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Re-Envisioning Libraries in the Information Society:

A Critical Theory of Library Technology

A dissertation submitted in partial satisfaction of the

requirements for the degree Doctor of Philosophy

in Information Studies

by

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DEDICATION

This dissertation is dedicated to the memory of my late father, Dr. Sudhindranath Pyati. Thank you for the gift of life, and for guiding me through this journey. I now have the wings to fly to where I was always meant to be. Love, Ajit

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ABSTRACT OF THE DISSERTATION

Re-Envisioning Libraries in the Information Society:

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by

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Libraries have been involved in technological transformation for several decades, and are now increasingly associated with discourses surrounding the development of a global information society. The information society, however, remains a contested terrain, with a major focus on connectivity to ICTs, and is often linked with technological determinist and technocratic agendas. The library profession and field do not adequately theorize technology in a way that offers a progressive alternative to this dominant information society vision.

In light of this context, this dissertation argues for the relevance of critical theory as a framework for guiding and analyzing library technology actions. This confluence of critical theory and library technology studies is named a “critical theory of library

technology.” The framework is both a conceptual tool for re-envisioning the roles of libraries in relation to technology, as well as an analytical tool for exploring library technology decisions at various levels of impact.

The open source software movement in libraries serves as test case in the application of this framework as a mode of analysis. Prominent library open source projects are discussed, and an in-depth, qualitative case study of Simon Fraser University Library in Canada, a library developing open source software for electronic resource management and electronic journal publishing, is undertaken. Interviews and documentary research are the main sources of data.

Findings indicate that while the software projects are nominally open source, the co-developer communities remain limited. Best practices research will have to address areas related to the on-going community development and sustainability of these projects. However, in relation to the critical framework, the library emerges as a model of high investment in the technological skills of systems staff. The case presents a regional example of cooperation that is benefiting smaller client libraries in the regional consortia. Open source ideology, however, appears as just one of a variety of factors behind the deployment of these projects. In the case of the electronic journal publishing software project, an open source/open access ideological orientation is prominent, and the project presents a potentially new model for academic libraries in the support of electronic publishing services.

Chapter 1: Introduction

1.0 Problem Statement

The increasingly prominent role of information and communication technologies (ICTs) in libraries is an undeniable reality. Countless articles over several decades have described the technological transformations in libraries – for instance, all major library functions in the areas of purchasing, collections, and services have been affected by changes in technology (Buschman, 1993b). Moreover, it can be argued that the traditional “paper library” exists alongside the increasingly prominent and more ICT-intensive “automated library” and “electronic library” (M. Buckland, 1992). Most forecasts about the “future of libraries” consequently include a continuously transformative and prominent role for ICTs.

In addition, on a policy level, a global discourse exists about the roles of libraries in developing an “information society” and national information infrastructures. An information society that is based largely on access to ICTs predominates policy discourses, and the emergence of a global information society is of significance to a wide range of actors, from national governments, corporations, international development agencies, and civil society. Information institutions, such as libraries, are joining in on this information society debate, arguing for the roles of libraries in the development of an information society (IFLA, 2005d).

The International Federation of Library Associations and Institutions (IFLA) is taking center-stage in the promotion of libraries as a fundamental part of a global information society. IFLA is the international representative of libraries, speaking

largely on behalf of national library associations in the world. IFLA placed a great emphasis on its efforts at the World Summit on the Information Society (WSIS), with IFLA president Alex Byrne delivering an address to the WSIS plenary (IFLA, 2005c) and through the development of the “Alexandria Manifesto on Libraries, the Information Society in Action” (IFLA, 2005a). The link between libraries and the development of a global information society, however, remains largely unexamined and unquestioned.

While library professional associations, such as IFLA, and international organizations, such as UNESCO, have argued for the cultural, democratic, public service, and communitarian ethics of libraries, the discourse of libraries constructed at the World Summit on the Information Society (WSIS) focused mainly on libraries as access points to ICTs (Pyati, 2005). Moreover, the information society concept, as it is used in policy circles and exemplified in WSIS, is highly influenced by ideologies of privatization and deregulation (Webster, 2002). WSIS was a two-part United Nations conference that sought to build a “people-centered and inclusive” information society (WSIS, 2003), but was influenced to a large degree by European Union information society policies that link access to ICTs with increasingly neo-liberal free-market ideologies. Thus, a central tension exists between the traditional public service ethic of libraries, and an information society framework that is linked to privatization strategies that can further commoditize information.

