of OpenOffice.org in a data-intensive public administration", *First Monday*, 13(10), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2238/2038 (current Feb.14, 2010).
Hyatt, J. (2008) "The Oh-So-Practical Magic of Open-Source Innovation", *MIT Sloan Management Review,* 50(1), pp. 15-19.
Iannacci, F. and E.Mitleton-Kelly (2005) "Beyond markets and firms: The emergence of Open Source networks", *First Monday*, 10(2), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1237/1157 (current Feb.14, 2010).
Iivari, N. (2009) "Empowering the users? A critical textual analysis of the role of users in open source software development", *AI & Society,* 23(4), pp. 511-528.
Isken, M.W. (2005) "Hillmaker: An open source occupancy analysis tool", *Clinical and Investigative Medicine,* 28(6), pp. 342-343.
Jarvenpaa, S.L., E.H. Tiller, and R. Simons (2003) "Regulation and the Internet: Public choice insights for business organizations", *California Management Review,* 46(1), pp. 72-85.
Järvensivu, J., M. Kosola, M. Kuusipalo, P. Reijula, and T. Mikkonen (2006) "Developing an Open Source Integrated Development Environment for a Mobile Device", ICSEA – International Conference on Software Engineering Advances, 2006.
Järvinen, P. (2000) "Research questions guiding selection of an appropriate research method", In Hansen Bichler & Mahrer (Eds.), Proceedings of ECIS2000, 3–5 July (pp. 124–131). Wien: Vienna University of Economics and Business Administration.
Jesiek, B. (2003) "Democratizing software: Open source, the hacker ethic, and beyond", *First Monday*, 8(10), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1082/1002 (current Feb.14, 2010).
Jin, L., D. Robey, and M-C. Boudreau (2007) "Beyond Development: A Research Agenda for Investigating Open Source Software User Communities", *Information Resources Management Journal,* 20(1), pp. 68-80.
Johnson, J.P. (2001) "Economics of open source software", Mimeo, http://opensource.mit.edu/papers/johnsonopensource.pdf, (current Oct 9, 2009).
Johnson, J.P. (2006) "Collaboration, peer review and open source software", *Information Economics and Policy,* 18(4), pp. 477-497.
Jones, P. (2001) "Opensourceing the doors for contributor-run digital libraries", *Association for Computing Machinery. Communications of the ACM,* 44(5), pp. 45-46.
Jones, C. and S.Mitnick (2006) "Open source disaster recovery: Case studies of networked collaboration", *First Monday*, 11(5), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1325/1245 (current Feb.14, 2010).
Jones, B.R. (2007) "Comment: virtual neighborhood watch: open source software and community policing against cybercrime", *Journal of Criminal Law & Criminology,* 97(2), pp. 601-629.
Jordan, T. (2009) "Hacking and power: Social and technological determinism in the digital age", *First Monday*, 14(7), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2417/2240 (current Feb.14, 2010).
Jorgensen, N. (2001) "Putting it All in the Trunk: Incremental Software Development in the FreeBSD Open Source Project", *Information Systems Journal*, 11(4), pp. 321-336.
Jørgensen, N. (2007) "Developer autonomy in the FreeBSD open source project", *Journal of Management & Governance,* 11(2), pp. 119-128.
Kahin, B. (2003) "Information process patents in the U.S. and Europe: Policy avoidance and policy

divergence", *First Monday*, 8(3), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1036/957 (current Feb.14, 2010).
Kalina, I. and A. Czyzycki (2005) "The Ins and Outs of Open Source", *Consulting to Management,* 16(3), pp. 41-46.
Kapor, M. (2005) "How is Open Source Special?" *EDUCAUSE Review,* 40(2), pp. 72-73.
Kast, F. E. and J.E. Rosenzweig (1972) "General Systems Theory: Applications for Organization and Management", *The Academy of Management Journal*, 15(4), pp. 447-465.
Kavanagh, E. (2006) "Citizen Auditors-Web-Enabled, Open-Source Government", *Public Manager,* 35(1), pp. 20-25.
Kawaguchi, S., P.K. Garg, M. Matsushita and K. Inoue (2006) "MUDABlue: An automatic categorization system for Open Source repositories", *The Journal of Systems and Software,* 79(7), pp. 939-953.
Keats, D. (2003) "Collaborative development of open content: A process model to unlock the potential for African universities", *First Monday*, 8(2), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1031/952 (current Feb.14, 2010).
Kidane, Y.H. and P.A. Gloor (2007) "Correlating temporal communication patterns of the Eclipse open source community with performance and creativity", *Computational and Mathematical Organization Theory,* 13(1), pp. 17-27.
Kipp, M. (2005) "Software and seeds: Open source methods", *First Monday*, 10(9), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1276/1196 (current Feb.14, 2010).
Klang, M. (2005) "Free software and open source: The freedom debate and its consequences", *First Monday*, 10(3), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1211/1131 (current Feb.14, 2010).
Knieps, G. and I. Vogelsang (2007) "Digital economy and regulatory issues. Introduction", *International Economics and Economic Policy,* 4(2), pp. 101-107.
Koch, S. and G. Schneider (2002) "Effort, Cooperation and Coordination in an Open Source Software Project: GNOME", *Information Systems Journal*, 12(1), pp. 27-42.
Koch, S. (2004) "Profiling an Open Source Project Ecology and Its Programmers", *Electronic Markets,* 14(2), pp. 77-88.
Koch, S. and J.M. Gonzalez-Barahona (2005) "Open Source software engineering – The state of research", *First Monday*, Special Issue 2, accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1466/1381 (current Feb.14, 2010).
Koch, S. (2008) "Effort modeling and programmer participation in open source software projects", *Information Economics and Policy*, 20(4), pp. 345-355.
Koch, S. and C. Neumann (2008) "Exploring the Effects of Process Characteristics on Product Quality in Open Source Software Development", *Journal of Database Management,* 19(2), pp. 31-57.
Kogut, B. and A. Metiu (2001) "Open-source software development and distributed innovation", *Oxford Review of Economic Policy,* 17(2), pp. 248-264.
Koru, A.G. and J. Tian (2004) "Defect handling in medium and large open source projects", *IEEE Software,* 21(4), pp. 54-61.
Koru, A.G. and J.J. Tian (2005) "Comparing High-Change Modules and Modules with the Highest Measurement Values in Two Large-Scale Open-Source Products", *IEEE Transactions on Software Engineering,* 31(8), pp. 625-642.
Koru, A.G. and H.Liu (2007) "Identifying and characterizing change-prone classes in two large-scale open-source products", *The Journal of Systems and Software,* 80(1), pp. 63-73.
Krippendorff, K. (1980) *Content analysis: An introduction to its methodology.* London: Sage.
Krishnamurthy, S. (2003) "A managerial overview of open source software", *Business Horizons,* 46(5), pp. 47-56.
Krishnamurthy, S. (2005) "The elephant and the blind men – Deciphering the Free/Libre/Open Source puzzle", *First Monday*, Special Issue 2, accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1464/1379 (current

Feb.14, 2010).
Krishnamurthy, S. and A.K. Tripathi (2009) "Monetary donations to an open source software platform", *Research Policy,* 38(2), pp. 404-414.
Kshetri, N. and A. Schiopu (2007) "Government Policy, Continental Collaboration and the Diffusion of Open Source Software in China, Japan, and South Korea", *Journal of Asia – Pacific Business,* 8(1), pp. 61-77.
Kubelka, A. and M. Fawcett (2006) "No Free Beer – Practice Tips for Open Source Licensing", *Santa Clara Computer and High Technology Law Journal,* 22(4), pp. 797-818.
Kuehnel, A-K..(2008) "Microsoft, Open Source and the software ecosystem: of predators and prey – the leopard can change its spots", *Information & Communications Technology Law,* 17(2), pp. 107-124.
Kuk, G. (2006) "Strategic Interaction and Knowledge Sharing in the KDE Developer Mailing List", *Organization Science,* 52(7), pp. 1031-1042.
Kumar, M.S.V., J. Merriman, and P. D. Long (2001) "Building 'open' frameworks for education", *EDUCAUSE Review,* 36(6), pp. 80-81.
Kurtz, C. (2009) "Three strands in a braid: Identity interaction in social software", *First Monday*, 14(12), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2746/2408 (current Feb.14, 2010).
Lakhani, K.R. and E. von Hippel (2003) "How open source software works: "Free" user-to-user assistance", *Research Policy,* 32(6), pp. 923-943.
Lakhani, K. and R. G. Wolf. (2005) "Why Hackers Do What They Do: Understanding Motivation and Effort in Free/Open Source Software Projects", In: Feller, J., B. Fitzgerald, S. Hissam, K. Lakhani (eds.), Perspectives on Free and Open Source Software, MIT Press, Cambridge.
LaMarca, R. (2006) "The Free Range", *Mechanical Engineering,* 128(3), pp. 26-29.
Lamastra, C.R. (2009) "Software innovativeness. A comparison between proprietary and Free/Open Source solutions offered by Italian SMEs", *R & D Management* , 39(2), p.153-169.
Lancashire, D. (2001) "Code, culture and cash: The fading altruism of open source development", *First Monday*, 6(12), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/904/813 (current Feb.14, 2010).
Landsberger, J. (2007) "An Interview with Anne Schreiber", *TechTrends,* 51(6), pp. 6-8.
Langlois, R.N. and G. Garzarelli (2008) "Of Hackers and Hairdressers: Modularity and the Organizational Economics of Open-source Collaboration", *Industry and Innovation,* 15(2), pp. 125-143.
Laxminarsaiah, A. and I.U. Rajgoli (2007) "Building institutional repository: an overview", *OCLC Systems and Services,* 23(3), pp. 278-286.
Lee, M.L. and J. Davis (2003) "Evolution of Open Source Software: A Study of the Samba Project", *Systèmes d'Information et Management,* 8(1), pp. 43-62.
Lee, K-S. (2006) "From underground cult to public policy for citizens: democratizing an open source artifact at a policy level in South Korea", *The Journal of Policy, Regulation and Strategy for Telecommunications, Information and Media,* 8(1), pp. 4-15.
Lee, D. and H. Mendelson (2008) "Divide and Conquer: Competing with Free Technology Under Network Effects", *Production and Operations Management,* 17(1), pp. 12-28.
Lee, S-Y. T., H-W. Kim, and S. Gupta (2009) "Measuring open source software success", *Omega,* 37(2), pp. 426-438.
Lehman, M.M., Perry, D.E,. and Turski, W.M. (1996) "Why is it so hard to find feedback control in software processes?", Invited Talk, Proc. 19th Australasian Comp. Science Conf., Melbourne, Australia, 31 January-2 February 1996, pp. 107-115.
Lehmann, F. (2004) "FLOSS developers as a social formation", *First Monday*, 9(11), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1186/1106 (current Feb.14, 2010).
Lerner, J. and J. Tirole (2000) "The Simple Economics of Open Source," *NBER Working Paper 7600*.
Lerner, J. and J. Tirole (2001) "The open source movement: Key research questions", *European Economic Review,* 45(4-6), pp. 819-826.
Lerner, J. and J. Tirole (2002) "Some simple economics of open source", *The Journal of Industrial Economics,* 50(2), pp. 197-234.

Lerner, J. and J. Tirole (2005) "The Economics of Technology Sharing: Open Source and Beyond", The *Journal of Economic Perspectives,* 19(2), pp. 99-120.
Lerner, J. (2005) "The Scope of Open Source Licensing", *Journal of Law Economics & Organization,* 21(1), pp. 20-56.
Lerner, J., P.A. Pathak, and J. Tirole (2006) "The Dynamics of Open-Source Contributors", *The American Economic Review,* 96(2), pp. 114-118.
Lessig, L. (1999) "The limits in open code: Regulatory standards and the future of the Net", *Berkeley Technology Law Journal,* 14(2), pp. 759-769.
Levesque, M. (2004) "Fundamental issues with open source software development ", *First Monday*, 9(4), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1484/1399 (current Feb.14, 2010).
Li, W. and R. Shatnawi (2007) "An empirical study of the bad smells and class error probability in the post-release object-oriented system evolution", *The Journal of Systems and Software,* 80(7), pp. 1120-1128.
Li, J., R. Conradi, C. Bunse, M. Torchiano, O. Slyngstad and M. Morisio (2009) "Development with Off-the-Shelf Components: 10 Facts", *IEEE Software,* 26(2), pp. 80-87.
Lin, Y. (2004) "Contextualising knowledge-making in Linux user groups", *First Monday*, 9(11), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1187/1107 (current Feb.14, 2010).
Lin, Y. (2005) "The future of sociology of FLOSS", *First Monday*, Special Issue 2, accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1467/1382 (current Feb.14, 2010).
Lin, Y-D., S-H Chen, P-C Lin and Y-C Lai (2008) "Designing and evaluating interleaving decompressing and virus scanning in a stream-based mail proxy", *The Journal of Systems and Software,* 81(9), p. 1517-1524.
Lin, L. (2008) "Impact of user skills and network effects on the competition between open source and proprietary software", *Electronic Commerce Research and Applications,* 7(1), pp. 68-81.
Ljungberg, J. (2000) "Open source movements as a model for organising", *European Journal of Information Systems,* 9(4), pp. 208-216.
Locke, J. and A. Lowe (2007) "XBRL: An)Open) Source of Enlightenment or Disillusion?" *European Accounting Review* 16(3), pp. 585-623.
Lohr, S. (2003) "Novell to Buy Suse Linux for $210 Million" *The New York Times*, November 5, p. 6 C.
Long, Y. and K. Siau (2007) "Social Network Structures in Open Source Software Development Teams", *Journal of Database Management,* 18(2), pp. 25-40.
Lorimer, R., R. Smith, and P. Wolstenholme (2000) "Fogo Island goes digital: taking a scholarly journal on-line, the case of CJC-Online.ca", *Canadian Journal of Communication,* 25(3), at http://www.cjc-online.ca/index.php/journal/article/viewArticle/1165/1084 (current Sep.26, 2009).
Lougee-Heimer, R. (2003) "The common optimization INterface for operations research: Promoting open-source software in the operations research community", *IBM Journal of Research and Development,* 47(1), pp. 57-66.
Lougee-Heimer, R. (2005) "COIN-OR Pays Off", *OR-MS Today,* 32(5), pp. 48-51.
Lougee-Heimer, R. (2006) "COIN-OR ready to roll in Pittsburgh", *OR-MS Today,* 33(5), p. 52.
Lougee-Heimer, R. (2007) "Making heads or tails of COIN-OR", *OR-MS Today,* 34(1), pp. 62-64.
Lougee-Heimer, R. (2008) "COIN-OR in 2008", *OR-MS Today,* 35(5), p. 46.
Louridas, P. (2005) "JUnit: Unit Testing and Coding in Tandem", *IEEE Software,* 22(4), pp. 12-15.
Louridas, P. (2006) "Static Code Analysis", *IEEE Software,* 23(4), pp. 58-61.
Louridas, P. (2007) "Declarative GUI Programming in Microsoft Windows", *IEEE Software,* 24(4), pp. 16-19.
Lucky, R. W. (1999) "Free software", *IEEE Spectrum,* 36(5), p. 24.
Lunsford II, P.J. (2007) "Implementing an Open Source Conferencing System for Distance Education", *Distance Learning,* 4(2), pp. 20-27.
Lussier, S. (2004) "New tricks: How open source changed the way my team works", *IEEE Software*, 21(1), pp. 68-72.
Luthiger, B. and C.Jungwirth (2007) "Pervasive Fun", *First Monday*, 12(1), accessible

at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1422/1340 (current Feb.14, 2010).
Luyt, B. (2008) "The One Laptop Per Child Project and the negotiation of technological meaning", *First Monday*, 13(6), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2144/1971 (current Feb.14, 2010).
MacCormack, A., J. Rusnak, and C.Y. Baldwin (2006) "Exploring the Structure of Complex Software Designs: An Empirical Study of Open Source and Proprietary Code", *Organization Science,* 52(7), pp. 1015-1030.
MacKenzie, S. (2005) "ETERNAL BITS", *IEEE Spectrum,* 42(7), pp. 22-27.
MacPherson, D.L. (2006) "Digitizing the Non-Digital: Creating a Global Context for Events, Artifacts, Ideas, and Information", *Information Technology and Libraries,* 25(2), pp. 95-102.
Madanmohan, T.R. and R. De (2004) "Open source reuse in commercial firms", *IEEE Software,* 21(6), pp. 62-69.
Mah, C. and K. Stranack (2006) "dbWiz: open source federated searching for academic libraries", *Library Hi Tech,* 23(4), pp. 490-503.
Malakoff, D. (2001) "Petition seeks public sharing of code", *Science,* 294(5540), p. 27.
Marchesin, A. (2004) "Using Linux for real-time applications", *IEEE Software,* 21(5), pp. 18-20.
Markus, M.L., B. Manville, and C.E. Agres (2000) "What Makes a Virtual Organization Work?" *MIT Sloan Management Review,* 42(1), pp. 13-26.
Markus, M.L. (2007) "The governance of free/open source software projects: monolithic, multidimensional, or configurational?" *Journal of Management & Governance,* 11(2), pp. 151-163.
Martin, K. and B. Hoffman (2007) "An Open Source Approach to Developing Software in a Small Organization", *IEEE Software,* 24(1), pp. 46-53.
Masri, W. and A. Podgurski (2008) "Application-based anomaly intrusion detection with dynamic information flow analysis", *Computers & Security,* 27(5/6), pp. 176-187.
Massey, B. (2005) "Opening the Mainstream: O'Reilly Oscon 2005", *IEEE Software,* 22(6), pp. 101-102.
Massey, B. (2006) "Open Source and Government Systems: Goscon 2005", *IEEE Software,* 23(1), pp. 111-113.
Mateos-Garcia, J. and W. E. Steinmueller (2008) "The institutions of open source software: Examining the Debian community", *Information Economics and Policy,* 20(4), pp. 333-344.
Matthiesen, M.W. (2002) "Affordable biocomputing for everyone: Using the Internet, freeware and open-source software", *Trends in Biochemical Sciences,* 27(11), pp. 586-588.
Mauri, R.A. (2004) "Unstoppable Linux", *Vital Speeches of the Day,* 70(11), pp. 340-344.
Maxwell, J.W. (2007) "Extending OJS into small magazines: The OMMM Project", *First Monday*, 12(10), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1962/1839 (current Feb.14, 2010).
May, C. (2006) "Escaping the TRIPs' Trap: The Political Economy of Free and Open Source Software in Africa", *Political Studies,* 54(1), pp. 123-146.
Mayo, A. (2001) *The Human Value of the Enterprise–Valuing People as Assets, Monitoring, Measuring, Managing.* London: Nicholas Brealey Publishing.
McConnell, S. (1999) "Open-source methodology: Ready for prime time?" *IEEE Software,* 16(4), pp. 6-8.
McGhee, D.D. (2007) "Free and Open Source Software Licenses: Benefits, Risks, and Steps Toward Ensuring Compliance", *Intellectual Property & Technology Law Journal,* 19(11), pp. 5-9
McGowan, D. (2005) "There is no such thing as free software (And it is a good thing, too)", *First Monday*, Special Issue 2, accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1469/1384 (current Feb.14, 2010).
McGowan, M.K., P. Stephens, and D. Gruber (2007) "An Exploration of the Ideologies of Software Intellectual Property: The Impact on Ethical Decision Making", *Journal of Business Ethics,* 73(4), pp. 409-424.
McLaughlin, L. (2005) "Inside the Software Patents Debate", *IEEE Software,* 22(3), pp. 102-105.

Meeker, H. (2008) "Outsource software development and open source: coming of age in the 2000s", *Santa Clara Computer and High Technology Law Journal,* 24(4), pp. 869-881.
Méndez-Durón, R. and C.E. García (2009) "Returns from social capital in open source software networks", *Journal of Evolutionary Economics,* 19(2), pp. 277-295.
Messerschmitt, D.G. (2004) "Back to the user", *IEEE Software*, 21(1), pp. 89-91.
Mikkonen, T., T.Vadén and N.Vainio (2007) "The Protestant ethic strikes back: Open source developers and the ethic of capitalism", *First Monday*, 12(2), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1623/1538 (current Feb.14, 2010).
Miles, M. and A.M. Huberman (1984). *Qualitative data analysis*. Beverly Hills, CA: Sage Publications.
Miles, M. and A.M. Huberman (1994). *Qualitative data analysis (2nd Ed.)*. Thousand Oaks, CA: Sage Publications.
Miralles, F., S. Sieber, and J. Valor (2006) "An Exploratory Framework for Assessing Open Source Software Adoption", *Systèmes d'Information et Management,* 11(1), pp. 85-103.
Mitchell, S., J. Mason, and L.Pender (2004) "Enabling technologies and service designs for collaborative Internet collection building", *Library Hi Tech,* 22(3), pp. 295-306.
Mockus, A., R. Fielding, and J. Herbsleb, (2000) "A case study of open source software development: the Apache server", In: Proceedings of the Presentation of the Paper at the International Conference on Software Engineering (ICSE), Limerick, Ireland.
Mockus, A., R. Fielding, and J. Herbsleb, (2002) "Two case studies of open source software development: Apache and mozilla", *ACM Transactions on Software Engineering and Methodology,* 11 (3), pp. 1–38.
Mooney, S.D. and P.H. Baenziger (2008) "Extensible open source content management systems and frameworks: a solution for many needs of a bioinformatics group", *Briefings in Bioinformatics* , 9(1), pp. 69-74.
Moore, A.H. (2002) "Lens on the future: Open-source learning", *EDUCAUSE Review,* 37(5), pp. 42-51
Morgan, E.L. (2002) "Possibilities for open source software in libraries", *Information Technology and Libraries,* 21(1), pp. 12-15.
Morgan, E.L. (2005) "Creating and managing XML with open source software", *Library Hi Tech,* 23(4), pp. 526-540.
Muir, S.P. (2005) "An introduction to the open source software issue", *Library Hi Tech,* 23(4), pp. 465-468.
Müller-Prove, M.(2007) "Community Experience at OpenOffice.org", *Interactions,* 14(6), pp. 47-48.
Murphy, G.C., M. Kersten, and L. Findlater (2006) "How Are Java Software Developers Using the Eclipse IDE?" *IEEE Software,* 23(4), pp. 76-83.
Mustonen, M. (2005) "When Does a Firm Support Substitute Open Source Programming?" *Journal of Economics & Management Strategy,* 14(1), pp. 121-139.
Myatt, D.P. and C. Wallace (2007) "An evolutionary analysis of the volunteer's dilemma", *Games and Economic Behavior,* 62(1), pp. 67-76.
Nakakoji, K., Y. Yamamoto, Y. Nishinaka, K. Kishida and Y. Ye (2002) "Evolution patterns of open-source software systems and communities", In Proceedings of the international Workshop on Principles of Software Evolution (Orlando, Florida, May 19 – 20, 2002). IWPSE '02. ACM, New York, NY, 76-85.
Nambisan, S., D. Wilemon (2000) "Software development and new product development: potential for cross-domain knowledge sharing", *IEEE Transactions on Engineering Management*, 47 (2), pp. 211-220.
Nau, D., T-C Au, O. Ilghami, U. Kuter, D. Wu, F. Yaman, H. Munoz-Avila and J.W. Murdock (2005) "Applications of SHOP and SHOP2", *IEEE Intelligent Systems,* 20(2), pp. 34-41.
Nelson, M., R. Sen, and C. Subramaniam (2006) "Understanding Open Source Software: A Research Classification Framework", *Communications of the Association for Information Systems,* 17, pp. 266-287.
Nelson, J., J. Courtial, and G. Whyte (2008) "Photorealistic visualization of imaging in canonical optical resonators", *American Journal of Physics,* 76(11), pp. 991-995.
Neumann, P.G. (1999) "Robust open-source software", *Association for Computing Machinery. Communications of the ACM,* 42(2), p. 128.
Neus, A. and P. Scherf (2005) "Opening minds: Cultural change with the introduction of open-source

collaboration methods", *IBM Systems Journal,* 44(2), pp. 215-225.
Newby, G.B., J. Greenberg, and P. Jones (2003) "Open source software development and Lotka's Law: Bibliometric patterns in programming", *Journal of the American Society for Information Science and Technology,* 54(2), pp. 169-178.
Newmarch, J. (2001) "Lessons from open source: Intellectual property and courseware", *First Monday*, 6(6), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/868/777 (current Feb.14, 2010).
Nichols, D. and M.Twidale (2003) "The Usability of Open Source Software", *First Monday*, 8(1), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1018/939 (current Feb.14, 2010).
Niederman, F., A. Davis, D. Wynn, M.E. Greiner and P.T. York (2006a) "A Research Agenda for Studying Open Source I: A Multi-Level Framework", *Communications of the Association for Information Systems,* 18, pp. 129-149.
Niederman, F., A. Davis, D. Wynn, M.E. Greiner and P.T. York (2006b) "Research Agenda for Studying Open Source II: View Through the Lens of Referent Discipline Theories", *Communications of the Association for Information Systems,* 18, pp. 150-175.
Niemi, T., M. Tuisku, A-P Hameri and T. Curtin (2009) "Server-Based Computing Solution Based on Open Source Software", *Information Systems Management,* 26(1), pp. 77-86.
Nizovtsev, D. and M. Thursby (2007) "To disclose or not? An analysis of software user behavior", *Information Economics and Policy,* 19(1), pp. 43-64.
Nolan, R.L. and J.C. Wetherbe (1980) "Toward a Comprehensive Framework for MIS Research", *MIS Quarterly*, 4(2), pp. 1-19.
Nolan-Stevaux, K.M. (2007) "Open source biology: a means to address the access & research gaps?, *Santa Clara Computer and High Technology Law Journal,* 23(2), pp. 271-316.
Norris, J.S. (2004) "Mission-critical development with open source software: Lessons learned", *IEEE Software*, 21(1), pp. 42-49.
Nuvolari, A. (2005) "Open source software development: Some historical perspectives", *First Monday*, 10(10), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1284/1204 (current Feb.14, 2010).
Obrenovic, Z. and D. Gasevic. (2007) "Open Source Software: All You Do Is Put It Together", *IEEE Software*, 24(5), pp. 86-95.
O'Donnell, C. (2004) "A case for Indian insourcing: Open Source interest in IT job expansion", *First Monday*, 9(11), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1188/1108 (current Feb.14, 2010).
Oh, W. and S. Jeon (2007) "Membership Herding and Network Stability in the Open Source Community: The Ising Perspective", *Organization Science,* 53(7), pp. 1086-1101.
O'Hanlon, C. (2006) "A conversation with Leo Chang of ClickShift", *ACM Queue* 4(5), pp. 12-18.
Okoli, C. and W. Oh (2007) "Investigating recognition-based performance in an open content community: A social capital perspective", *Information & Management,* 44(3), pp. 240-252.
O'Mahony, S. (2003) "Guarding the commons: How community managed software projects protect their work", *Research Policy,* 32(7), pp. 1179-1198.
O'Mahony, S. and F. Ferraro (2004) "Managing the boundary of an 'open' project",
IESE Research Papers D/537, IESE Business School.
O'Mahony, S. and F. Ferraro (2007) "The emergence of governance in an open source community", *Academy of Management Journal,* 50(5), pp. 1079-1106.
O'Mahony, S. (2007) "The governance of open source initiatives: what does it mean to be community managed?" *Journal of Management & Governance,* 11(2), pp. 139-150.
Omar, I. (2005) "The penguin in peril: SCO's legal threats to Linux", *First Monday*, 10(1), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1203/1123 (current Feb.14, 2010).
O'Reilly, T. (1999) "Lessons from open-source software development", *Association for Computing Machinery. Communications of the ACM,* 42(4), pp. 32-37.
Orman, W.H. (2008) "Giving It Away for Free? The Nature of Job-Market Signaling by Open-Source

Software Developers", *Advances in Economic Analysis & Policy,* 8(1), Article 12.
Osterloh, M. and S. Rota (2007) "Open source software development Just another case of collective invention?" *Research Policy,* 36(2), pp. 157-171.
Ousterhout, J. (1999) "Free software needs profit", *Association for Computing Machinery. Communications of the ACM,* 42(4), pp. 44-45.
Overbeek, R., T. Disz, and R. Stevens (2004) "The SEED: A Peer-to-Peer Environment for GENOME ANNOTATION", *Association for Computing Machinery. Communications of the ACM,* 47(11), pp. 46-51.
Papadopoulos, P.M., C.A. Papadopoulos, M.J. Katz, W.J. Link and G. Bruno (2004) "Configuring Large High-Performance Clusters at Lightspeed: A Case Study", *The International Journal of High Performance Computing Applications,* 18(3), pp. 317-326.
Pashalidis, A. and M. Fleury (2004) "Secure Network Management Within an Open-Source Mobile Agent Framework", *Journal of Network and Systems Management,* 12(1), pp. 9-31.
Patton, M. Q. (1980). *Qualitative evaluation methods*. Beverly Hills, CA: Sage.
Paulson, J.W., G. Succi, and A. Eberlein (2004) "An Empirical Study of Open-Source and Closed-Source Software Products", *IEEE Transactions on Software Engineering,* 30(4), pp. 246-256.
Payne, C. (2002) "On the Security of Open Source Software", *Information Systems Journal*, 12(1), pp. 61-78.
Pénin, J. and J-P. Wack (2008) "Research tool patents and free-libre biotechnology: A suggested unified framework", *Research Policy,* 37(10), pp.1909-1921.
Perens, B. (1999) "The Open Source Definition", in DiBona, C., Ockman, S. and Stone, M., eds., Open Sources: Voices from the Open Source Revolution, Sebastopol, CA: O'Reilly, pp. 171-188.
Perens, B. (2005) "The emerging economic paradigm of Open Source", *First Monday*, Special Issue 2, accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1470/1385 (current Feb.14, 2010).
Perkins, M. and J. Pfaffman (2006) "Using a course management system to improve classroom communication", *The Science Teacher,* 73(7), pp. 33-37.
Pestian, J.P., L. Itert, C. Andersen and W. Duch (2006) "Preparing Clinical Text for Use in Biomedical Research", *Journal of Database Management,* 17(2), pp. 1-11.
Petracca, M., R. Birke, and A. Bianco (2009) "HERO: High-speed enhanced routing operation in Ethernet NICs for software routers", *Computer Networks,* 53(2), pp. 168-179.
Pfaffman, J. (2007) "It's Time to Consider Open Source Software", *TechTrends,* 51(3), pp. 38-43.
Pfaffman, J. (2008) "Transforming High School Classrooms with Free/Open Source Software: It's Time for an Open Source Software Revolution", *The High School Journal,* 91(3), pp. 25-31.
Picci, L. (2007) "Reputation-based governance", *First Monday*, 12(9), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2010/1885 (current Feb.14, 2010).
Pisano, G. (2006) "Profiting from innovation and the intellectual property revolution", *Research Policy,* 35(8), pp. 1122-1130.
Pitt, L.F., R.T. Watson, P. Berthon, D. Wynn and G. Zinkhan (2006) "The Penguin's Window: Corporate Brands From an Open-Source Perspective", *Academy of Marketing Science Journal,* 34(2), pp. 115-127.
Pomerantz, J. and F.Stutzman (2006) "Collaborative reference work in the blogosphere", *Reference Services Review,* 34(2), pp. 200-212.
Potenza, J.M. and S. Chang (2008) "The SCO Group, Linux, and Life After SCO's Setback Against Novell", Intellectual Property & Technology Law Journal, 20(1), p. 11.
Pykalainen, T. (2007) "Model for profiting from software innovations in the new era in computing", *Technovation,* 27(4), pp. 179-193.
Pykalainen, T. (2008) "Adaption of Linux SSL servers across cultures", *First Monday*, 13(12), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2255/2054 (current Feb.14, 2010).
Racine, J. and R. Hyndman (2002) "Using R to teach econometrics", *Journal of Applied Econometrics,* 17(2), pp. 175-189.
Racine, J. (2006) "Gnuplot 4.0: a portable interactive plotting utility", *Journal of Applied Econometrics,* 21(1), pp. 133-141.