The concept of an information society is a contested terrain, understood at various social, political, economic, and theoretical levels. Thus, the role of libraries in “building” an information society needs to be critically examined. Specifically, what libraries are

building, and for whom, remain important concerns. For instance, much of the field often does not critically examine the dominant conception of the information society. This dominant conception of the information society is often linked to technological determinist assumptions, “techno-boosterism” and neo-liberal economic philosophies (Webster, 2004). Notwithstanding, however, certain scholars within the library and information science (LIS) field have questioned some of the dominant discourses of the information society and its implications for library services (Harris *et al.*, 1998).

In *Into the future: the foundations of library and information services in the post-industrial era*, for instance, Harris, Hannah and Harris (1998) discuss how the profession must find a way to transcend the two most common reactions to the information society – the “complacent (yet delirious) camp-following celebration” and the “moralizing condemnation” common to the profession (p. 26). These authors thus bring to the surface two important points about information society discourses that also parallel discourses about technology in libraries. These two opposite poles that the authors describe, I label as “technophilic” and “technophobic” tendencies in the LIS field. While by nature these descriptions are generalizations and do not capture the nuances of technological and information society positions in the discipline, they serve a useful purpose for illustrating the contrasts in the field. The technophilic pole is associated with unquestioned enthusiasm for technology, accepts technological determinist positions, and is generally uncritical of dominant information society visions. This orientation, moreover, can be associated with predictions about the “paperless library” and an “all electronic future” for libraries (Lancaster, 1978). This vision prompted anxiety at the beginning of the 1990s

about the “future of libraries” (Nunberg, 1998), as some “techno-futurists” predicted the end of libraries as we know them. As a response to some of the techno-enthusiast visions of libraries, various library leaders decried the “madness of technolust” in the field and what they saw as an information science/technological camp dominating LIS (Crawford & Gorman, 1995; Gorman, 2000). This reaction to the techno-enthusiast vision is thus the technophobic pole in the ICT and information society debate in the library community.

Returning to Harris, Hannah, and Harris (1998), the authors offer a path between these two polarizing camps, as they argue that “we must find a way to confront critically and intervene intelligently in the process of change sweeping our society and, more explicitly, our profession” (p. 26). The authors refer to this path as a “project of critical intervention” (p. 26). Similar to these authors, John Buschman (1993) edited a book entitled, *Critical approaches to information technology in librarianship*, which also argues against approaches to technology in libraries that are uncritical and simplistic in their analyses. He writes that:

At worst, our literature is plainly celebratory, often exhortative, and full of vague and dire threats of the results if we do not embrace information technology more thoroughly and enthusiastically. There is a need for a new framework through which to examine information technology’s role in the information field (p. 7).

Quoting Herbert Schiller, Buschman (1993) adds that we need “critical research in the information age” (p. 7), as “such research would focus on production of information rather than consumption; it would focus on sources of power and how it is exercised in

relation to information and communication; and it would rest on a strong sense of continuous social and institutional change and history” (p. 8).

Thus, to answer the call of Harris, Hannah, and Harris (1998) and Buschman (1993), this dissertation research is a critical intervention into the roles of libraries in the information society. It provides a new framework through which to examine information technology’s role in the library field and tests cases of library technology development. On a broader level, this research brings a critical theory framework to the study of libraries and library technology. As I argue in this dissertation, the transformative role of ICTs in libraries is inadequately theorized and framed for more democratic and progressive purposes; however, critical theory is uniquely placed to address this pressing concern. While invoked in LIS, critical theory is largely under-utilized, and this dissertation, thus, opens a much needed space for critical theory approaches in the field. As will be discussed further in this chapter and in Chapter 3, critical theory has a specific history and lineage, and the approach utilized in this study draws to a great degree from the Frankfurt School of critical theory.

A few notable scholars in the field have provided some much-needed critical interventions, but are largely an exception in the field. For instance, with regard to library and information science, Wayne Wiegand (1999) issued a call to address the “tunnel visions and blind spots” (p.1) that plague discourses and studies of American librarianship. In response to Wiegand’s exhortation, a special issue of *Library Quarterly* (Volume 73, Number 1) was published in January 2003, with various authors addressing critical theoretical interventions into LIS (J. M. Budd, 2003; Raber, 2003; Radford,

2003). The authors in this issue draw from scholars as diverse as Foucault, Gramsci, Hall, and Habermas to question some of the fundamental assumptions and “blind spots” of the field. Even before this more recent infusion of critical theoretical frameworks, Michael Harris (1986) critically interrogated commonly held assumptions about the development of the American public library, as well as the dominance of positivist epistemologies in LIS. However, critical theory in the form of the Frankfurt School is not common in LIS, and this dissertation is a critical intervention in this tradition. This research project aims to show critical theory’s usefulness to the field, particularly in its linkage of theory to practice, with a particular focus on library technology.