Rademacher, J.D.M. and S. Lippke (2007) "Dynamic online surveys and experiments with the free open-source software dynQuest", *Behavior Research Methods,* 39(3), pp. 415-426.
Raisinghani, M.S. (2005) "Search Engine Technology: A Closer Look at Its Future", *Information Resources Management Journal,* 18(2), pp. i-vii.
Rajlich, V. and P. Gosavi (2004) "Incremental change in object-oriented programming", *IEEE Software,* 21(4), pp. 62-69.
Ramli, M.F. (2005) "Open source geographical resources analysis support system)GRASS) for landslide hazard assessment", *Disaster Prevention and Management,* 14(4), pp. 522-532.
Rasch, C. (2001) "The Wall Street performer protocol: Using software completion bonds to fund open source software development", *First Monday*, 6(6), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/865/774 (current Feb.14, 2010).
Ravi, S. (2007) "Waiting for Usable Open Source Software? Don't Hold Your Breath!" *Communications of the Association for Information Systems,* 20, Article 25.
Raymond, E.S. (1999) "Linux and open-source success", *IEEE Software,* 16 (1), pp. 85–89.
Raymond, E.S. (2001a) "Revenge of the Hackers", in: The Cathedral and the Bazaar: Musings on Linux and Open Source by an Accidental Revolutionary, E.S. Raymond (ed.), O'Reilly, Sebastopol, 2001, pp. 169-191.
Raymond, E.S. (2001b) "Why Microsoft smears – and fears – open source", *IEEE Spectrum,* 38(8), pp. 14-15.
Raymond, E.S. (2004) "Up from alchemy", *IEEE Software*, 21(1), pp. 88-90.
Reas, C. and B. Fry (2006) "Processing: programming for the media arts", *AI & Society,* 20(4), pp. 526-538.
Rechtman, Y. (2004) "Open-Source Software: Implications for CPAs", *The CPA Journal,* 74(1), pp. 66-69.
Reiner, L. and A. Smith (2005) "CUFTS", *Journal of Academic Librarianship,* 31(6), p. 611.
Reisman A. (2004) "How can OR/MS Educators Benefit From Creating and Using Taxonomies?", INFORMS Transactions on Education, 4(3), accessible at http://ite.pubs.informs.org/Vol4No3/Reisman/ (current Sep.26, 2009).
Remillard, J. (2005) "Source code review sytems", *IEEE Software,* 22(1), pp. 74-77.
Rey, S.J. (2009) "Show me the code: spatial analysis and open source", *Journal of Geographical Systems,* 11(2), pp. 191-207.
Riehle, D., J. Ellenberger, T. Menahem, B. Mikhailovski, Y. Natchetoi, B. Naveh and T. Odenwald (2009) "Open Collaboration within Corporations Using Software Forges", *IEEE Software,,* 26(2), pp. 52-58.
Ringle, M. (2004) "Can Collaboration Rescue Imperiled It Budgets", *EDUCAUSE Review,* 39(6), pp. 38-46.
Roach, R. (2003) "Open source software maker offers academic program", *Black Issues in Higher Education,* 20(2), p. 41.
Roberts, J.A., I-H. Hann, and S.A. Slaughter (2006) "Understanding the Motivations, Participation, and Performance of Open Source Software Developers: A Longitudinal Study of the Apache Projects", *Organization Science,* 52(7), pp. 984-999.
Rossi, M. A. (2004) "Decoding the Free/Open Source (F/OSS) Software Puzzle: A survey of theoretical and empirical contributions", Universiti degli Studi di Siena, Dipartimento Di Economia Politica, accessible at http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.112.4800&rep=rep1&type=pdf (current Apr.23, 2010).
Rossi, C. and A. Bonaccorsi (2005) "Intrinsic vs. extrinsic incentives in profit–oriented firms supplying Open Source products and services", *First Monday*, 10(5), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1242/1162 (current Feb.14, 2010).
Royce, W. (1998) *Software Project Management: A Unified Framework*, Addison-Wesley, Inc., Reading, MA.
Ruffin, M. and C.Ebert (2004) "Using open source software in product development: A primer", *IEEE Software*, 21(1), pp. 82-86.
Rzepa, H.S., A. Wheat, and M.J. Williamson (2006) "ChemSem: An Extensible and Scalable RSS-

Based Seminar Alerting System for Scientific Collaboration", *Journal of Chemical Information and Modeling,* 46(3), pp. 985-990.
Sadowski, B.M., G. Sadowski-Rasters, and G. Duysters (2008) "Transition of governance in a mature open software source community: Evidence from the Debian case", *Information Economics and Policy,* 20(4), pp. 323-332.
Saltzman, M. (2004) "Who Is Darl McBride, and Why Is He Saying Those Terrible Things about Linux?" *OR-MS Today,* 31(3), p. 8.
Samoladas, I., I. Stamelos, L. Angelis and A. Oikonomou (2004) "Open source software development should strive for even greater code maintainability", *Association for Computing Machinery. Communications of the ACM,* 47(10), pp. 83-87.
Sampson, F. (2007) "Who Said "Usability Is Free"?", *Interactions,* 14(4), pp. 10-11.
Samuelson, P. (2006) "IBM's pragmatic embrace of open source", *Association for Computing Machinery. Communications of the ACM,* 49(10), pp. 21-25.
Santos Jr., C. (2008) "Understanding Partnerships between Corporations and the Open Source Community: A Research Gap", *IEEE Software,,* 25(6), pp. 96-97.
Sarker, S. and C. Schneider (2009) "Seeing Remote Team Members as Leaders: A Study of US-Scandinavian Teams", *IEEE Transactions on Professional Communication,* 52(1), pp. 75-94.
Satchwell,M.W. (2005) "The TAO of Open Source: Minimum Action for Maximum Gain", *Berkeley Technology Law Journal,* 20(4), pp. 1757-1798.
Sauer, R.M. (2007) "Why develop open-source software? The role of non-pecuniary benefits, monetary rewards, and open-source licence type", *Oxford Review of Economic Policy,* 23(4), pp.605-619.
Savirimuthu, J. (2005) "Open source, code and architecture: It is the Memes stupid", *International Review of Law, Computers & Technology,* 19(3), pp. 341-362.
Scacchi, W. (2004) "Free and open source development practices in the game community", *IEEE Software*, 21(1), pp. 59-66.
Scacchi, W. (2007) "Free and open source software development: Recent research results and methods", *Advances in Computers*. M. Zelkowitz, Elsevier Press, 69, pp. 243-295.
Scheer, C. (2007) "Factors to consider before building your own DAM", *Journal of Digital Asset Management,* 3(1)F, pp. 17-22.
Schlesinger, D. (2007) "Working with Open Source: A Practical Guide", *Interactions,* 14(6), pp. 35-37.
Schmidt, D.C. and A. Porter (2001) "Leveraging open-source communities to improve the quality performance of open-source software", in: Making Sense of the Bazaar, Proceedings of the First Workshop on Open Source Software, Feller, J., Fitzgerald, B. & van der Hoek, A. (eds), pp. 52–56.
Schmidt, D.P. (2004) "Intellectual Property Battles in a Technological Global Economy: A Just War Analysis", *Business Ethics Quarterly,* 14(4), pp. 679-693.
Schulte-Mecklenbeck, M. and M. Neun (2005) "WebDiP: A tool for information search experiments on the World-Wide Web", *Behavior Research Methods,* 37(2), pp. 293-300.
Schultz, E. (2002a) "Microsoft joins initiative for software choice", *Computers & Security,* 21(7), p. 584.
Schultz, E. (2002b) "Microsoft plans to publish Palladium source code", *Computers & Security,* 21(6), p. 482.
Schultz, E. (2002c) "Microsoft takes stand against open source software", *Computers & Security,* 21(6), p. 481.
Schweik, C. (2003) "The Institutional Design of Open Source Programming: Implications for Addressing Complex Public Policy and Management Problems", *First Monday*, 8(1), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1019/2426 (current Feb.14, 2010).
Schweik, C.M. and R.English (2007) "Tragedy of the FOSS commons? Investigating the institutional designs of free/libre and open source software projects", *First Monday*, 12(2), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1619/1534 (current Feb.14, 2010).
Schweik, C.M., M.T. Fernandez, M.P. Hamel, P. Kashwan, Q. Lewis and A. Stepanov (2009) "Reflections of an Online Geographic Information Systems Course Based on Open Source Software", *Social Science Computer Review,* 27(1), pp.118-129.
Seacord, R. C., D. Plakosh, and G.A. Lewis (2003) *Modernizing Legacy Systems: Software*

Technologies, Engineering Process, and Business Practices. Addison-Wesley, SEI Series in Software Engineering.
Searls, D. (2005) "*Making a New World*", in: Open Sources 2.0: The Continuing Evolution, Dibona, C., Cooper, D., and Stone, M. (ed.), O'Reilly, Sebastopol, 2005, pp. 231-252.
Sen, A., Y. Chen, and B. Zhang (2008) "A New Architecture for Personalization Engines: An Open Source Approach", *Journal of Organizational Computing and Electronic Commerce,* 18(3), pp. 224-253.
Serrano, N., S. Calzada, J.M. Sarriegui and I. Ciordia (2004) "From proprietary to open source tools in information systems development", *IEEE Software*, 21(1), pp. 56-58.
Serrano, N. and J.M. Sarriegi (2006) "Open Source Software ERPs: A New Alternative for an Old Need", *IEEE Software,* 23(3), pp. 94-97.
Sexton, A., C. Turner, G. Yeo and S. Hockey (2004a) "Understanding users: A prerequisite for developing new technologies", *Journal of the Society of Archivists,* 25(1), pp. 33-49.
Sexton, A., G. Yeo, C. Turner and S. Hockey (2004b) "User feedback: Testing the LEADERS demonstrator application", Society of Archivists)Great Britain). *Journal of the Society of Archivists,* 25(2), pp. 189-208.
Shah, S.K. (2005) "Open beyond software" in: C. Dibona, D. Cooper, M. Stone, (eds.) *Open Sources 2: The Continuing Evolution*. O'Reilly Media, Sebastopol, CA.
Shah, S.K. (2006) "Motivation, Governance, and the Viability of Hybrid Forms in Open Source Software Development", *Organization Science,* 52(7), pp. 1000-1014.
Sharma, S., V.Sugumaran and B.Rajagopalan (2002) "A Framework for Creating Hybrid-OSS Communities", *Information Systems Journal*, 12(1), pp. 7-26.
Shen, X. (2005) "Developing Country Perspectives on Software: Intellectual Property and Open Source – A Case Study of Microsoft and Linux in China", *International Journal of IT Standards & Standardization Research,* 3(1), pp. 21-43.
Shimizu, H., J.Iio and K.Hiyane (2004) "The realities of Free/Libre/Open Source Software developers in Japan and Asia", *First Monday*, 9(11), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1190/1110 (current Feb.14, 2010).
Simon, K.D. (2005) "The value of open standards and open-source software in government environments", *IBM Systems Journal,* 44(2), pp. 227-238.
Sitas, A. (2006) "CDSware (CERN Document Server Software)", *Library Hi Tech,* 24(3), pp. 420-429.
Skiba, D.J. (2005) "Open Source: Will You Follow the Cathedral or the Bazaar Model?" *Nursing Education Perspectives,* 26(3), pp. 184-185.
Smith, C.A., E.J. Want, G. O'Maille, R. Abagyan and G. Siuzdak (2006) "XCMS: Processing Mass Spectrometry Data for Metabolite Profiling Using Nonlinear Peak Alignment, Matching, and Identification", *Analytical Chemistry,* 78(3), pp. 779-787.
Smith, A. (2007) "Introducing Zoomify Image", *Information Technology and Libraries,* 26(1), pp. 48-51.
Snyder Jr, G.F. and M. Qaissaunee (2006) "Flat world strategies: New Technologies Create Interactive Learning", *Community College Journal,* 77(2), pp. 38-41.
Sohn, S.Y. and M.S. Mok (2008) "A strategic analysis for successful open source software utilization based on a structural equation model", *The Journal of Systems and Software,* 81(6), p. 1014.
Sondag, T. and J. Feher (2007) "Open Source Wifi Hotspot Implementation", *Information Technology and Libraries,* 26(2), pp. 35-43.
Souzis, A. (2005) "Building a Semantic Wiki", *IEEE Intelligent Systems,* 20(5), pp. 87-91.
Sowe, S., I. Stamelos, and L. Angelis (2006) "Identifying knowledge brokers that yield software engineering knowledge in OSS projects", *Information and Software Technology,* 48(11), pp. 1025-1033.
Sowe, S.K., I. Stamelos, and L. Angelis (2008) "Understanding knowledge sharing activities in free/open source software projects: An empirical study", *The Journal of Systems and Software,* 81(3), pp. 431-446.
Spinellis, D. and C.Szyperski (2004) "How is open source affecting software development?", *IEEE Software*, 21(1), pp. 28-33.
Spudich, G., X.M. Fernández-Suárez, and E. Birney (2007) "Genome browsing with Ensembl: a practical overview", *Briefings in Functional Genomics & Proteomics,* 6(3), pp. 202-219.
Srinivas, K.R. (2006) "Intellectual property rights and bio commons: open source and beyond",

International Social Science Journal, 58(2), pp. 319-334.
Stajich, J.E. and H. Lapp (2006) "Open source tools and toolkits for bioinformatics: significance, and where are we?" *Briefings in Bioinformatics,* 7(3), pp. 287-296.
Stalder, F. and J.Hirsh (2002) "Open Source Intelligence", *First Monday*, 7(6), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/961/882 (current Feb.14, 2010).
Stamelos, I., L. Angelis, A. Oikonomou and G.L. Bleris (2002) "Code Quality Analysis in Open-Source Software Development", *Information Systems Journal*, 12(1), pp. 43-60.
Stanford, J. and R. Mikula (2008) "A model for online collaborative cancer research: report of the NCI caBIG project", *International Journal of Healthcare Technology & Management,* 9(3), pp. 231-246.
Stephenson, D. (2006) "Futures in e-learning", *Campus-Wide Information Systems,* 23(2), pp. 102-103.
Stewart, J.E., H. Mangalam, and J. Zhou (2001). "Open Source Software meets gene expression", *Briefings in Bioinformatics,* 2(4), pp. 319-328.
Stewart, K.J., A.P. Ammeter, and L.M. Maruping (2006) "Impacts of License Choice and Organizational Sponsorship on User Interest and Development Activity in Open Source Software Projects", *Information Systems Research,* 17(2), pp. 126-144.
Stewart, K.J. and S. Gosain (2006) "The Impact of Ideology on Effectiveness in Open Source Software Development Teams", *MIS Quarterly,* 30(2), pp. 291-314.
Stone, A. (2002) "Open source acceptance grows", *IEEE Software,* 19(2), p. 102.
Stuermer, M., S. Spaeth, and G. von Krogh (2009) "Extending private-collective innovation: a case study", *R & D Management,* 39(2), pp.170-191.
Subramanyam, R. and M. Xia (2008) "Free/Libre Open Source Software development in developing and developed countries: A conceptual framework with an exploratory study", *Decision Support Systems,* 46(1), pp. 173-186.
Subramaniam, C., R. Sen, and M.L. Nelson (2009) "Determinants of open source software project success: A longitudinal study", *Decision Support Systems,* 46(2), pp. 576-585.
Swift, B. (2001) "Opening up a discussion on computing: Finding security alternatives and more", *Risk Management,* 48(10), pp. 26-32.
Sykora, V.J. and D.E. Leahy (2008) "Chemical Descriptors Library (CDL) A Generic, Open Source Software Library for Chemical Informatics", *Journal of Chemical Information and Modeling,* 48(10), pp. 1931-1942.
Szulik, M.J. (2007) "Open for Change", *EDUCAUSE Review,* 42(1), pp. 4-5.
Thierstein, J. (2009) "Education in the Digital Age", *EDUCAUSE Review,* 44(1), pp. 33-34.
Thilmany, J. (2004) "Computers You Take for Granted", *Mechanical Engineering,* 126(8), pp. 16-18.
Thilmany, J. (2005) "On the Same Wavelength", *Mechanical Engineering,* 127(1), p. 14.
Thilmany, J. (2009) "Warp Speed Wireless", *Mechanical Engineering*, 131(5), p. 16.
Thomas, D. and A. Hunt (2004) "Open source ecosystems", *IEEE Software,* 21(4), pp. 89-91.
Thomas, S., L. Williams, and T. Xie (2009) "On automated prepared statement generation to remove SQL injection vulnerabilities", *Information and Software Technology,* 51(3), pp. 589-598.
Torvalds, L. and D. Diamond (2001) "Why open source makes sense", *EDUCAUSE Review,* 36(6), pp. 70-77.
Tribunella, T. and J. Baroody (2008) "20 Questions on Open Source Accounting Software", The CPA Journal, 78(7), pp. 67-72.
Troxel, G.D., E. Blossom, S. Boswell, A. Caro, I. Castineyra, A. Colvin, T. Dreier, J.B. Evans, N. Goffee, K.Z. Haigh, T. Hussain, V. Kawadia, D. Lapsley, C. Livadas, A. Medina, J. Mikkelson (2008) "Enabling open-source cognitively-controlled collaboration among software-defined radio nodes", *Computer Networks,* 52(4), pp.898-911.
Tsai, J. (2007) "For better or worse: Introducing the GNUGeneral Public License Version 3", *Berkeley Technology Law Journal,* 23(1), pp. 547-581.
Tsakalozos, K., V. Stoumpos, K. Saidis and A. Delis (2009) "Adaptive disk scheduling with workload-dependent anticipation intervals", *The Journal of Systems and Software,* 82(2), pp.274-291.
Tsantalis, N., A. Chatzigeorgiou, and G. Stephanides (2005) "Predicting the Probability of Change in Object-Oriented Systems", *IEEE Transactions on Software Engineering,* 31(7), pp. 601-614.
Tsantalis, N. and A. Chatzigeorgiou (2009) "Identification of Move Method Refactoring Opportunities",