In the context of the technological determinism and techno-capitalism of the information society and the often uncritical assumptions about information technology in the field, I propose what I call a “critical theory of library technology” framework for examining the role of ICTs in libraries and which offers a more progressive and democratic vision for information technology in libraries. A critical theory of library technology, however, is also at its core a critical theory of library goals, functions, practices, and services. Critical theory helps to bring about a critical re-examination of the power dynamics in libraries and is a challenge to re-envision more democratic and progressive roles for libraries.

This concern with power dynamics in libraries leads to a reassessment of technological instrumentalist and determinist positions within LIS. A critical theory of library technology envisions wider community input and participation in library technology development, exposing the contradictions of techno-capitalism and its

impacts on libraries. This critical theory framework helps libraries to embrace new roles in an information society to counter the techno-capitalism of the information society. Some of these new roles can include more active participation in *grassroots* and new media technology efforts to re-envision an information society from community-based standpoints. One such grassroots movement with worldwide appeal and an ethic of developing an information society “from below” is open source software. The confluence between open source software and technology development within libraries is the focus of the case study portion of the dissertation.

The major aim of the dissertation therefore is to present the case for a more prominent role for critical theory in discourses about library technologies and services. I argue that this critical orientation is needed due to the context of the techno-capitalist and technological determinist tendencies of the information society (as exemplified in its latest incarnation, the WSIS). In response to these tendencies of the dominant information society, popular grassroots technology models and activist movements, such as open source and free software, have arisen. The open source software movement is also affecting libraries, and it is useful to examine if and how open source software is giving libraries new opportunities to counteract some of the determinist and techno-capitalist strands of the information society. For instance, open source software potentially offers a model of greater local control and democratization of library processes and technology. However, little research has studied this movement in libraries, let alone with a critical theory-informed lens. Thus, using the critical theory of library technology framework, open source software in libraries serves as a test case in

understanding elements of progressive transformation and democratization in libraries, within the context of an alternative, community-based and grassroots vision of an information society.

1.1 Dissertation Overview

Returning to the discussion about WSIS and libraries, the limited conception of libraries in WSIS as ICT access points in an information society promotes technological determinism and does not speak fully to the public service missions of libraries. For instance, an expanded role of libraries in an information society can include literacy education, and cultural and recreational services, creating important public spaces for democratic engagement (Apostle & Raymond, 1997). IFLA, as part of its efforts at WSIS, has also created a “Libraries Success Stories Database,” in which libraries can be places for: 1) ICT access points; 2) ICT learning centers; 3) continuing education; 4) specific needs; and 5) cultural heritage (IFLA, 2005b). Thus, IFLA itself provides a broader framework for thinking about the roles of libraries in an information society. However, the WSIS documents do not reflect this larger understanding of libraries.

Many “non-information” related roles, such as the function of the library as a democratic space and as a place for cultural preservation are important, but are not the main focus of this particular study. I focus instead on the heart of the library-information society nexus, which is concerned with the role of libraries in relation to ICTs. As IFLA mentions, libraries can be ICT access points, and also ICT learning centers. However, what is often missing in the discourse surrounding ICTs and libraries is the role libraries could potentially play in shaping technology for more inclusive and democratic ends.

Some of this technology shaping can take the form of active library technology development for user communities.

With this idea in mind, I argue that frameworks such as critical theory, and critical theory of technology (Feenberg, 2002) are needed, which can envision a role for libraries to become more active participants and shapers of ICTs for progressive and democratic ends. This type of technology shaping can take many forms. For example, library-led initiatives are underway in Australia in which technology is being used to extend multicultural services in public libraries (Cunningham & Stillman, 2002). This particular project, “The Open Road,” was developed to help libraries support multilingual fonts in different platforms and provides links to information in many of the languages of Australia’s multicultural population, responding to a need to help support non-English content in an English language-dominated Internet landscape. This example of libraries using technology to enhance public service missions is just one case.

Additionally, with the development of more interactive technologies, such as wikis and blogs, new forms of democratic participation are flourishing on the Internet (Kahn & Kellner, 2005), which can have profound influences on the future of library services. For instance, the dawning of “Web 2.0” has prompted the Association of College and Research Libraries (ACRL) to commission a monograph entitled, *Library 2.0 Initiatives in Academic Libraries*, which explores the roles of new web technologies in the transforming academic library environment (Cohen, 2007). Some of the guiding principles of “Library 2.0” include the use of social information tools favored by users; the building of personalized, participatory library services driven by user needs; an

embrace of radical trust; the shift toward taking the library to users; and the rapid change mobilized by assessment (Cohen, 2007). This re-envisioning of academic library services includes, for example, the use of blogging and social networking tools for community outreach, research, and teaching.

Library services are, thus, evolving with the continuous development of Internet technologies, affecting areas such as digital reference, electronic journal development, open access publishing, information search tools, and integrated library systems, to name a few. This dissertation research focuses on one particular technological movement within the library community that has been greatly facilitated by the Internet – open source software. Open source software, also often associated with the “free software” movement, usually has source code that is “open” and is distributed free of charge. The open source and free software movements are worldwide phenomena, with various international organizations interested in their potential for alternatives to commercial software dominance (European Commission, 2005; UNESCO, 2007). Open source software is also tied into discussions of the information society, as it is considered an important effort grassroots, development-centered effort aimed at constructing a global information society (UNESCO, 2007). Libraries, for instance, are utilizing open source software as an alternative to purchasing the often expensive software that commercial vendors sell for various library functions, such as integrated library systems, electronic resource management tools, and information searching tools.

While libraries are frequently mentioned as important players in developing an information society, information infrastructures, and ICTs, there is, however, a notable

lack of critical theorizations of technology use by libraries. Critical theory, in its broadest sense, refers to theory that can undertake a systematic and dialectical analysis of the economy, the state, and the political realm and its linkages to culture, ideology, and everyday life (Kellner, 1989). In this particular study, critical theory is highly relevant to a critique of the technophilic, determinist, and technophobic viewpoints that predominate discourses of library technology. In addition, critical theory's interrogation of techno-capitalism is of growing importance, mainly because of the increased importance of culture, technology, media, information, knowledge, and ideology in more domains of social life (Kellner, 1989). Libraries are one place where techno-capitalist ideologies of the information society are gaining more of a foothold, and thus critical examinations are needed in order for emancipatory alternatives to be formulated. Critical theory's form of dialectical analysis involves both making connections and demonstrating the contradictions that provide the opening for political intervention (Kellner, 1989). Critical theory of technology (Feenberg, 2002) also helps to expose the dialectic of Internet technologies. In other words, corporate hegemonic and progressive, community-oriented visions of the Internet and ICTs are in dialectical tension, exposing the contradictions inherent in Internet technologies, and opening up spaces for democratic possibilities.

Libraries, in becoming more conscious developers and *shapers* of ICTs for democratic and progressive ends, may help to combat some of the hegemony of the dominant information society, by exposing some of these contradictions and tensions. Libraries, whether as community spaces or places of information access, are often discussed as democratic spaces. Thus, if we perceive the library as embodying

democratic values, then it is important to think of the roles libraries have to play in the democratization of information technology. This project is thus concerned about both democratic outcomes of library technology development and the democratization of library technological decision-making. These issues need to be critically engaged to tackle technological discourses, which are undeniably becoming discourses of power in society. Libraries, therefore, need a voice in wider societal discourses about technology development, especially since they purportedly serve a function of democratic access to information.

This study, in its broadest sense, critically explores the question of what it means for libraries to participate in developing an information society. An information society that is associated with techno-capitalism, neo-liberalism, and ideologies of deregulation can ultimately undermine the basis of the public service mission of libraries. From this starting framework, the study proposes that libraries with public service mandates (particularly public and certain academic libraries) act in some degree as “anti-capitalist” and democratic spaces. Thus, the library can serve as a center where the dialectical tension between regressive and progressive visions of an information society takes place, exposing contradictions in the dominant techno-capitalist vision of an information society, and opening up library-centered visions. These visions, however, require a critical theoretical framework to guide informed action, something that is currently lacking.

The study I am proposing has two major components. On the one hand, it is a theoretical intervention in library technology discourses, while on the other hand it is also

an exploration of open source software development in libraries. The first component, in response to the lack of critical theoretical frameworks to guide the development of a more progressive technology development in libraries, develops such a critical theoretical framework. Drawing on the work of Frankfurt School critical theory and its critiques of technological society, as well as Feenberg's (1999) critical theory of technology and technology studies, this part of the study develops the dimensions and framework for what I call a "critical theory of library technology." The goal of this part of the study is to argue for the importance and increased relevance of critical theory, critical theory of technology, and critical technology studies in helping to frame a more democratic conception of technology in libraries and of libraries themselves; to develop a critical theoretical framework and model to guide and advocate for critically-informed library innovations of technology; and to present this framework and model for evaluating library technological innovations.

The second part of the study is an empirical component and focuses on the open source movement within libraries, primarily academic libraries. Various grassroots and potentially more democratic technology models exist for libraries, such as blogs, wikis, certain social networking applications, and mobile networks. Open source software is another such grassroots technology model which has received a great deal of attention as an alternative to commercial software development. Grassroots technology activists often place open source and free software at the heart of efforts to define alternative, community-driven visions of an information society (CRIS Campaign, 2005).