IEEE Transactions on Software Engineering, 35(3), p. 347-367.
Tuomi, I. (2001) "Internet, innovation, and open source: Actors in the network", *First Monday*, 6(1), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/824/733 (current Feb.14, 2010).
Tuomi, I. (2004) "Evolution of the Linux Credits file: Methodological challenges and reference data for Open Source research", *First Monday*, 9(6), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1151/1071 (current Feb.14, 2010).
Tuomi, I. (2005) "What did we learn from open source", *First Monday*, Special Issue 2, accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1471/1386 (current Feb.14, 2010).
Turnu, I., M. Melis, A. Cau, A. Setzu, G. Concas and K. Mannaro (2006) "Modeling and simulation of open source development using an agile practice", *Journal of Systems Architecture,* 52(11), pp. 610-618.
Uchida, S., A. Monden, N. Ohsugi, T. Kamiya, K. Matsumoto and H. Kudo (2005) "Software Analysis by Code Clones in Open Source Software", *The Journal of Computer Information Systems,* 45(3), pp. 1-11.
Vaisman, D. (2007) "Coding a Revolution", *Foreign Policy*, 159, p. 93.
Välimäki, M. and C. Borsalino (2003) "Dual licensing in open source software industry," *Systèmes d'Information et Management*, 8(1), pp. 63-75.
Valverde, S., G. Theraulaz, J. Gautrais, V. Fourcassie and R.V. Sole (2006) "Self-Organization Patterns in Wasp and Open Source Communities", *IEEE Intelligent Systems,* 21(2), pp. 36-40.
van Horn, R. (2007) "The Other Office", *Phi Delta Kappan,* 88(7), pp. 487,551.
van Rooij, S.W. (2007) "Perceptions of Open Source Versus Commercial Software: Is Higher Education Still on the Fence?" J*ournal of Research on Technology in Education,* 39(4), pp. 433-453.
van Rooij, S.W. (2009) "Adopting Open-Source Software Applications in U.S. Higher Education: A Cross-Disciplinary Review of the Literature", *Review of Educational Research,* 79(2), pp. 682-701.
Vassis, D., G. Kormentzas, A. Rouskas and I. Maglogiannis (2005) "The IEEE 802.11 g Standard for High Data Rate WLANs", *IEEE Network*, 19(3), pp. 21-26.
Vaughan-Nichols, S. J. (2003) "The Battle over the Universal Java IDE" *IEEE Computer*, 36 (4), pp. 21-23.
Vemuri, V.K. and V. Bertone (2004) "Will the Open Source Movement Survive a Litigious Society?" *Electronic Markets,* 14(2), pp. 114-123.
Ven, K. and H. Mannaert (2008) "Challenges and strategies in the use of Open Source Software by Independent Software Vendors", *Information and Software Technology,* 50(9/10), pp. 991-1002.
Ven, K., J. Verelst, and H. Mannaert (2008) "Should You Adopt Open Source Software?" *IEEE Software,* 25(3), pp. 54-59.
Voßkühler, A., V. Nordmeier, L. Kuchinke and A.M. Jacobs (2008) "OGAMA – Open Gaze and Mouse Analyzer: Open-source software designed to analyze eye and mouse movements in slideshow study designs", *Behavior Research Methods,* 40(4), pp. 1150-1162.
Vogel, D.R. and J.C.Wetherbe (1984) "MIS Research: A Profile of Leading Journals and Universities", DATA BASE, 16(1), pp. 3-14
von Bertalanffy, L.(1934) Untersuchungen über die Gesetzlichkeit des Wachstums. I. Allgemeine Grundlagen der Theorie; mathematische und physiologische Gesetzlichkeiten des Wachstums bei Wassertieren. Arch. Entwicklungsmech., 131, pp. 613-652.
von Bertalanffy, L.(1950) "An Outline of General System Theory", *British Journal for the Philosophy of Science*, 1(2), pp. 134-165.
von Bertalanffy, L. (1962) "General system theory – A Critical Review" *General Systems,* 7, pp. 1-20.
von Bertalanffy, L. (1968) *General System Theory: Foundations, Development, Applications*. New York: George Braziller
von Bertalanffy, L. (1972) "The History and Status of General Systems Theory", *The Academy of Management Journal*, 15(4), pp. 407-426.
von Hippel, E. (2001) "Innovation by User Communities: Learning from Open-Source Software", *MIT*

Sloan Management Review, 42(4), pp. 82-86.
von Hippel, E. and G. von Krogh (2003) "Open source software and the "private-collective" innovation model: Issues for organization science", *Organization Science,* 14(2), pp. 209-223.
von Krogh, G. (2003) "Open-source software development", *MIT Sloan Management Review,* 44(3), pp. 14-18.
von Krogh, G., S. Spaeth, and K.R. Lakhani (2003) "Community, joining, and specialization in open source software innovation: A case study", *Research Policy,* 32(7), pp. 1217-1241.
von Krogh, G. and E. von Hippel (2006) "The Promise of Research on Open Source Software", *Management Science,* 52(7), pp. 975-983.
von Wangenheim, C.G., J.C.R. Hauck, and A. von Wangenheim (2009) "Enhancing Open Source Software in Alignment with CMMI-DEV", *IEEE Software,,* 26(2), pp. 59-67.
Voth, D. (2003) "Open source in the US government", *IEEE Software,* 20(1), p. 73.
Voth, D. and H. Lanir (2006) "In the News", *IEEE Software,* 23(5), pp. 96-98.
Vujovic, S. and J.P. Ulhøi (2008) "Online innovation: the case of open source software development", *European Journal of Innovation Management,* 11(1), pp. 142-156.
Wacha, J.B. (2005) "Taking the Case: Is the GPL Enforceable?" *Santa Clara Computer and High Technology Law Journal,* 21(2), pp. 451-492.
Wagner, H.R.(2002) "The EOR toolkit: An open source solution for RDF metadata", *Information Technology and Libraries,* 21(1), pp. 27-31.
Wagner, C. (2006) "Breaking the Knowledge Acquisition Bottleneck Through Conversational Knowledge Management", *Information Resources Management Journal,* 19(1), pp. 70-83.
Waldo, J. (2008) "Scaling in Games and Virtual Worlds", *Association for Computing Machinery. Communications of the ACM,* 51(8), pp. 38-44.
Wang, H. and C. Wang (2001) "Open source software adoption: A status report", *IEEE Software,* 18(2), pp. 90-95.
Waring, T. and P. Maddocks (2005) "Open Source Software implementation in the UK public sector: Evidence from the field and implications for the future", *International Journal of Information Management,* 25(5), pp. 411-428.
Watson, R.T., M-C Boudreau, P.T. York, M.E. Greiner and D.E. Wynn (2008a) "The Business of OPEN SOURCE", *Association for Computing Machinery. Communications of the ACM,* 51(4), pp. 41-46.
Watson, R.T. , M-C Boudreau, P.T. York, M.E. Greiner and D.E. Wynn (2008b) "Opening the Classroom", *Journal of Information Systems Education,* 19(1), pp. 75-85.
Weber, S. (2004) *The Success of Open Source.* Cambridge MA. Harvard University Press.
Weber, S. and J. Bussell (2005) "Will Information Technology Reshape the North-South Asymmetry of Power in the Global Political Economy?" *Studies in Comparative International Development,* 40(2), pp. 62-84.
Webster, J., and R.T. Watson (2002) "Analyzing the Past to Prepare for the Future: Writing a Literature Review", *MIS Quarterly,* 26(2), pp. xii-xxiii.
Weekes, S. (2008) "In the Moodle", *Training & Coaching Today, p.* 16.
Weinstein, M. (2006) "TAMS Analyzer: Anthropology as Cultural Critique in a Digital Age", *Social Science Computer Review,* 24(1), pp. 68-77.
Weiss, A.(2008) "Linux Ready for the Desktop? Yes, No, and Maybe", *NetWorker,* 12(2), pp. 38-40.
Werry, C. (2001) "The work of education in the age of E-College", *First Monday*, 6(5), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/858/767 (current Feb.14, 2010).
Wesselius, J. (2008) "The Bazaar inside the Cathedral: Business Models for Internal Markets", *IEEE Software,* 25(3), pp. 60-66.
West, J. (2003) "How open is open enough? Melding proprietary and open source platform strategies", *Research Policy,* 32(7), pp. 1259-1285.
West, J. and J. Dedrick (2006) "Scope and Timing of Deployment: Moderators of Organizational Adoption of the Linux Server Platform", *International Journal of IT Standards & Standardization Research,* 4(2), pp. 1-15,17-23.
West, J. and S. Gallagher (2006) "Challenges of open innovation: the paradox of firm investment in open-source software", *R & D Management,* 36(3), pp. 319-331.
West, J. and K.R. Lakhani (2008) "Getting Clear About Communities in Open Innovation", *Industry*

and Innovation, 15(2), pp. 223-231.
West, J. and S. O'Mahony (2008) "The Role of Participation Architecture in Growing Sponsored Open Source Communities", *Industry and Innovation,* 15(2), pp. 145-168.
Wheeler, B. (2004a) "Open Source 2007: How Did This Happen?" *EDUCAUSE Review,* 39(4), pp. 12-27.
Wheeler, B. (2004b) "The Open Source Parade", *EDUCAUSE Review,* 39(5), pp. 68-69.
Wheeler B. (2007) "Open Source 2010: Reflections on 2007", *EDUCAUSE Review,* 42(1), pp. 48-67.
Whitehurst, J. (2009) "Open Source: Narrowing the Divides between Education, Business, and Community", *EDUCAUSE Review,* 44(1), pp.70-71.
Whitfield, J. (2003) "DNA-chip firm backs down over upgrade", *Nature,* 424(6945), p. 119.
Willinsky, J. (2005a) "Open Journal Systems: An example of open source software for journal management and publishing", *Library Hi Tech,* 23(4), pp. 504-519.
Willinsky, J. (2005b) "The unacknowledged convergence of open source, open access, and open science", *First Monday*, 10(8), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1265/1185 (current Feb.14, 2010).
Witten, I.H., D. Bainbridge, and S. J. Boddie (2001) "Greenstone: Open-source digital library software with end-user collection building", *Online Information Review,* 25(5), pp. 288-298.
Witten, I.H. (2006) "Digital libraries for the developing world", *Interactions,* 13(4), pp. 20-21.
Witt, L. (2006) "Constructing a framework to enable an open source reinvention of journalism", *First Monday*, 11(6), accessible at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1338/1258 (current Feb.14, 2010).
Wolcott, H. (1994) "Description, Analysis and Interpretation in Qualitative Inquiry", in Transforming Qualitative Data, Thousand Oaks, CA: Sage, pp. 9-54.
Wray, B. and R. Mathieu (2008) "Evaluating the performance of open source software projects using data envelopment analysis", *Information Management & Computer Security,* 16(5), pp. 449-462.
Wrosch, J. (2005) "Using open source to provide remote patron authentication", *Library Hi Tech,* 23(4), pp. 520-525.
Wu, C.G., J.H. Gerlach, and C.E. Young (2007) "An empirical analysis of open source software developers' motivations and continuance intentions", *Information & Management,* 44(3), pp. 253-262.
Wüstner, E., P. Buxmann, and S. Schade (2005) "<x:act>: A Web Service for the Conversion of XML Standards", *International Journal of IT Standards & Standardization Research,* 3(2), pp. 15-28.
Xi, P., B. Rajwa, J.T. Jones and J.P. Robinson (2007) "The design and construction of a cost-efficient confocal laser scanning microscope", *American Journal of Physics,* 75(3), pp. 203-207.
Xing, Z. and E. Stroulia (2007) "API-Evolution Support with Diff-CatchUp", *IEEE Transactions on Software Engineering,* 33(12), pp. 818-836.
Xu, B., D.R. Jones and B. Shao (2009) "Volunteers' involvement in online community based software development", *Information & Management*, 46(3), pp. 151-158.
Yalta, A.T. and R. Lucchetti (2008) "The GNU/Linux platform and freedom respecting software for economists", *Journal of Applied Econometrics,* 23(2), pp. 279-286.
Yan, N., D. Leip, and K. Gupta (2005) "The use of open-source software in the IBM corporate portal", *IBM Systems Journal,* 44(2), pp. 419-425.
Yang, Z. and M. Jiang (2007) "Using Eclipse as a Tool-Integration Platform for Software Development", *IEEE Software,* 24(2), pp. 87-89.
Ye, Z.E., S. Smith, and D. Anthony (2005) "Trusted paths for browsers", *ACM Transactions on Information and System Security,* 8(2), pp. 153-186.
Yoo, T.S. and M.J. Ackerman (2005) "Open source software for medical image processing and visualization", *Association for Computing Machinery. Communications of the ACM,* 48(2), pp. 55-59.
Yu, L., S.R. Schach, K. Chen and J. Offutt (2004) "Categorization of Common Coupling and Its Application to the Maintainability of the Linux Kernel", *IEEE Transactions on Software Engineering,* 30(10), pp. 694-706.
Yu, L., S.R. Schach, K. Chen, G.Z. Heller and J. Offutt (2006) "Maintainability of the kernels of open-

source operating systems: A comparison of Linux with FreeBSD, NetBSD, and OpenBSD", *The Journal of Systems and Software,* 79(6), pp. 807-815.

Yu, L. (2008) "Self-organization process in open-source software: An empirical study", *Information and Software Technology,* 50(5) pp. 361-374.

Zachman, J. (1987) "A Framework for IS Architecture", IBM Systems Journal, 26(3), pp. 276-292.

Zeitlyn, D. (2003) "Gift economies in the development of open source software: Anthropological reflections", *Research Policy,* 32(7), pp. 1287-1291.

Zhao, L and S. Elbaum (2003) "Quality assurance under the open source development model", *The Journal of Systems and Software,* 66(1), pp. 65-75.

Zhao, L. and F.P. Deek (2004) "User Collaboration in Open Source Software Development", *Electronic Markets,* 14(2), pp. 89-103.

Zhu, L., N.B. Bui, Y. Liu and I. Gorton (2007) "MDABench: Customized benchmark generation using MDA", *The Journal of Systems and Software,* 80(2), pp. 265-282.

Zucker, D.F. and D. Bulterman (2007) "Open Standard and Open Sourced SMIL for Interactivity", *Interactions,* 14(6), pp. 41-46.

Appendices

Appendix A: Pattern/Code Descriptions and Related Articles

Table A: Code Descriptions and Related Articles

Pattern	CONCEPTUAL: Articles combined under this pattern provide a descriptive account of OSS, talk about its potential and realized advantages and disadvantages, compare OSS with proprietary software, and attempt to provide categorizations and models of existing research as well as agendas to shape future research efforts.	
Code	**Description**	**Articles**
OSS DESCRIPTIVE	Articles that define and differentiate or give historical background on either the open source phenomenon in general or on one (or more) of exemplary open source applications (such as Linux Operating System).	Jordan (2009), Campbell-Kelly (2008), Cromie and Ewing (2008), Watson et al. (2008a), West and Lakhani (2008), Yalta and Lucchetti (2008), Bisson et al. (2007a), Cerri and Fuggetta (2007), Görling (2007), Fitzgerald (2006), Forge (2006), Massey (2006), Al Marzouq et al. (2005), Carver (2005), Falcioni (2005), Hill (2005), Kapor (2005), Klang (2005), Koch and Gonzalez-Barahona (2005), Lerner and Tirole (2005), Massey (2005), Alonso and Mitcham (2004), Gacek and Arief (2004), O'Donnell (2004), Baldi et al. (2003), Fuggetta (2003), Krishnamurthy (2003), von Krogh (2003), von Hippel and von Krogh (2003), Bretthauer (2002), Lerner and Tirole (2002), Benkler (2001), Cass (2001), Fitzgerald and Feller (2001), Tuomi (2001), Castelluccio (2000), Ljungberg (2000), Bezroukov (1999a), Blau (1999), Lucky (1999), O'Reilly (1999).
OSS BENEFITS / DRAWBACKS	Articles that talk about various technical and non-technical benefits or drawbacks and risks of using open source software.	Yalta and Lucchetti (2008), Ajila and Wu (2007), van Rooij (2007), May (2006), Al Marzouq et al. (2005), Bruce et al. (2005), Falcioni (2005), Kapor (2005), Ringle (2004), Hawkins (2004), Paulson et al. (2004), Spinellis and Szyperski (2004), Fuggetta (2003), Applewhite (2003), Voth (2003), Cervone (2003), Kogut and Metiu (2001), Castelluccio (2000), Lorimer et al. (2000), Bezroukov (1999a), Blau (1999).
OSS VISION / ROADMAP	Articles examining the future role and power of OSS that provide a glimpse of and/or future predictions about where OSS is heading.	Ebert (2009), Campbell-Kelly (2008), Ebert (2008), Watson et al. (2008a), Fitzgerald (2006), Forge (2006), McGowan (2005), von Krogh (2003).
OSS RESEARCH CATEGORIZATION / RESEARCH AGENDA	Articles that categorize OSR, create frameworks to organize research efforts, and/or propose research agendas/models to guide and shape future OSR.	West and Lakhani (2008), Jin et al. (2007), Scacchi (2007), von Krogh and von Hippel (2006), Niederman et al. (2006a,b), Nelson et al. (2006), Crowston (2005), Koch and Gonzalez-Barahona (2005), Krishnamurthy (2005), Lerner and Tirole (2005), Lin (2005), Rossi (2004), Ghosh (2003a), von Hippel and von Krogh (2003), Fitzgerald and Feller (2002), Fitzgerald and Feller (2001), Lerner and Tirole (2001), Feller and Fitzgerald (2000).

Table A: Code Descriptions and Related Articles		
OSS VERSUS PROPRIETARY	Articles that compare OSS with proprietary software from both process and product perspectives. Such comparisons include feature, attribute, design structure, or overall process comparisons as well as elaborations on competitive factors, risk, legal, and financial aspects. Proprietary in this sense sometimes means traditional software development practices or simply closed source.	Dedeke (2009), Lamastra (2009), Lee and Mendelson (2008), Lin (2008), Yu (2008), Aberdour (2007), Ajila and Wu (2007), Bisson et al. (2007d), Bitzer and Schröder (2007), Greco (2007), Hedgebeth (2007), Hoepman and Jacobs (2007), Jin et al. (2007), Locke and Lowe (2007), Schlesinger (2007), van Rooij (2007), Bruce et al. (2006), Casadesus-Masanell and Ghemawat (2006), Castelluccio (2006), Economides and Katsamakas (2006), Johnson (2006), Louridas (2006), MacCormack et al. (2006), Samuelson (2006), Barbrook (2005), Boulanger (2005), Bruce et al. (2005), Evans (2005), Goldsborough (2005a), Goldsborough (2005b), Kalina and Czyzycki (2005), Koch and Gonzalez-Barahona (2005), Lerner et al. (2006), Lerner and Tirole (2005), Neus and Scherf (2005), Remillard (2005), Simon (2005), Wrosch (2005), Gacek and Arief (2004), Gallaway and Kinnear (2004), Koch (2004), Messerschmitt (2004), Paulson et al. (2004), Raymond (2004), Raymond and Messerschmitt (2004), Samoladas et al. (2004), Serrano et al. (2004), Zhao and Deek (2004), Fuggetta (2003), Ghosh (2003b), Jesiek (2003), West (2003), Zhao and Elbaum (2003), Anonymous (2002), Schultz (2002b), Stone (2002), Payne (2002), Raymond (2001b), Stewart et al. (2001), Torvalds and Diamond (2001), Neumann (1999).
BUSINESS / ECONOMIC MODELS AND STRATEGIES / POLICIES FOR OSS	Articles in this category propose economic models to explain OSS, devise business models to explore how OSS can be taken advantage of, and/or talk about firm or nation level strategies and policies involving OSS.	Ågerfalk and Fitzgerald (2008), Dahlander and Magnusson (2008), Feller et al. (2008), Feller, et.al. (2008), Fosfuri et al. (2008), Haruvy et al. (2008), Hyatt (2008), Lee and Mendelson (2008), Myatt and Wallace (2008), Weekes (2008), Wesselius (2008), Ajila and Wu (2007), Bitzer and Schröder (2007), Dahlander (2007), Fei and Olson (2007), Görling (2007), Mikkonen (2007), Pykalainen (2007), Sauer (2007), Bärwolff (2006), Beckman and Hirsch (2006a), Bonaccorsi et al. (2006), Casadesus-Masanell and Ghemawat (2006),Demil and Lecocq (2006), Forge (2006), Lee (2006), West and Gallagher (2006), Witt (2006), Al Marzouq et al. (2005), Barbrook (2005), Bitzer and Schröder (2005), Capek et al. (2005), Dahlander and Magnusson (2005), Goth (2005a), Goth (2005c), Kalina and Czyzycki (2005), Lerner and Tirole (2005), Mustonen (2005), Nuvolari (2005), Perens (2005), Rossi and Bonaccorsi (2005), Saint-Paul (2005), Weber and Bussell (2005), Alonso et al. (2004), Ciffolilli (2004), Comino and Manenti (2005), Cusumano (2004), Gallaway and Kinnear (2004), Glass (2004), Grand et al. (2004), Hawkins (2004), de Laat (2004), Tuomi (2004), Wheeler (2004a), Carrasco-Muñoz (2003), Fuggetta (2003), Välimäki and Borsalino (2003), von Krogh (2003), West (2003), Lerner and Tirole (2002), Sharma et al. (2002), Lancashire (2001), Rasch (2001), Gannon (2000), Lessig (1999), Markus et al. (1999), O'Reilly (1999), Ousterhout (1999).

Table A: Code Descriptions and Related Articles		
Pattern	PERFORMANCE METRICS: This pattern groups articles that investigate quality aspects and efficiencies of OSS, performance of OSS development teams and determinants of success for OSS projects.	
Code	**Description**	**Articles**
SOFTWARE QUALITY	This category covers studies on various aspects of software quality including performance, reliability, adaptability, flexibility, maintainability, usability, and functionality. While some articles investigate potential relationships between development process, methodology and ideology, and quality, others look at how quality factors are linked to OSS adoption and utilization. Key components of high quality OSS delivery are assessed and quality of OSS applications are compared to those of proprietary applications on different levels. Some articles talk about OSS quality tools in general.	Dedeke (2009), Li et al. (2009), Tsantalis and Chatzigeorgiou (2009), Ayewah et al. (2008), Capra et al. (2008), Del Grosso et al. (2008), Koch and Neumann (2008), Sohn and Mok (2008), Wray and Mathieu (2008), Aberdour (2007), Ajila and Wu (2007), Cetin and Gokturk (2007), Falzone et al. (2007), Higo et al. (2007), Koru and Liu (2007), Muller-Prove (2007), Oh and Jeon (2007), Sampson (2007), Sen (2007), Wheeler (2007), Duguid (2006), Forge (2006), Goh (2006), O'Hanlon (2006), Stewart and Gosain (2006), Turnu et al. (2006), Yu et al. (2006), Alpern et al. (2005), Chan et al. (2005), Edelsohn et al. (2005), Falcioni (2005), Goldsborough (2005a), Gyimothy (2005), Koru and Tian (2005), Lerner and Tirole (2005), Tsantalis et al. (2005), Uchida et al. (2005), Wrosch (2005), Glance (2004), Lussier (2004), Messerschmitt (2004), Norris (2004), Paulson et al. (2004), Raymond (2004), Raymond and Messerschmitt (2004), Ruffin and Ebert (2004), Samoladas et al. (2004), Yu et al. (2004), Bayrak and Davis (2003), Fuggetta (2003), Nichols and Twidale (2003), Zhao and Elbaum (2003), Stamelos et al. (2002), Jørgensen (2001), Castelluccio (2000), Neumann (1999).
SOFTWARE QUALITY - TESTING and BUG FIXES	Articles in this category represent a subset of software quality. Specifically, studies in this category focus on defect handling and bug fixing processes within OSS teams. Some articles focus on performance (defined as the ratio of submitted bugs to resolved ones) whereas some others zoom in on the bug fixing process and practices as an indication of underlying social patterns or as a surrogate for organizational learning. OSS bug tracking tools are evaluated against proprietary ones.	Au et al. (2009), Ayewah et al. (2008), Crowston and Scozzi (2008), Kidane and Gloor (2007), Long and Siau (2007), Nizovtsev and Thursby (2007), Louridas (2006), Falcioni (2005), Gyimothy et al. (2005), Louridas (2005), Remillard (2005), Glance (2004), Koru and Tian (2004), Huntley (2003), Bollinger et al. (1999), McConnell (1999).

Table A: Code Descriptions and Related Articles		
SOFTWARE QUALITY - OSS SECURITY	Articles in this category represent a subset of software quality with a particular focus on security. The dilemma surrounding public disclosure of vulnerabilities is discussed and the security of OSS applications is evaluated and compared with that of proprietary systems. The rationale for OSS use in security appliances is elaborated on.	Masri and Podgurski (2008), Hoepman and Jacobs (2007), Nizovtsev and Thursby (2007), Boulanger (2005), Ye et al. (2005), Pashalidis and Fleury (2004), Hansen et al. (2002), Payne (2002), Swift (2001).
SOFTWARE DEVELOPMENT - OSS CODE EFFICIENCIES	Articles in this category evaluate the efficiencies of open source creation and provide comparisons of structure and relative performance of OSS and proprietary projects. While this category is inextricably linked to overall quality, it only covers certain aspects of quality such as maintainability.	Tsantalis and Chatzigeorgiou (2009), Haefliger et al. (2008), Koch (2008), Wray and Mathieu (2008), Aberdour (2007), Ajila and Wu (2007), Falzone et al. (2007), Higo et al. (2007), Koru and Liu (2007), Obrenovic and Gasevic (2007), Zhu et al. (2007), Baldwin and Clark (2006), MacCormack et al. (2006), Stewart and Gosain (2006), Turnu et al. (2006), Yu et al. (2006), Chan et al. (2005), Edelsohn et al. (2005), Koru and Tian (2005), Tsantalis et.al. (2005), Uchida et al. (2005), Angster (2004), Koch (2004), Lussier (2004), Madanmohan and De (2004), Samoladas et al. (2004), Ciffolilli (2003), von Krogh et al. (2003), Bollinger et al. (1999).
DEVELOPMENT TEAM PERFORMANCE	Articles investigating factors that may affect developer performance, productivity, and creativity, and contribute to the success of OSS projects. Relationships between the various project characteristics and team performance are explored.	Au et al. (2009), Hossain and Zhu (2009), Koch (2008), Comino et al. (2007), Fershtman and Gandal (2007), Crowston et al. (2007a), Kidane and Gloor (2007), Long and Siau (2007), Roberts et al. (2006), Stewart and Gossain (2006), Koch (2004), von Krogh et al. (2003), Newby et al. (2003), Koch and Schneider (2002).
OSS SUCCESS	Studies in this category investigate one or many determinants of OSS success and the relationships among them. Various definitions of success as well as factors contributing to the success of OSS projects are evaluated. Aspects of OSS projects that are considered as successful are looked at.	Beecher et al. (2009), Lee et al. (2009), Méndez-Durón and García (2009), Subramaniam et al. (2009), Crowston and Scozzi (2008), Frank (2008), Sohn and Mok (2008), Bayersdorfer (2007), Comino et al. (2007), Schweik and English (2007), Grewal et al. (2006), Stewart and Gosain (2006), Stewart et al. (2006).
Pattern	LEGAL AND REGULATORY: This pattern hosts articles that talk about licensing of OSS	

Table A: Code Descriptions and Related Articles		
	applications, intellectual property rights and implications, various legal issues, and the importance/implications of standardization and regulation.	
Code	**Description**	**Articles**
OSS LICENSING	Articles in this category investigate and compare various OSS license types, their terms and risks, as well as determinants of license selection. The potential impacts of license choice on development activity and on the success of the OSS project are considered. Steps that can be taken to ensure license compliance and related infringement risks are deliberated. Whether OSS type licensing can be extended into other areas of technology is discussed.	Cheliotis (2009), Colazo and Fang (2009), Subramaniam et al. (2009), Acello (2008), Anonymous (2008), Chumney and Zhou (2008), Kuehnel (2008), Meeker (2008), Tsai (2008), Bayersdorfer (2007), Burk (2007), Comino et al. (2007), Fershtman and Gandal (2007), Hedgebeth (2007), McGhee (2007), Nolan-Stevaux (2007), Osterloh and Rota (2007), Schlesinger (2007), Beckman and Hirsch (2006a), Bonaccorsi et al. (2006), Demil and Lecocq (2006), Determann (2006), Fayle (2006), Gambardella and Hall (2006), Kubelka and Fawcett (2006), Nelson et al. (2006), Stewart et al. (2006), Al Marzouq et al. (2005), Alpern et al. (2005), Carver (2005), de Laat (2005), Gandel and Wheeler (2005), Gutsche (2005), Kalina and Czyzycki (2005), Lerner (2005), Lerner and Tirole (2005), McGowan (2005), Omar (2005), Wacha (2005), Madanmohan and De (2004), Ringle (2004), Ruffin and Ebert (2004), Ghosh (2003b), Schweik (2003), Välimäki and Borsalino (2003), von Krogh (2003), Bretthauer (2002), Lerner and Tirole (2002), Newmarch (2001), Wang and Wang (2001), Markus et al. (2000), O'Reilly (1999).
OSS INTELLECTUAL PROPERTY RIGHTS	Articles in this category focus on intellectual property rights and issues concerning OSS. Patents, trademarks, copyright, as well as ideological and ethical aspects are considered. The relationship between intellectual property rights and OSS commercialization, intellectual property regimes and quality/stability of OSS, and intellectual property rights and affordability are explored. Potential impact and effects of intellectual property protection on the strength and direction of innovation are investigated.	Carillo and Okoli (2008), Chumney and Zhou (2008), Fosfuri et al. (2008), Potenza and Chang (2008), Biagioli (2007), Burk (2007), Filby (2007), Greco (2007), Knieps and Vogelsang (2007), McGowan et al. (2007), Nolan-Stevaux (2007), Osterloh and Rota (2007), Berry and Moss (2006b), Cook and Horobin (2006), Determann (2006), Duguid (2006), Fayle (2006), Henkel (2006), Kubelka and Fawcett (2006), LaMarca (2006), May (2006), Pisano (2006), Samuelson (2006), Srinivas (2006), Barbrook (2005), de Laat (2005), Evans (2005), Freedman (2005), Graham and Mowery (2005), Kipp (2005), Lerner and Tirole (2005), McGowan (2005), McLaughlin (2005), Millar et al. (2005), Omar (2005), Saint-Paul (2005), Satchwell (2005), Savirimuthu (2005), Shen (2005), Tuomi (2005), Weber and Bussell (2005), Willinsky (2005b), Berry (2004), Ciffolilli (2004), Coleman (2004), Gallaway and Kinnear (2004), Saltzman (2004), Schmidt (2004), Vemuri and Bertone (2004), Geppert (2003), Kahin (2003), O'Mahony (2003), von Krogh (2003), Schultz (2002b), Schultz (2002c), Newmarch (2001), Rasch (2001).

Table A: Code Descriptions and Related Articles		
OSS LEGAL ISSUES	Articles assessing legal issues and risks/uncertainties concerning OSS. Legal and ideological views on open source ownership are debated and legal enforceability of OSS terms and licenses are discussed. The need for existing law to extend beyond tangible property to virtual reality is voiced.	Anonymous (2008), Banerjee et al. (2008), Chumney and Zhou (2008), Potenza and Chang (2008), Tsai (2008), Burk (2007), Coyle (2007), Filby (2007), McGhee (2007), McGowan et al. (2007), Nolan-Stevaux (2007), Determann (2006), Fayle (2006), Freedman (2005), Lerner and Tirole (2005), McLaughlin (2005), Omar (2005), Wacha (2005), Berry (2004), David (2004), Ruffin and Ebert (2004), Saltzman (2004), Vemuri and Bertone (2004), Geppert (2003), Ghosh (2003b), Välimäki and Borsalino (2003), Schultz (2002b).
OSS STANDARDS AND REGULATION	Articles about OSS standards and regulation. The differences between open standards and OSS are highlighted. The links between open standards and agility and OSS and regulation are investigated. The potential effects of standards on community evolution and OSS diffusion are looked at.	Calero et al. (2009), Dorman (2008), Ebert (2008), Mateos-Garcia and Steinmueller (2008), Cerri and Fuggetta (2007), Coyle (2007), Locke and Lowe (2007), Zucker and Bulterman (2007), Fox (2006), Guha et al. (2006), Kubelka and Fawcett (2006), Sitas (2006), Weinstein (2006), Comino and Manenti (2005), Morgan (2005), Shen (2005), Simon (2005), Smith (2005), Wüstner et al. (2005), Egyedi and de Joode (2004), Jarvenpaa et al. (2003), Coyle (2002), Wagner (2002), Lessig (1999).
Pattern	OSS PRODUCTION: This pattern groups articles that address various aspects of the production of OSS applications. It covers a number of input related topics such as developer motivations and team formation, process topics such as the development process itself, and governance, as well as a few output related topics such as learning and community evolution.	
Code	**Description**	**Articles**
PROCESS	This category covers articles that examine the process of OSS development. Various elements of the development process that range from OSS methodology and design structures to OSS architectures and work practices are assessed. Methods for determining developer responsibilities, self-organization of work, and a number of techniques (agile practices, extreme programming etc.) are investigated. The potential effects of process characteristics on product quality are addressed.	Carillo and Okoli (2008), Elliott and Scacchi (2008), Koch and Neumann (2008), Crowston et al. (2007b), Dueñas et al. (2007), Dykstra-Erickson and Cheri (2007), Goth (2007), Görling (2007), Hagan et al. (2007), Koru and Liu (2007), Locke and Lowe (2007), Martin and Hoffman (2007), Obrenovic and Gasevic (2007), Baldwin and Clark (2006), MacCormack et al. (2006), Samuelson (2006), Turnu et al. (2006), Dinh-Trong and Bieman (2005), Koch and Gonzalez-Barahona (2005), de Laat (2004), Lussier (2004), Rajlich and Gosavi (2004), Scacchi (2004), Thomas and Hunt (2004), Bayrak and Davis (2003), Glass (2003), Schweik (2003), Koch and Schneider (2002), Sharma et al. (2002), Jørgensen (2001), McConnell (1999), Bezroukov (1999b), Bollinger et al. (1999).

Table A: Code Descriptions and Related Articles		
COMMUNITIES	Articles that look at the definitions of the community construct as well as the underlying social, cultural, and economic elements of OSS communities. Sponsored and autonomous communities are differentiated and their norms, value systems, and common practices are investigated. Community governance structures as well as coordination practices are assessed. The effect of community portals on collaboration and the relationship between communities and commercial firms are looked at.	Krishnamurthy and Tripathi (2009), Carillo and Okoli (2008), Crowston and Scozzi (2008), De Paoli et al. (2008), Elliott and Scacchi (2008), Mateos-Garcia and Steinmueller (2008), West and Lakhani (2008), West and O'Mahony (2008), Benoit-Barne (2007), Comino et al. (2007), Dueñas et al. (2007), Görling (2007), Kidane and Gloor (2007), Mikkonen et al. (2007), Muller-Prove (2007), O'Mahony (2007), O'Mahony and Ferraro (2007), Vaisman (2007), Bagozzi and Dholakia (2006), Dahlander and Wallin (2006), Grewal et al. (2006), Hemetsberger and Reinhardt (2006), Roberts et al. (2006), Valverde et al. (2006), Voth and Lanir (2006), Yu et al. (2006), Bitzer and Schröder (2005), Choi et al. (2005), Gandel and Wheeler (2005), Gutsche (2005), Hemetsberger (2005), Iannacci and Mitleton–Kelly (2005), Millar et al. (2005), Lehmann (2004), O'Donnell (2004), Scacchi (2004), Shimizu et al. (2004), Thomas and Hunt (2004), Tuomi (2004), Glass (2003), Gosain (2003), von Krogh et al. (2003), Dempsey et al. (2002), Koch and Schneider (2002), Sharma et al. (2002), Bergquist and Ljungberg (2001), Kogut and Metiu (2001), Tuomi (2001).
TEAM FORMATION	Articles examining the formation of OSS teams and how individuals make decisions about what teams to join. Strategies and processes by which new people join are evaluated and interactions between team members are investigated. Studies looking at the geographical location or network embeddedness of developers involved in OSS projects are also included in this category.	Carillo and Okoli (2008), Gonzalez-Barahona (2008), Hahn et al. (2008), Crowston et al. (2007b), Oh and Jeon (2007), Vaisman (2007), Grewal et al. (2006), Roberts et al. (2006), Valverde et al. (2006), Lehmann (2004), Shimizu et al. (2004), von Krogh et al. (2003), Lancashire (2001).
GOVERNANCE	Studies in this category look at how communities producing collective goods govern themselves. Various definitions of governance are investigated and dimensions and types of governance are categorized. Community hierarchies, conflict management, and decision making mechanisms are examined.	Capra et al. (2008), De Paoli et al. (2008), Mateos-Garcia and Steinmueller (2008), Sadowski et al. (2008), de Laat (2007), Dykstra-Erickson and Cheri (2007),Hagan et al. (2007), Hertel (2007), Jørgensen (2007), Locke and Lowe (2007), Markus (2007), O'Mahony (2007), O'Mahony and Ferraro (2007), Picci (2007), Schweik and English (2007), Demil and Lecocq (2006), Gambardella and Hall (2006), Shah (2006), Valverde et al. (2006), Iannacci and Mitleton–Kelly (2005), Lerner (2005), de Joode (2004), Egyedi and de Joode (2004), Lehmann (2004), Bonaccorsi and Rossi (2003), Ciffolilli (2003), Franck and Jungwirth (2003), Glass (2003), O'Mahony (2003), Lerner and Tirole (2002), Sharma et al. (2002), Gallivan (2001), Markus et al. (2000), Fielding (1999).