Similarly, an increasing number of libraries are utilizing open source software as an alternative to the commercially dominated ICT market in the library community. Open source software offers potential benefits in increased customization and control for libraries over their technology development, plus reduced costs (Courant & Griffiths, 2006). The open source model offers challenges to proprietary models of software development, and presents a useful case to begin exploring the critical theory of library technology framework developed in the first part of the study. The key idea explored in this second part of the dissertation is whether or not the open source movement in libraries embodies the qualities and characteristics argued for in the critical theory of library technology framework.

The purpose of the case study on open source in libraries is to explore the framework developed in the first part of the study in relation to the case and to begin to understand the dimensions of the model for its applicability to other cases (e.g., other types of libraries, information institutions, and technological innovations). This case study serves as a test case in the application of a critical theory of library technology framework as a mode of analysis.

Key library open source communities and projects are discussed, in relation to the framework developed earlier and with a view to highlighting preliminary areas for best practices research in library open source projects. The second component of this part of the research is an in-depth, qualitative study of a specific library open source project. It is a test case for demonstrating how a critical theory of library technology framework can be used to study library technology development. An academic library and its library

community in Western Canada are the focus of the in-depth case study, which was chosen because of the wide range of open source software this library develops, and also because it is widely believed to be a regional library open source success story. This academic library develops software for managing and searching library electronic resources, meta-search tools, and citation management functions.

In addition, this library is actively involved in developing and managing open source electronic journal publishing software, in conjunction with a university research team. This partnership is fairly unique, and this electronic journal publishing software is arguably the most widely used open source software of its kind in the world. Another unique component of the study is the confluence of the open source and open access publishing movements, as the electronic publishing software in this case study lends itself to open access models.

This project has also developed without significant foundation or corporate money, and potentially presents a model of a more local community-driven library technology project. As an academic library dealing with similar problems of other academic libraries in managing a burgeoning number of electronic resources, this case study also has the potential to offer lessons for other academic libraries, particularly in the exploration of best practices. On a separate note, however, the in-depth case study's location in Canada offers an exploration into a Canadian culture of library open source software development. While not known for a great volume of library open source projects, segments of the Canadian library community are actively involved in promoting library open source projects and arranging library technology conferences with open

source emphases. This in-depth case study thus also offers a view of the Canadian library open source community.

This case study on open source software and libraries will explore the applicability of the proposed framework, and the in-depth case study will provide additional insights into a Canadian academic library culture of open source software and technological innovation. Various economic, technological, social, institutional, and political factors will be explored in relation to how they influence this particular case. The overall case study of open source in libraries and the in-depth Canadian institutional case study, however, serve as a base study for future assessments of library technology using the critical theory of library technology framework. A major goal of the dissertation research is to develop the critical theory of library technology framework to serve as a model for future critical studies of libraries and technology in other parts of North America and the world.

The remaining part of this chapter is a review of the literature relevant to the study. Chapter 2 details the methodology of the research, focusing on the framework building component and the case study. More details about the case will be discussed, along with the heuristics for the data analysis. Chapter 3 focuses on the development and foundations for the critical theory of library technology framework. Chapter 4 is the first of three chapters dealing with the case study of open source software and libraries – this particular chapter outlines some of the major research on open source communities, discusses some prominent library open source projects, and previews the in-depth case study. Chapter 5 presents all the findings from the analysis of the in-depth case study,

according to the themes and sub-themes identified in the analysis. Chapter 6 presents the key findings of the in-depth case study, analyzes the in-depth case study in relation to the critical theory of library technology framework, and identifies preliminary areas for best practices research in library open source software projects. Finally, Chapter 7 highlights the major findings of the dissertation research and discusses areas for future study and research.

1.2 Literature Review

1.2.1 *Introduction*

The literature that informs this study comes from a wide range of sources. This study is unique in its perspective, developing an analysis through the intertwining of literature on libraries and public service ethics; roles and ethics of academic libraries; libraries, technology, and their information age discourses; critiques of the information society; critical theory and critical theory of technology, and open source software movements in libraries. Each area has an extensive literature – for the purposes of this discussion, I will focus on the literature that has the most direct bearing on the main arguments of the study. The literature on critical theory and critical theory of technology, and open source software, discussed briefly in what follows, will be discussed in more detail in Chapters 3 and 4, respectively.

The literature review begins with a general discussion of library ethics and democratic values within a largely Western and North American context. The discussion then moves on to look specifically at academic libraries, and their roles, values, ethics, and public service missions within the larger context of colleges and universities. In the

next section, a broad overview will be given of library technology issues, and some of the challenges facing both public libraries and academic libraries in the “information age.” This section will focus specifically on some of the information and technology-related discourses that are shaping the roles, missions, and visions of public and academic libraries. With some of this background on library ethics and goals in the information age established, the discussion shifts to some of the ramifications of the information society concept for libraries, such as technological determinism and information commodification.