Table A: Code Descriptions and Related Articles		
TEAM / PROJECT LEADERSHIP	Articles that investigate individual and project-level factors leading to the emergence of project leaders among OSS community participants. Studies that talk about the link between skills of OSS leaders and its influence on OSS success are also included in this group.	Sarker and Schneider (2009), Frank (2008), Giuri et al. (2008), O'Mahony and Ferraro (2007), Jones and Mitnick (2006), Lerner and Tirole (2002), Lerner and Tirole (2001), Torvalds, and Diamond (2001), Edwards (2000).
INDIVIDUAL AND TEAM LEARNING	Articles in this category are concerned with individual and collective learning practices in OSS projects. Factors affecting learning process and adaptive learning mechanisms are investigated.	Au et al. (2009), Hemetsberger and Reinhardt (2006), Valverde et al. (2006), Cornford et al. (2005), Huntley (2003), Lakhani and von Hippel (2003).
INNOVATION	Articles that examine the properties of OSS mode of distributed innovation and look at the role of communities in creating, shaping, and disseminating innovations. The process of OSS innovation is explored and the role of online networking in the innovation process is investigated.	David and Rullani (2008), Haefliger et al. (2008), Vujovic and Ulhøi (2008), West and Lakhani (2008), Bisson et al. (2007b), Bitzer and Schröder (2007), Ebert (2007), Hicks and Pachamanova (2007), Henkel (2006), Samuelson (2006), Colyer and Clement (2005), Hill (2005), Lin (2004), Jesiek (2003), von Hippel and von Krogh (2003), von Krogh (2003), von Krogh et al. (2003), Kogut and Metiu (2001), O'Reilly (1999).
ROLE OF VOLUNTEER USERS / DEVELOPERS	Studies in this category examine the role of volunteer users and developers in OSS development and analyze the relationship between different actors in OSS production. Both the determinants and results of volunteer involvement in OSS projects are investigated.	Iivari (2009), Xu et al. (2009), Koch (2008), Benoit-Barne (2007), Comino et al. (2007), Dykstra-Erickson and Cheri (2007), Fershtman and Gandal (2007), Bitzer and Schröder (2005), Sexton et al. (2004a), Sexton et al. (2004b), Zhao and Deek (2004), Dempsey et al. (2002), Glass (2000).

Table A: Code Descriptions and Related Articles		
COLLABORATION AND KNOWLEDGE SHARING	This category looks at collaboration and its role in creation and dissemination of knowledge. Knowledge-sharing activities in OSS communities are compared with those at traditional organizations, and potential benefits of OSS style collaboration in organizations are discussed. Articles investigating the task assignment and work allocation mechanisms in collaborative efforts and ones assessing factors affecting collaboration are included in this category.	Hossain and Zhu (2009), Kurtz (2009), den Besten et al. (2008), Haefliger et al. (2008), Langlois and Garzarelli (2008), Sowe et al. (2008), Vujovic and Ulhøi (2008), Benoit-Barne (2007), Crowston et al. (2007a), Crowston et al. (2007b), Dykstra-Erickson and Cheri (2007), Endres et al. (2007), Goth (2007), Kidane and Gloor (2007), Long and Siau (2007), Oh and Jeon (2007), Schlesinger (2007), Coffin (2006), Johnson (2006), Jones and Mitnick (2006), Kuk (2006), Gambardella and Hall (2006), Valverde et.al. (2006), Voth and Lanir (2006), Grewal et al. (2006), Kawaguchi et al. (2006), Hemetsberger and Reinhardt (2006), Colyer and Clement (2005), Cornford et al. (2005), Neus and Scherf (2005), Angster (2004), Lehmann (2004), Lin (2004), Zhao and Deek (2004), Gosain (2003), von Krogh et al. (2003), Lucky (1999).
USER AND DEVELOPER MOTIVATIONS	Articles in this group investigate the dynamics that affect the motivation of participants in OSS communities. Intrinsic and extrinsic motivations including personal attributes, attitudes, behavioral patterns, and job related factors and how they affect individual developers' selections of projects/project preferences are evaluated. Implications for commercial firms are discussed.	Brabham (2008), Carillo and Okoli (2008), David and Shapiro (2008), Elliott and Scacchi (2008), Hahn et al. (2008), Orman (2008), Subramanyam and Xia (2008), Bitzer et al. (2007), Fershtman and Gandal (2007), Hertel (2007), Luthiger and Jungwirth (2007), Okoli and Oh (2007), Sauer (2007), Sen (2007), Wu et al. (2007), Bagozzi and Dholakia (2006), Baldwin and Clark (2006), Roberts et al. (2006), Shah (2006), Stewart et.al. (2006), Bitzer and Schröder (2005), Dahlander and Mckelvey (2005), Iannacci and Mitleton–Kelly (2005), Lerner and Tirole (2005), Millar et al. (2005), Bonaccorsi and Rossi (2004), Shimizu et al. (2004), Thomas and Hunt (2004), Zhao and Deek (2004), Bonaccorsi and Rossi (2003), Cedergren (2003), Ciffolilli (2003), Hertel et al. (2003), von Hippel and von Krogh (2003), von Krogh (2003), Zeitlyn (2003), Lerner and Tirole (2002), Bergquist and Ljungberg (2001), Lerner and Tirole (2001), Glass (2000), Markus et al. (2000), Lucky (1999).
ROLE OF COMMERCIAL CORPORATIONS	Articles focusing on corporations' motivations to engage in open source development endeavors. Firm efforts in commercialization of OSS as well as indirect effects on emergence of OSS projects are assessed. Various scenarios of firm participation including sponsored communities as well as code donations are discussed. Potential link between organizational sponsorship and OSS success is investigated.	Santos Jr. (2008), Dahlander (2007), O'Mahony (2007), Sen (2007), Dahlander and Wallin (2006), Gruber and Henkel (2006), Henkel (2006), Johnson (2006), Lerner et al. (2006), Samuelson (2006), Stewart et al. (2006), Voth and Lanir (2006), Capek et al. (2005), Dahlander and Magnusson (2005), Dahlander and Mckelvey (2005), Edelsohn et al. (2005), Hess (2005), Lerner and Tirole (2005), Mustonen (2005), Rossi and Bonaccorsi (2005), Bonaccorsi and Rossi (2004), Cusumano (2004), de Joode (2004), Grand et al. (2004), Hawkins (2004), de Laat (2004), Lerner and Tirole (2002), Goth (2001), Lerner and Tirole (2001), Torvalds and Diamond (2001), Ousterhout (1999).

Table A: Code Descriptions and Related Articles		
SOFTWARE DEVELOPMENT - USE OF OSS COMPONENTS	Studies focusing on components-based development, code reuse, and modularity. Some of these articles assess potential effects of OSS component reuse on software development economics. Modularity comparisons between OSS and proprietary software as well as module quality evaluations among OSS applications are also provided.	Li et al. (2009), Haefliger et al. (2008), Ajila and Wu (2007), Falzone et al. (2007), Fei and Olson (2007), Higo et al. (2007), Obrenovic and Gasevic (2007), Zhu et al. (2007), Baldwin and Clark (2006), MacCormack et al. (2006), O'Hanlon (2006), Rzepa et al. (2006), Bruce et al. (2005), Guy (2005), Koru and Tian (2005), Cusumano (2004), de Laat (2004), Madanmohan and De (2004), Norris (2004), von Krogh et al. (2003), Bollinger et al. (1999).
OSS PRODUCTION - ROLE OF LICENSING AND IP	These studies look at the relationship between characteristics of OSS licenses/intellectual property rights and levels of project participation, developer activity, and project progress.	Colazo and Fang (2009), De Paoli et al. (2008), Comino et al. (2007), Fershtman and Gandal (2007), Vaisman (2007), Gambardella and Hall (2006), Henkel (2006), Stewart et al. (2006), Gandel and Wheeler (2005), Lerner (2005), Satchwell (2005), Shimizu et al. (2004).
SELF-ORGANIZATION (PRODUCT AND COMMUNITY EVOLUTION)	Articles in this category examine the self-organization process of OSS, its effects on product and community evolution and how it is different from that of proprietary systems.	Elliott and Scacchi (2008), Yu (2008), Crowston et al. (2007a), Crowston et al. (2007b), Jones and Mitnick (2006), Murphy et al. (2006), Stephenson (2006), Valverde et al. (2006), Gruber et.al. (2005), Gutsche (2005), Hess (2005), Koru and Tian (2005), Egyedi and de Joode (2004), Koch (2004), de Laat (2004), Rajlich and Gosavi (2004), Glass (2003), Lee and Davis (2003), Dempsey et al. (2002), Tuomi (2001).
Pattern	OSS APPLICATIONS: This pattern hosts a bundle of articles that focus on area or discipline specific OSS applications.	
Code	**Description**	**Articles**
TELECOMMUNICATIONS – NETWORKING AND ARCHITECTURE	Articles focusing on OSS applications for the telecommunications industry, wireless technologies, networking, and systems architecture/infrastructure.	Petracca et al (2009), Thilmany (2009), Feher and Sondag (2008), Troxel et al. (2008), Sondag and Feher (2007), Chan et al. (2005), Vassis et al. (2005), Bruce et al. (2005), Thilmany (2005), Marchesin (2004), Pashalidis and Fleury (2004).

Table A: Code Descriptions and Related Articles		
EDUCATION	Articles focusing on OSS applications for education such as course management and administrative systems, integrated learning environments, open access learning repositories, and financial systems for educational institutions.	Schweik et al. (2009), Thierstein (2009), van Rooij (2009), Whitehurst (2009), Ellaway et al. (2008), Ellaway and Martin (2008), Luyt (2008), Pfaffman (2008), Watson et al. (2008b), Weekes (2008), Hewson (2007), Lunsford II (2007), Pfaffman (2007), Szulik (2007), van Rooij (2007), Wheeler (2007), Bennett and Watson (2006), Bisson (2006), Haughwout (2006), Perkins and Pfaffman (2006), Reas and Fry (2006), Snyder Jr. and Qaissaunee (2006), Stephenson (2006), Currie (2005), Gandel and Wheeler (2005), Skiba (2005), Angster (2004), Glance et al. (2004), Hepburn (2004), Ringle (2004), Serrano et al. (2004), Wheeler (2004a), Wheeler (2004b), Roach (2003), Moore (2002), Racine and Hyndman (2002), Kumar et al. (2001).
LIBRARIES, ARCHIVES, DATABASES, AND REPOSITORIES	Articles focusing on OSS applications for libraries, online archives, and repositories. Known OSS database applications are evaluated and their pros and cons in relation to proprietary alternatives are discussed.	Houser (2009a), Houser (2009b), Houser (2009c), Houser (2009d), Riehle et.al. (2009), Bowen (2008), Breeding (2008a), Breeding (2008b), Breeding (2008c), Breeding (2008d), Dorman (2008), Hyatt (2008), Lougee-Heimer (2008), Bisson et al. (2007b), Bisson et al. (2007c), Bisson et al. (2007d), Coyle (2007), Han and Rawan (2007), Laxminarsaiah and Rajgoli (2007), Lougee-Heimer (2007), Fox (2006), Goh et al. (2006), Kawaguchi et al. (2006), Lougee-Heimer (2006), MacPherson (2006), Pomerantz and Stutzman (2006), Sitas (2006), Voth and Lanir (2006), Witten (2006), Bieber and Schweibenz (2005), Chudnov et al. (2005), Cornford et al. (2005), Di Giacomo (2005), Hassler (2005), Lougee-Heimer (2005), Mah and Stranack (2005), Morgan (2005), Muir (2005), Reiner and Smith (2005), Smith (2005), Willinsky (2005a), Wrosch(2005), Mitchell et al. (2004), Overbeek et al. (2004), Sexton et al. (2004a), Sexton et.al. (2004b), Anonymous (2003), Cervone (2003), Lougee-Heimer (2003), Breeding (2002), Coyle (2002), Highsmith et al. (2002), Morgan (2002), Wagner (2002), Jones (2001), Witten et al. (2001).
CONTENT, INFORMATION AND KNOWLEDGE MANAGEMENT SYSTEMS	Articles focusing on OSS applications for web content or corporate information and knowledge management systems.	Feller et al. (2008), Mooney and Baenziger (2008), Aldous and Lintott (2007), Bisson et al. (2007d), Hedgebeth (2007), Laxminarsaiah and Rajgoli (2007), Lunsford II (2007), Maxwell (2007), Jones and Mitnick (2006), MacPherson (2006), Pomerantz and Stutzman (2006), Rzepa et al. (2006), Wagner (2006), Witten (2006), Becking et al. (2005), Bieber and Schweibenz (2005), Di Giacomo (2005), Donnellan et al. (2005), Guy (2005), Hassler (2005), Mah and Stranack (2005), Raisinghani (2005), Schulte-Mecklenbeck and Neun (2005), Smith (2005), Souzis (2005), Willinsky (2005a), Yan et al. (2005), Fitzgerald and Kenny (2004), Ciffolilli (2003), von Krogh et al. (2003), Jones (2001), Witten et al. (2001).

Table A: Code Descriptions and Related Articles		
IMAGING, PLOTTING AND VISUAL	Articles focusing on OSS applications for graphical manipulation, visual imaging and plotting.	Filippov and Nicklaus (2009), Nelson et al. (2008), Voßkühler et al. (2008), Bisson et al. (2007d), Scheer (2007), Smith (2007), Xi et al. (2007), Racine (2006), Bieber and Schweibenz (2005), Yoo and Ackerman (2005).
SECURITY AND CYBERCRIME	Articles focusing on OSS applications for computer/online security. The threat of cybercrime is discussed.	Calero et al. (2009), Thomas et al. (2009), Lin et al. (2008), Wray and Mathieu (2008), Coyle (2007), Jones (2007), Pashalidis and Fleury (2004), Swift (2001).
SUPPLY CHAIN MANAGEMENT AND OPTIMIZATION	Articles focusing on OSS applications for corporate supply chain management such as OSS enterprise resource planning and customer relationship management systems, electronic data interchange and operational planning and optimization applications.	Christou and Ponis (2009), Brydon and Vining (2008), Aldous and Lintott (2007), Fei and Olson (2007), Bruce et al. (2006), Serrano and Sarriegi (2006), Nau et al. (2005), Wüstner et al. (2005), Curtis and Funderburg (2003).
DESKTOP AND SERVER OPERATING SYSTEMS	Articles focusing on OSS desktop and server operating systems or OSS components for those systems. Known and widely used OSS operating systems such as Linux and FreeBSD (or various distributions of such systems) are evaluated in different contexts that tie to other research categories.	Houser (2009a), Niemi et al. (2009), Tsakalozos et al. (2009), Weiss (2008), Jørgensen (2007), van Horn (2007), Bagozzi and Dholakia (2006), Casadesus-Masanell and Ghemawat (2006), Castelluccio (2006), Dera (2006), Hemetsberger and Reinhardt (2006), West and Dedrick (2006), Yu et al. (2006), Appavoo et al. (2005), Cornford et al. (2005), Dinh-Trong and Bieman (2005), Iannacci and Mitleton–Kelly (2005), Fitzgerald and Kenny (2004), Marchesin (2004), Mauri (2004), Thilmany (2004), Yu et al. (2004), Roach (2003), Bretthauer (2002), Raymond (2001b), Tuomi (2001), Castelluccio (2000).

Table A: Code Descriptions and Related Articles		
GAMING AND SIMULATIONS	Articles focusing on OSS applications for computer gaming and simulations.	Flaten and Gill (2008), Waldo (2008), Ampatzoglou and Chatzigeorgiou (2007), Vassis et al. (2005), Scacchi (2004).
SOFTWARE DEVELOPMENT AND ENGINEERING	Articles focusing on OSS applications for the software development and engineering industry, such as various open source programming, scripting, modeling, and markup languages; website/application development and personalization; object oriented software; integrated development environments, and virtualization and cluster computing.	Bellifemine et al. (2008), Forte (2008), Hassler (2008), Sen et al. (2008), Ampatzoglou and Chatzigeorgiou (2007), Goth (2007), Goth and Costlow (2007), Li and Shatnawi (2007), Louridas (2007), Xing and Stroulia (2007), Yang and Jiang (2007), Zucker and Bulterman (2007), Bennett and Watson (2006), Fox (2006), Murphy et al. (2006), Reas and Fry (2006), Alpern et al. (2005), Carletta et al. (2005), Colyer and Clement (2005), Donnellan et al. (2005), Edelsohn et al. (2005), Goth (2005b), Gruber et al. (2005), Gyimothy et al. (2005), Harrison et al. (2005), Louridas (2005), Morgan (2005), Tsantalis et al. (2005), Hrastnik (2004), Papadopoulos et al. (2004), Rajlich and Gosavi (2004), Yan et al. (2004), Cullen (2002), Cribari-Neto et al. (1999).
ACADEMIC AND COMMERCIAL RESEARCH	Articles focusing on OSS applications that help researchers organize and share digital information for research purposes such as: • OSS citation document and webpage management software, • Collaborative OSS tools that help develop new research approaches such as OSS social computing applications that would allow the creation of new research communities, and • OSS data gathering and analysis tools for both qualitative and quantitative research.	Anonymous (2008), Cooke and Buckley (2008), Lougee-Heimer (2008), Lougee-Heimer (2007), Maxwell (2007), Rademacher and Lippke (2007), Azoulay et al. (2006), Fox (2006), Lougee-Heimer (2006), Weinstein (2006), Alpern et al. (2005), Chudnov et al. (2005), Di Giacomo (2005), Lougee-Heimer (2005), Schulte-Mecklenbeck and Neun (2005), Willinsky (2005a), Bleasby (2004), Lougee-Heimer (2003), Racine and Hyndman (2002), Malakoff (2001), Lorimer et al. (2000), Cribari-Neto et al. (1999).

Table A: Code Descriptions and Related Articles		
BIOMEDICAL AND HEALTH SCIENCES	Articles focusing on OSS applications for biomedical and health sciences research and practice. Such applications range from large infrastructural applications to exchange biomedical information to smaller scale informatics tools that allow handling of large biomedical datasets such as genome databases, analyze complex data, or allow collaboration among biomedical and health researchers and practitioners.	Mooney and Baenziger (2008), Stanford and Mikula (2008), Alvord et al. (2007), Feigenbaum et al. (2007), Greco (2007), Nolan-Stevaux (2007), Spudich et al. (2007), Xi et al. (2007), Dera (2006), Field et al. (2006), Pestian et al. (2006), Smith et al. (2006), Srinivas (2006), Stajich and Lapp (2006), Isken (2005), Skiba (2005), Yoo and Ackerman (2005), Bleasby (2004), David (2004), Fitzgerald and Kenny (2004), Overbeek et al. (2004), Whitfield (2003), Matthiesen (2002), Malakoff (2001), Stewart et al. (2001).
BUSINESS, PROFESSIONAL AND SOCIAL SCIENCES	Articles focusing on OSS applications for business, professional, or other social sciences, such as project, business process management and business intelligence tools, accounting, statistics, and economics applications.	von Wangenheim (2009), Fleisher (2008), Ghalimi (2008), Tribunella and Baroody (2008), Yalta and Lucchetti (2008), Hrastnik (2004), Rechtman (2004), Racine and Hyndman (2002), Cribari-Neto et al. (1999).
NATURAL SCIENCES	Articles focusing on OSS applications for natural sciences such as chemistry, physics, GIS, astronomy, and environmental sciences.	Rey (2009), Schweik et al. (2009), Benton et al. (2008), Buliung and Remmel (2008), Hand (2008), Sykora and Leahy (2008), Guha et al. (2006), Rzepa et al. (2006), Ramli et al. (2005), Anselin et al. (2004).
PUBLIC SECTOR AND E-GOVERNMENT	Articles focusing on OSS applications for the public and the non-profit sector as well as specific tools and applications for e-Government.	Anderson (2008), Benoit-Barne (2007), Vaisman (2007), Berry and Moss (2006a), Cook and Horobin (2006), Kavanagh (2006), Waring and Maddocks (2005), David (2004), Chadwick (2003).
Pattern	OSS DIFFUSION: Articles in this pattern focus mainly on the technology outputs of OSS development process and address various aspects of OSS adoption and implementation.	
Code	**Description**	**Articles**
OSS ADOPTION - GENERAL	Articles in this category explore key drivers of OSS adoption as well as user characteristics. Adoption and diffusion models are investigated and illustrated through case studies.	van Rooij (2009), Brydon and Vining (2008), Castelluccio (2008), Lee and Mendelson (2008), Pykalainen (2008), Ven and Mannaert (2008), Jin et al. (2007), May (2006), Choi et al. (2005), Dahlander and Mckelvey (2005), Goth (2005b), Applewhite (2003), Bonaccorsi and Rossi (2003), Ghosh (2003b), Roach (2003), Voth (2003).

Table A: Code Descriptions and Related Articles

OSS ADOPTION - BARRIERS	Studies in this category explore barriers to OSS and reasons for rejection. Strategies employed by commercial firms against the perceived threat of OSS are also covered.	Huysmans et al. (2008), Lee and Mendelson (2008), Pfaffman (2008), Hedgebeth (2007), van Rooij (2007), West and Dedrick (2006), Goldsborough (2005a), Goode (2005), Levesque (2004), Schultz (2002a), Schultz (2002c), Raymond (2001b), Wang and Wang (2001).
OSS ADOPTION - DECISION FACTORS	Articles that evaluate key factors in open source software adoption decisions and investigating when, how, and why barriers to adoption are overcome.	Cromie and Ewing (2009), Cassell (2008), Lin (2008), Sohn and Mok (2008), Ven et al. (2008), Scheer (2007), Kubelka and Fawcett (2006), May (2006), Miralles et al. (2006), West and Dedrick (2006), Yu et al. (2006), Glance et al. (2004), Voth (2003), Goth (2001), Wang and Wang (2001).
OSS IMPLEMENTATION - GENERAL	Studies in this category explore implications of using open source software in a project. Implementation challenges are discussed and lessons learned listed.	Belcher and Sexton (2008), Bayersdorfer (2007), Martin and Hoffman (2007), van Rooij (2007), Beckman and Hirsch (2006b), Fitzgerald and Kenny (2004), Glance et al. (2004), Rechtman (2004), Ringle (2004), Wheeler (2004b), Bonaccorsi and Rossi (2003), Lakhani and Hippel (2003), Roach (2003), Stone (2002).
OSS IMPLEMENTATION - IMPLEMENTATION COMMUNITIES AND NETWORKS	Articles that elaborate on the importance of user support community groups both for implementation and for long-term viability of OSS. Implications for commercial firms aiming to use OSS in hybrid form are discussed. Some articles in this category investigate the role of collaborative business networks in OSS implementation. Focus on both commercial and non-profit networks are possible.	Hamel and Schweik (2009), Ven and Mannaert (2008), Feller et al. (2007), Jin et al. (2007), Sowe et al. (2006), Shah (2006), Yu et al. (2006), Hess (2005).

Table A: Code Descriptions and Related Articles		
OSS IMPLEMENTATION - GOVERNMENTS / NATIONS	Studies that explore the roles played and contributions made by governments to OSS initiatives during the implementation process. Non-profit organizations are also included in this category.	Hamel and Schweik (2009), Cassell (2008), Huysmans et al. (2008), Câmara and Fonseca (2007), Kshetri and Schiopu (2007), Cook and Horobin (2006), Lee (2006), May (2006), Comino and Manenti (2005), Goth (2005c), Lerner and Tirole (2005), Shen (2005), Simon (2005), Waring and Maddocks (2005), Alonso et al. (2004), O'Donnell (2004), Applewhite (2003), Ghosh (2003b), Voth (2003), Schultz (2002a), Schultz (2002c), Hancock (2000).
Pattern	BEYOND SOFTWARE: This important pattern groups articles that explore implications of OSS over and beyond the software development domain. In general, these categories investigate the possibility of the applicability of OSS style organization and work practices to other domains and their implications for users.	
Code	**Description**	**Articles**
OPEN PARADIGM	Studies in this category investigate how various OSS approaches can influence non-software areas. These studies look at wider socio-political effects of OSS and see OSS as a broader icon for openness and collaboration and key to understanding future forms of organizations. The primary focus is placed on benefits that can be derived from the OSS philosophy and translation of OSS approaches to corporate management that emulate OSS style and governance practices.	Balka et al. (2009), Butcher (2009), Carillo and Okoli (2008), Biagioli (2007), Nolan-Stevaux (2007), Picci (2007), Berry and Moss (2006b), Coffin (2006), Duguid (2006), Federman (2006), Haughwout (2006), Jones and Mitnick (2006), Kavanagh (2006), Witt (2006), Iannacci and Mitleton–Kelly (2005), Kipp (2005), Savirimuthu (2005), Weber and Bussell (2005), Willinsky (2005b), Coleman (2004), David (2004), Hemetsberger (2004), Chadwick (2003), Schweik (2003), Lerner and Tirole (2002), Deuze (2001), Gallivan (2001), Torvalds and Diamond (2001), Ljungberg (2000), Markus et al. (2000), Bezroukov (1999b).

Table A: Code Descriptions and Related Articles		
OPEN INNOVATION	Articles that focus on the concept of open innovation, that is, investment of resources by individuals/firms to create public goods innovations. Some studies look at costs and benefits of open innovation while others explore potential replication of this model in other industries. The main focus is on the open and distributed nature of innovation, role of communities and non-proprietary networking during the innovation process as well as its theoretical and managerial implications.	Stuermer et al. (2009), Dahlander and Magnusson (2008), Hutchinson (2008), Hyatt (2008), Pénin and Wack (2008), Stanford and Mikula (2008), Vujovic and Ulhøi (2008), West and Lakhani. (2008), de Laat (2007), Ebert (2007), Hicks and Pachamanova (2007), Knieps and Vogelsang (2007), Nolan-Stevaux (2007), Osterloh and Rota (2007), Gruber and Henkel (2006), LaMarca (2006), Pisano (2006), Srinivas (2006), West and Gallagher (2006), Falcioni (2005), Hemetsberger (2005), Nuvolari (2005), Grand et al. (2004), Holtgrewe (2004), von Hippel and von Krogh (2003), von Krogh (2003), Kogut and Metiu (2001), von Hippel (2001).
OPEN KNOWLEDGE FLOWS	Articles in this category investigate the possibility of the use of OSS style knowledge exchange in other industries and use of OSS principles for more effective knowledge acquisition and augmentation of current knowledge management practices. Some studies focus on structure exploring collaborative structures for knowledge exchange while some others track direction of knowledge flows among projects throughout social networks and consider their impact on project success or on the overall transparency of governance.	Guttikonda and Gutam (2009), Méndez-Durón and García (2009), Carillo and Okoli (2008), Stanford and Mikula (2008), Burk (2007), Câmara and Fonseca (2007), Nolan-Stevaux (2007), Coffin (2006), De Valk and Martin (2006), Haughwout (2006), Kavanagh (2006), Wagner (2006), Iannacci and Mitleton–Kelly (2005), Savirimuthu (2005), Schulte-Mecklenbeck and Neun (2005), Souzis (2005), Willinsky (2005a), Yoo and Ackerman (2005), Awazu and Desouza (2004), Berry (2004), Cedergren (2003), Stalder and Hirsh (2002), Jones (2001), Newmarch (2001), Lorimer et.al. (2000).
OPEN STANDARDS	Studies in this category assess linkages between open standards, proprietary and OSS development and argue that open source is one (but not the only) way to enforce and exploit open standards. Some articles approach open standards as a business strategy whereas some others develop a pragmatic concern for the importance of open standards for long-term access to information.	Fisher et al. (2008), Cerri and Fuggetta (2007), LaMarca (2006), Simon (2005), Smith (2005), Wüstner et al. (2005), Wheeler (2004a), Coyle (2002).

Table A: Code Descriptions and Related Articles		
OPEN EDUCATION	Articles that investigate the possibility of a new model of education based on the OSS movement. OSS is discussed as it relates to educational platforms, and efficacy of open source education software is assessed. Some articles propose the OSS model as an opportunity to revolutionize future administrative systems while some others look at known cases of open education such as MIT's OpenCourseWare.	Chumney and Zhou (2008), Luyt (2008), Watson et al. (2008b), Landsberger (2007), Currie (2005), Hepburn (2004), Wheeler (2004a), Baldi et al. (2003), Keats (2003), Moore (2002), Newmarch (2001), Werry (2001).
USER OR CO-PRODUCTION OF GOODS AND CONSUMER IMPLICATIONS	Studies in this category elaborate on how OSS changes the traditionally hierarchical power and control of producers by moving from consumer towards a co-producer perspective and its implications for producers. Evolution of corporate brands from closed to open brands are discussed.	de Laat (2007), Pitt et al. (2006), Hemetsberger (2005), Hemetsberger (2004), Cedergren (2003), von Hippel (2001).

Appendix B: Extant Categorizations of Open Source Research

Table B1: Feller and Fitzgerald (2000)	
Feller and Fitzgerald (2000) Category	Matching Categories from The Taxonomy of Open Source Research
What (Transformation): • What defines a software project as OSS? • What types of projects tend to be OSS?	OSS DESCRIPTIVE OSS LICENSING OSS APPLICATIONS – (All sub-categories)
Why (Weltanshauung/World View): • What are the technological motivations for OSS development? • What are the economic motivations for OSS development? • What are the socio-political motivations for OSS development?	SOFTWARE QUALITY SOFTWARE DEVELOPMENT – OSS CODE EFFICIENCIES OSS PRODUCTION – USER AND DEVELOPER MOTIVATIONS OSS STANDARDS AND REGULATION OSS VERSUS PROPRIETARY
When and Where (Environment): • What are the temporal dimensions of OSS development? • What are the spatial/geographic dimensions of OSS development?	OSS PRODUCTION – PROCESS OSS BENEFITS/DRAWBACKS OSS PRODUCTION – COLLABORATION AND KNOWLEDGE SHARING
How: • How is the OSS development process organized? • What tools are used to support the OSS model?	OSS PRODUCTION – PROCESS OSS PRODUCTION – GOVERNANCE OSS PRODUCTION – COMMUNITIES SOFTWARE QUALITY (all sub-categories) OSS PRODUCTION – COLLABORATION AND KNOWLEDGE SHARING
Who (Client, Actor, Owner): • What are the characteristics of the individual developers contributing to OSS projects? • What are the characteristics of the companies distributing OSS products? • What are the characteristics of the users of OSS products?	OSS PRODUCTION – COMMUNITIES OSS PRODUCTION – ROLE OF VOLUNTEER USERS/DEVELOPERS OSS PRODUCTION – ROLE OF COMMERCIAL CORPORATIONS OSS PRODUCTION – ROLE OF VOLUNTEER USERS/DEVELOPERS

Notes: *Feller and Fitzgerald (2000)* drew on Zachman's information systems architecture (Zachman, 1987) and Checkland's CATWOE framework from Soft Systems Methodology (Checkland, 1981), to propose a framework to organize and analyze open source research. The main elements of the proposed framework along with its linkages to the taxonomy codes are shown in Table B1.

Table B2: Lerner and Tirole (2001)	
Lerner and Tirole (2001) Categories	Matching Categories from The Taxonomy of Open Source Research
Why do programmers participate?	OSS PRODUCTION – USER AND DEVELOPER MOTIVATIONS
What constitutes a good project and good leadership?	OSS SUCCESS OSS PRODUCTION – DEVELOPMENT TEAM PERFORMANCE OSS PRODUCTION – TEAM/PROJECT LEADERSHIP
Why do software vendors participate?	OSS PRODUCTION – ROLE OF COMMERCIAL CORPORATIONS OSS PRODUCTION – COMMUNITIES SOFTWARE DEVELOPMENT – USE OF OSS COMPONENTS BUSINESS/ECONOMIC MODELS AND STRATEGIES/POLICIES FOR OSS
Opening proprietary code	OSS PRODUCTION – ROLE OF COMMERCIAL CORPORATIONS OSS PRODUCTION – GOVERNANCE BUSINESS/ECONOMIC MODELS AND STRATEGIES/POLICIES FOR OSS
Legal aspects	OSS LICENSING OSS LEGAL ISSUES OSS INTELLECTUAL PROPERTY RIGHTS
Sociological aspects	OSS PRODUCTION – USER AND DEVELOPER MOTIVATIONS OSS PRODUCTION – ROLE OF COMMERCIAL CORPORATIONS SOFTWARE DEVELOPMENT – USE OF OSS COMPONENTS OSS PRODUCTION – SELF-ORGANIZATION (PRODUCT AND COMMUNITY EVOLUTION)

Notes: *Lerner and Tirole (2001)* were concerned with exploring the incentives for programmers and software vendors to participate in open source software projects, and built their framework to explore this topic area. Table B2 shows the matching of topics that have been discussed or proposed for further research by the authors to the taxonomy codes established in this study.