The next section will focus on a critique of the information society, introducing some literature from critical theory, notably the work of Herbert Marcuse, as a way to begin critically examining the roles of libraries within dominant discourses of information. With critical theory of technology and critical technology studies in mind, the final section will focus on a short history of open source software initiatives, some of the current debates in this evolving field, and some library experiences with open source software. This literature review thus develops the social, institutional, political, and theoretical background for the study, establishing the need for a critical theory of library technology and “exemplars” to begin testing, refining, and broadening the applicability of this theory.

1.2.2 Library Ethics and Values in a Western/North American Context

The idea of a “library ethic” of service is important to the LIS field and profession. While I use the terms “ethics” and “values” in this section, ethics refers to a professional code of ethics in librarianship, while values refers more to general qualities

regarding librarianship. Library professional institutions, both within the United States and Canada, as well as internationally, have been important in defining ethics of the profession. Discussions of library ethics, values, and history in a North American context, however, are often US-centric and ignore the context of the Canadian library experience. However, because of many similarities in ethics and values, I will refer to both traditions interchangeably. It will be useful at this point to explore some of the ethical codes and values of library professional organizations, both in the United States and Canada.

For instance, the American Library Association (ALA), the largest and most influential professional association in United States librarianship, has its “Code of Ethics of the American Library Association,” that affirms:

- 1) We provide the highest level of service to all library users through appropriate and usefully organized resources; equitable service policies; equitable access; and accurate, unbiased, and courteous responses to all requests.
- 2) We uphold the principles of intellectual freedom and resist all efforts to censor library resources.
- 3) We protect each library user's right to privacy and confidentiality with respect to information sought or received and resources consulted, borrowed, acquired or transmitted.
- 4) We recognize and respect intellectual property rights.

- 5) We treat co-workers and other colleagues with respect, fairness and good faith, and advocate conditions of employment that safeguard the rights and welfare of all employees of our institutions.
- 6) We do not advance private interests at the expense of library users, colleagues, or our employing institutions.
- 7) We distinguish between our personal convictions and professional duties and do not allow our personal beliefs to interfere with fair representation of the aims of our institutions or the provision of access to their information resources.
- 8) We strive for excellence in the profession by maintaining and enhancing our own knowledge and skills, by encouraging the professional development of co-workers, and by fostering the aspirations of potential members of the profession (ALA, 2000).

Similarly, the Canadian Library Association (CLA) has a “Code of Ethics” that states:

- 1) Support and implement the principles and practices embodied in the current Canadian Library Association Statement on Intellectual Freedom.
- 2) Make every effort to promote and maintain the highest possible range and standards of library service to all segments of Canadian society.
- 3) Facilitate access to any or all sources of information which may be of assistance to library users.
- 4) Protect the privacy and dignity of library users and staff (CLA, 1976).

Both codes embrace certain ethical standards common to the library profession in the United States and Canada, particularly the focus on intellectual freedom and service.

While ethics guide professional codes of conduct, certain values are also at the heart of the Canadian and U.S. library professions. The CLA, for instance, has a values statement entitled, “Our Values,” that state: 1) We believe that libraries and the principles of intellectual freedom and free universal access to information are key components of an open and democratic society; 2) Diversity is a major strength of our Association; 3) An informed and knowledgeable membership is central in achieving library and information policy goals; and 4) Effective advocacy is based upon understanding the social, cultural, political and historical contexts in which libraries and information services function (CLA, 2005). In the same vein, the ALA has developed a “Core Values Statement” that speaks to core values that define, inform, and guide professional practice (ALA, 2004). These core values are: 1) Access; 2) Confidentiality; 3) Privacy; 4) Democracy; 5) Diversity; 6) Education and Lifelong Learning; 6) Intellectual Freedom; 7) Preservation; 8) The Public Good; 9) Professionalism; 10) Service; and 11) Social Responsibility (ALA, 2004). The main commonality in these value statements of importance for this dissertation is the focus on democratic values. A critical theory of library technology is aligned with some of these larger democratic and service-oriented goals.

A large literature also establishes this idea of North American library values and ethics. For instance, Richard Rubin’s *Foundations of Library and Information Science* (2004) gives a broad overview of library and information science history and current trends in the field. In this work, Rubin dedicates a chapter to exploring the “library’s

mission and its values,” (Rubin, 2004) and frequently refers to the service nature of the profession. Rubin’s focus is generally on libraries in a Western context, with the United States being the focal point of the discussion. While he does focus mainly on the United States, he provides a useful overview of the common types of libraries – public libraries, special libraries for business and industry, and academic libraries. Many of the values that Rubin discusses, related to cultural preservation and service, are shaped by the societies in which they exist. In the context of the future of the modern American library, he lists seven prevailing values – 1) Value of Service; 2) Reading and the book are important; 3) Respect for Truth and the Search for Truth; 4) Tolerance; 5) The Public Good; 6) Justice; and 7) Aesthetics. Rubin’s list is certainly not exhaustive, but provides a framework for understanding the dominant thinking behind libraries in an American context. These values are certainly idealized conceptions, and are nuanced in their own right.