Table B3: Rossi (2004)	
Rossi (2004) Categories	Matching Categories from The Taxonomy of Open Source Research
Motivation for F/OSS Contributions Extrinsic Motivations Intrinsic Motivations	OSS PRODUCTION – USER AND DEVELOPER MOTIVATIONS OSS PRODUCTION – GOVERNANCE OSS PRODUCTION – INNOVATION OSS PRODUCTION – COMMUNITIES
Governance	OSS PRODUCTION – GOVERNANCE
Features of F/OSS Production	OSS PRODUCTION – PROCESS PERFORMANCE METRICS – SOFTWARE DEVELOPMENT – OSS CODE EFFICIENCIES OSS PRODUCTION – INNOVATION
F/OSS Project Coordination	OSS PRODUCTION – COMMUNITIES OSS PRODUCTION – COLLABORATION AND KNOWLEDGE SHARING OSS PRODUCTION – TEAM/PROJECT LEADERSHIP
F/OSS and Commercial Firms Competition with Proprietary Software Cooperation with Commercial Firms	OSS PRODUCTION – ROLE OF COMMERCIAL CORPORATIONS CONCEPTUAL – OSS VERSUS PROPRIETARY PERFORMANCE METRICS – SOFTWARE QUALITY OSS DIFFUSION – OSS ADOPTION – GENERAL CONCEPTUAL – BUSINESS/ECONOMIC MODELS AND OSS STRATEGIES/POLICIES
F/OSS and IP Issues F/OSS Licenses F/OSS and IP F/OSS and Interface Standards	LEGAL AND REGULATORY – OSS LICENSING LEGAL AND REGULATORY – OSS LEGAL ISSUES LEGAL AND REGULATORY – OSS INTELLECTUAL PROPERTY RIGHTS LEGAL AND REGULATORY – OSS STANDARDS AND REGULATION
Government Policies	OSS DIFFUSION – OSS IMPLEMENTATION – GOVERNMENTS/NATIONS CONCEPTUAL – BUSINESS/ECONOMIC MODELS AND OSS STRATEGIES/POLICIES LEGAL AND REGULATORY – OSS STANDARDS AND REGULATION

Notes: *Rossi (2004*) provided a comprehensive review on the production side of free and OSS research with particular attention to the topics of intellectual property and governmental policies. After elaborating on topics that have already been explored in extant research, Rossi provided directions for future research suggesting a number of research worthy areas that included institutional–individual motivation complementarity, long-term view on voluntary community governance, and impact of commercial involvement as well as licensing issues for publicly funded software and extension of open source model to other domains.

Table B4: Lerner and Tirole (2005)	
Lerner and Tirole (2005) Categories	Matching Categories from The Taxonomy of Open Source Research
What Motivates Open Source Contributors?	OSS PRODUCTION – USER AND DEVELOPER MOTIVATIONS
How Do Commercial Firms Work and Compete with Open Source?	OSS PRODUCTION – ROLE OF COMMERCIAL CORPORATIONS OSS PRODUCTION – COMMUNITIES SOFTWARE DEVELOPMENT – USE OF OSS COMPONENTS BUSINESS/ECONOMIC MODELS AND STRATEGIES/POLICIES FOR OSS
How Does the Legal System Affect Open Source?	OSS LICENSING OSS LEGAL ISSUES
What is the Relative Quality of Open Source Software?	SOFTWARE QUALITY OSS VERSUS PROPRIETARY SOFTWARE DEVELOPMENT – OSS CODE EFFICIENCIES
What are Appropriate Public Policies Toward Open Source?	BUSINESS/ECONOMIC MODELS AND STRATEGIES/POLICIES FOR OSS OSS IMPLEMENTATION – GOVERNMENTS / NATIONS
How Will Software Patents Affect Open Source?	OSS INTELLECTUAL PROPERTY RIGHTS OSS LEGAL ISSUES
Can Open Source Work Beyond Software?	BEYOND OSS – OPEN PARADIGM BEYOND OSS – OPEN INNOVATION BEYOND OSS – OPEN KNOWLEDGE FLOWS
Can Firms Realize the Benefits of Open Source in Other Ways?	OSS BENEFITS/DRAWBACKS OSS VISION/ROADMAP BUSINESS/ECONOMIC MODELS AND STRATEGIES/POLICIES FOR OSS OSS INTELLECTUAL PROPERTY RIGHTS OSS LICENSING OSS STANDARDS AND REGULATION
Open Source and Academia	BEYOND OSS – OPEN KNOWLEDGE FLOWS BEYOND OSS – OPEN PARADIGM BEYOND OSS – OPEN EDUCATION OSS PRODUCTION – USER AND DEVELOPER MOTIVATIONS OSS INTELLECTUAL PROPERTY RIGHTS

Notes: *Lerner and Tirole (2005)* continued their exploration of the motivation for open source contributions with a third study in 2005. In this study, they focused on the interaction between commercial and open source software, as well as a set of relevant legal systems. Their categories are presented in Table B4.

Table B5: von Krogh and von Hippel (2006)	
von Krogh and von Hippel (2006) Categories	Matching Categories from The Taxonomy of Open Source Research
Motivations for contributions	OSS PRODUCTION – USER AND DEVELOPER MOTIVATIONS OSS PRODUCTION – ROLE OF COMMERCIAL CORPORATIONS OSS PRODUCTION – COMMUNITIES SOFTWARE DEVELOPMENT – OSS CODE EFFICIENCIES
Governance, organization, and innovation process	OSS PRODUCTION – GOVERNANCE OSS PRODUCTION – COMMUNITIES OSS PRODUCTION – TEAM FORMATION OSS PRODUCTION – INNOVATION OSS PRODUCTION – SELF-ORGANIZATION (PRODUCT AND COMMUNITY EVOLUTION) OSS PRODUCTION – PROCESS OSS IMPLEMENTATION – IMPLEMENTATION COMMUNITIES AND NETWORKS BEYOND OSS – OPEN INNOVATION
Competitive dynamics	OSS PRODUCTION – ROLE OF COMMERCIAL CORPORATIONS BUSINESS/ECONOMIC MODELS AND STRATEGIES/POLICIES FOR OSS OSS VERSUS PROPRIETARY OSS PRODUCTION – COMMUNITIES OSS PRODUCTION – COLLABORATION AND KNOWLEDGE SHARING OSS PRODUCTION – SELF-ORGANIZATION (PRODUCT AND COMMUNITY EVOLUTION)

Notes: *Von Krogh and von Hippel (2006)* developed a framework to organize the submission to a special issue of *Management Science* on Open Source Software. Table B5 summarizes the proposed framework categories and matching taxonomy codes from the literature review.

Table B6: Nelson et al. (2006)	
Nelson et al. (2006) Categories	Matching Categories from The Taxonomy of Open Source Research
Initiation Phase: • Why are open source projects started in the first place? • What incentives regulate the initiation phase?	OSS PRODUCTION – USER AND DEVELOPER MOTIVATIONS
Ongoing Project Phase: • What motivates individuals and organizations to participate in an ongoing open source project? • How can individuals and organizations participate? What are the roles they play and the quality of contributions they make? • Which coordinating and communication mechanisms aid or hinder open source projects?	OSS PRODUCTION – USER AND DEVELOPER MOTIVATIONS OSS PRODUCTION – ROLE OF COMMERCIAL CORPORATIONS BUSINESS/ECONOMIC MODELS AND STRATEGIES/POLICIES FOR OSS OSS PRODUCTION – PROCESS OSS PRODUCTION – COMMUNITIES OSS PRODUCTION – TEAM FORMATION OSS PRODUCTION – GOVERNANCE OSS PRODUCTION – ROLE OF VOLUNTEER USERS / DEVELOPERS
Adoption/Deployment Phase	OSS ADOPTION – (all sub-categories) OSS IMPLEMENTATION – (all sub-categories)
Coordination Mechanisms in an OSS Project	OSS PRODUCTION – PROCESS OSS PRODUCTION – GOVERNANCE OSS PRODUCTION – COMMUNITIES OSS PRODUCTION – TEAM FORMATION OSS STANDARDS AND REGULATION OSS PRODUCTION – COLLABORATION AND KNOWLEDGE SHARING
Impact of OSS Projects	OSS SUCCESS SOFTWARE DEVELOPMENT – OSS CODE EFFICIENCIES OSS PRODUCTION – ROLE OF LICENSING AND IP OSS PRODUCTION – COLLABORATION AND KNOWLEDGE SHARING OSS VERSUS PROPRIETARY
Participation Alternatives	BUSINESS/ECONOMIC MODELS AND STRATEGIES/POLICIES FOR OSS OSS PRODUCTION – USER AND DEVELOPER MOTIVATIONS

Notes: *Nelson et al. (2006)* categorized open source software research in three major phases and three additional research domains. A number of leading questions were provided. Table B6 lists the proposed phases and additional domains and maps them to the taxonomy categories.

Table B7: Niederman et al. (2006a,b)	
Niederman et al. (2006a,b) Categories	Matching Categories from The Taxonomy of Open Source Research
The Software Artifact: • Artifact type: Contrasting open source and proprietary artifact characteristics • License type: Precursors to the choice of license type, effect of license type on diffusion and use of software • Quality of product (bugs, security)	OSS VERSUS PROPRIETARY OSS LICENSING OSS PRODUCTION – ROLE OF LICENSING AND IP OSS ADOPTION – BARRIERS SOFTWARE QUALITY – OSS SECURITY SOFTWARE QUALITY – TESTING and BUG FIXES
The Individual: • Developer: Motivations for participation • User: Choice of project, adoption decisions	OSS PRODUCTION – USER AND DEVELOPER MOTIVATIONS OSS ADOPTION – DECISION FACTORS
The Team/Project/Community: • Organization governance: Mixtures of paid and volunteer developers • Mechanics for artifact creation: Processes for modularizing projects, "assigning" work tasks, for evaluating and integrating new code. Communication processes and patterns.	OSS PRODUCTION – GOVERNANCE OSS PRODUCTION – ROLE OF VOLUNTEER USERS / DEVELOPERS OSS PRODUCTION – ROLE OF COMMERCIAL CORPORATIONS OSS PRODUCTION – COMMUNITIES OSS PRODUCTION – PROCESS SOFTWARE DEVELOPMENT – USE OF OSS COMPONENTS OSS PRODUCTION – COLLABORATION AND KNOWLEDGE SHARING SOFTWARE DEVELOPMENT – OSS CODE EFFICIENCIES
The Organization : • Developer/distributor/users: Business models for developers and distributors of open source software. Total cost of ownership for investing in open source. Mixtures of open source and proprietary software over a whole MIS department.	BUSINESS/ECONOMIC MODELS AND STRATEGIES/POLICIES FOR OSS OSS PRODUCTION – ROLE OF COMMERCIAL CORPORATIONS SOFTWARE DEVELOPMENT – USE OF OSS COMPONENTS OSS PRODUCTION – COMMUNITIES OSS IMPLEMENTATION – IMPLEMENTATION COMMUNITIES AND NETWORKS
The Society: • Influence on society: Diffusion of the open source "philosophy" to other areas such as licensing of intellectual property. Governmental policies regarding the use of open source versus proprietary software.	BEYOND OSS – OPEN PARADIGM OSS IMPLEMENTATION – GOVERNMENTS/NATIONS BUSINESS/ECONOMIC MODELS AND STRATEGIES/POLICIES FOR OSS OSS VERSUS PROPRIETARY

Notes: *Niederman et al. (2006a,b)* present a two-part study of open source research. In Part 1, the authors frame open source software "in a larger context" and propose a multi-level framework for the investigation of the open source software domain. In Part II, selected theories from information systems and other disciplines are introduced as being potentially relevant to open source research. Table B7 maps the research issues by levels of analysis.

Table B8: Scacchi (2007)	
Scacchi (2007) Categories	Matching Categories from The Taxonomy of OSR
Individual Participation in FOSSD Projects	OSS PRODUCTION – USER/DEV. MOTIVATIONS OSS PRODUCTION – GOVERNANCE OSS PRODUCTION – COMMUNITIES OSS PRODUCTION – TEAM FORMATION
Resources&Capabilities Supporting FOSSD: • Personal software development tools and networking support • Beliefs supporting FOSS Development • FOSSD informalisms • Competently skilled, self-organizing, and self-managed software developers • Discretionary time and effort of developers • Trust and social accountability mechanisms	OSS PRODUCTION – ROLE OF VOLUNTEER USERS / DEVELOPERS OSS PRODUCTION – COLLABORATION AND KNOWLEDGE SHARING OSS PRODUCTION – USER/DEV. MOTIVATIONS OSS PRODUCTION – COMMUNITIES OSS PRODUCTION – PROCESS OSS PRODUCTION – GOVERNANCE OSS PRODUCTION – SELF-ORGANIZATION
Cooperation, coordination, and control in FOSS projects	OSS PRODUCTION – COLLABORATION AND KNOWLEDGE SHARING OSS PRODUCTION – PROCESS OSS PRODUCTION – GOVERNANCE
Alliance formation, inter-project social networking and community development Community development and system development	OSS PRODUCTION – COLLABORATION AND KNOWLEDGE SHARING OSS PRODUCTION – SOFTWARE DEVELOPMENT – USE OF OSS COMPONENTS OSS PRODUCTION – INDIVIDUAL AND TEAM LEARNING LEGAL AND REGULATORY – OSS LICENSING OSS PRODUCTION – COMMUNITIES OSS IMPLEMENTATION – IMPLEMENTATION COMMUNITIES AND NETWORKS OSS PRODUCTION – SELF-ORGANIZATION
FOSS as a multi-project software ecosystem: • Co-evolving socio-technical systems for FOSS	OSS PRODUCTION – COMMUNITIES OSS PRODUCTION – COLLABORATION AND KNOWLEDGE SHARING OSS PRODUCTION – SOFTWARE DEVELOPMENT – USE OF OSS COMPONENTS OSS PRODUCTION – SELF-ORGANIZATION PERFORM. METRICS – SOFTWARE QUALITY OSS PRODUCTION – INNOVATION
FOSS as a Social Movement	OSS PRODUCTION – COMMUNITIES LEGAL AND REGULATORY – OSS LICENSING OSS PRODUCTION – ROLE OF COMMERCIAL CORPORATIONS

Notes: Focusing on free and open source software development (FOSSD) and evolution *Scacchi (2007)* provides a comprehensive review of selected empirical studies along a variety of dimensions, talks about their limitations and identifies potential contributions FOSSD can make to traditional software engineering practices. Table B8 summarizes topical categories examined by Scacchi and the overlapping OSS taxonomy codes.

Table B9: Jin et al. (2007)	
Jin et al. (2007) Categories	Matching Categories from The Taxonomy of Open Source Research
Creation of OSS User Communities: • How do new users, especially technically disadvantaged users, learn about OSS alternatives to proprietary software? • How are OSS user communities created? • What are the incentives for participating in OSS user communities?	OSS ADOPTION – GENERAL OSS PRODUCTION – COMMUNITIES OSS PRODUCTION – USER AND DEVELOPER MOTIVATIONS
Characteristics of OSS User Communities: • What is the structure of OSS user communities? • How do user communities coordinate their physical and virtual activities?	OSS PRODUCTION – COMMUNITIES OSS PRODUCTION – PROCESS OSS IMPLEMENTATION – IMPLEMENTATION COMMUNITIES AND NETWORKS OSS IMPLEMENTATION – GENERAL OSS PRODUCTION – GOVERNANCE OSS PRODUCTION – COLLABORATION AND KNOWLEDGE SHARING
Contributions by members of OSS User Communities: • What do OSS users contribute to the community by using free software? • What do OSS users contribute to the community beyond their use of free software? • What contributions can OSS user communities make to other users?	OSS PRODUCTION – ROLE OF VOLUNTEER USERS / DEVELOPERS OSS PRODUCTION – COMMUNITIES OSS PRODUCTION – COLLABORATION AND KNOWLEDGE SHARING OSS PRODUCTION – INDIVIDUAL AND TEAM LEARNING OSS PRODUCTION – INNOVATION
Change and Evolution of OSS User Communities: • How will OSS user communities change as they grow larger and more successful? • How will the character of OSS user communities change over time?	OSS PRODUCTION – SELF-ORGANIZATION (PRODUCT AND COMMUNITY EVOLUTION)

Notes: *Jin et al. (2007)* point out that most open source research has looked at development rather than use of open source software, and thus propose a framework establishing four areas of investigation to guide open source software usage research. The four areas of investigation along with several guiding research questions are summarized and mapped against the taxonomy codes in Table B9.

About the Authors

ALTAY AKSULU is a doctoral candidate in Operations Management and Information Systems at the Schulich School of Business in Toronto, Canada. His research focuses on the adoption and use of open source technologies and systems in an organizational context. Altay is an aeronautical engineer and has an MBA degree with a concentration in information systems. Prior to his academic career, Altay worked for 15 years as an Information Technology professional in both private and public sector enterprises in North America, Europe, and the Middle East.

MICHAEL R. WADE is Professor of Innovation and Strategic Information Management at IMD in Lausanne, Switzerland. Previously, he was an Associate Professor and Academic Director of the Kellogg-Schulich Executive MBA Program at York University, Toronto, Canada. He received a Ph.D. from the Ivey Business School at the University of Western Ontario. Professor Wade has worked extensively with public and private sector organizations to further an understanding of the strategic use of information systems for sustainable competitive advantage. He has lived and worked in seven countries across four continents and consulted for top international organizations like Cisco Systems, Shell, IBM, and Credit Suisse. His research has appeared in journals such as MIS Quarterly, Strategic Management Journal, and the Communications of the ACM. He is a Senior Editor at the Journal of the AIS and an Associate Editor at ISR. Professor Wade has co-authored six books in the areas of Information Systems, eCommerce, and Management Theory.