In *The Story of Libraries* (1998), Fred Lerner focuses on a broad history of libraries, charting libraries through ancient times to the present day. Central to his “story” of libraries is the role of libraries as repositories of knowledge, as well as their essential roles of collecting, cataloging, preserving, and guiding (Lerner, 1998). In keeping with a discussion of traditional library ethics and roles, one of the most famous statements of library ethics and values is S.R. Ranganathan’s “Five Laws of Library Science.” Ranganathan, an influential librarian from India, stated his five laws as follows: 1) Books are for use; 2) Every reader his book; 3) Every book its reader; 4) Save the time of the reader; and 5) Library is a growing organism (Ranganathan, 1988). In

line with Ranganathan's five laws, Michael Gorman formulated his "Five New Laws of Librarianship." These "laws" are: 1) Libraries serve humanity; 2) Respect all forms by which knowledge is communicated; 3) Use technology intelligently to enhance service; 4) Protect free access to knowledge; and 5) Honor the past and create the future (Gorman, 1995). Gorman's statements serve as an update to Ranganathan's formulations in the increasingly information and technology driven environment in which libraries operate. These types of guiding statements from both Ranganathan and Gorman are part of a "library ethic" of service. This public service ethic will be important in the theory development component of the study, as a critical theory of library technology builds off some of these foundational ethics. In particular, Gorman's third law, "Use technology intelligently to enhance service" provides inspiration to the theory development component.

While discussing the presence of a library ethic of service, a tendency exists to associate this ethic largely with public libraries. While this tendency exists, it is certainly not the case. At this point, it would be useful to explore some of the unique features of academic libraries and the challenges they face in the information age.

1.2.3 Roles and Ethics of Academic Libraries

In "The history and development of libraries in American higher education," (1989), Plummer Alston Jones Jr. gives a brief history of academic libraries in the U.S., which serves as an executive briefing for administrators and potential donors. Jones discusses the history and development of libraries in American higher education, and notes that college and university libraries often reflect the fortunes of their respective

institutions, as well as the character and tendencies of their curricula and instructional methods. While the first university libraries were not large and had limited functions of collecting and preserving materials, several changes occurred to transform academic libraries in the United States (Jones, 1989). The influence of the Morrill Acts of 1862 and 1890, as well as the founding of Johns Hopkins University in 1876 on the German research model of the university, made the library gain importance and recognition as the “heart of the university.” Jones goes on to point out that at the turn of the 20th century, a shift in emphasis from conservation and protection of library materials to actions promoting the circulation of books to faculty and students occurred. He also discusses how the post-World War II era saw a boom in the construction of college libraries, and collection development grants funded by the U.S. government.

In *The Academic Library: Its Context, Purpose, and its Operation* (1998), John Budd details the diversity of academic libraries, and the challenges and the opportunities that they will face in the coming years. Budd points out that the nature of the academic library is not singular, as the nature of higher education is not singular. Academic libraries are affected by the environment of higher education, but in general, they exist to serve their academic communities (J. Budd, 1998). Thus, academic libraries have an essential service mission as well, but this mission is more specific to an academic context, rather than the broader mandate of most public libraries.

Academic libraries face a wide set of challenges, however, resulting from changes in the nature of higher education and the growth of information technology. In “Academic Libraries: 2000 and Beyond,” (1996), James Neal discusses some of the

major issues confronting academic libraries, and notes that the academic library will play a central role in the development of the campus information environment (Neal, 1996). In addition, he notes that, “rather than being told what technology to adopt, library staff will be integral in determining what the next innovations will be” (p.74). Central to this study is this declaration of the academic library’s significance in shaping technological innovation. Some of the technological innovations that Neal mentions include supporting distance learning, and extending the reach of the library through campus network infrastructures. In addition, he raises the important issue of copyright, and the central role of the academic library in negotiating the increasingly contested notion of copyright in a digital environment. The copyright issue, as it relates to online academic publishing, is especially pertinent to this particular case study. In keeping with the increasing need to redefine academic library roles in the future, in “The Academic Library in the Enterprise of Colleges and Universities: Toward a New Paradigm” (2001), Edward Owusu-Ansah emphasizes the importance of the growing educational mission of academic libraries. He argues that, “the academic library has arrived at the threshold of a new mission...one that moves the academic library from a custodial role into a directly educational one” (p. 291). According to him, the growth in the volume of information and the associated complexity entailed in retrieving high volumes of information makes this educational mission more important than ever (Owusu-Ansah, 2001).

In the context of Canadian academic libraries, Ethel Auster and Shauna Taylor provide some timely information on current Canadian academic library challenges in *Downsizing in Academic Libraries: The Canadian Experience* (2004). Surveying library

professionals in various academic libraries throughout Canada, the authors study the impact downsizing in the last decade has had on Canadian academic libraries (Auster & Taylor, 2004). A recession, decreasing support from federal and provincial governments, and a depreciating Canadian dollar made the 1990s a challenging decade for Canadian academic libraries, as cutbacks were made in library staff and various work reorganizations were undertaken (Jobe, 2005). The reality of this downsizing experience in Canadian academic libraries is part of larger economic forces, both in Canadian universities and in society at large. This context of downsizing will be important to understand in relation to the dimensions of a critical theory of library technology. For instance, the open source and open access publishing software now being developed at the library in the case study will need to be analyzed in the context of these organizational shifts and changes in Canadian academic libraries.

Academic libraries both in Canada and the United States are also taking the initiative in academic publishing efforts. This development is particularly important in the context of the case study. For example, in a statement by the Association of Research Libraries (ARL), entitled, “Principles for Emerging Systems of Scholarly Publishing,” (2000) the increasing cost of scholarly publishing is referred to as a scholarly publishing crisis, and academic libraries are mentioned as sources of potentially new models of scholarly publishing. This statement was produced at a meeting of university librarians in Tempe, Arizona in March 2000. Various recommendations were made to help contain the rising cost of journal subscriptions, including containing the cost to the academy of public research, using electronic capabilities to provide wide access to scholarship, and

maintaining a balance in copyright, to name a few (ARL, 2000). ARL has also been involved in the open access model of academic publishing, as a means to address the scholarly publishing crisis of high costs and copyright in the digital realm. For instance, in “Promoting Open Access: Developing New Strategies for Managing Copyright and Intellectual Property,” (2002) Mary Case argues that the current intellectual property regime in academic publishing works against library goals. The promotion of an open access model that lowers the barriers to scholarly information is an area that Case promotes for the ARL (Case, 2002). In the Canadian environment, the Canadian Association of Research Libraries (CARL) is also focusing on open access issues, with its mission statement focusing on long-term programs in the areas of information policy, resource sharing, and scholarly communication (CARL, 2005). This increasing advocacy for open access publishing models will be important when analyzing the case study, as this particular academic library also develops open source journal publishing software.

The open access model of scholarly publishing has also been endorsed by IFLA. For instance, through the “IFLA Statement on Open Access to Scholarly Literature and Research Documentation,” (2003), IFLA recognizes the importance of open access models for a wider dissemination of scholarly information, particularly to combat inequities in information access. This statement includes language affirming that “comprehensive open access to scholarly literature and research documentation is vital to the understanding of our world and to the identification of solutions to global challenges and particularly the reduction of information inequality” (IFLA, 2003).

This brief exploration of some of the literature focused on academic libraries and the challenges they face in the future highlights a transformation of roles. Two significant role transformations include an expansion of technological innovation, and an intensified research and educational mission. The role of technological innovation is of particular interest to this study, but at this point, it will be helpful to contextualize these expanded technological roles in the context of libraries and their information age and technological discourses.

1.2.4 Libraries, Technology, and their Information Age Discourses

Since this dissertation focuses to a large extent on library technology, some background on categories of library technology and technological discourses in libraries would be useful. To some degree, libraries have always been using technology, with various “paper technologies” utilized in the pre-ICT era (M. Buckland, 1992). However, with shifts in technology and the growing importance of electronic information, the “library of the future” is increasingly being viewed as the “electronic library.” The role of information technology in libraries spans a wide range of functions, and it is instructive at this point to discuss some basic areas of library technology.

John Burke (2001), in the *Neal-Schuman Library Technology Companion: A Basic Guide for Library Staff*, discusses some major categories for understanding library technology. According to him, some categories for describing library technology include: 1) computer workstations; 2) library automation systems; 3) networking and communications technology; 4) the Internet; 5) electronic library resources; 6) methods for storing information; 7) adaptive and assistive technology; and 8) technologies for

education and instruction (Burke, 2001). However, as Buckland (1992) points out in *Redesigning Library Services: A Manifesto*, paper technologies, including books and card catalogs, have played a role in libraries from the beginning. While the paper library utilizes technology for information access to populations, it also has limitations for access. Information technology in the context of the electronic library can overcome some of these limitations by some of the features it provides, such as compact storage, ease of reproduction, remote access to full text, hypertext, and more sophisticated information searching (M. Buckland, 1992). While ICTs are not the only defining characteristic of modern libraries, the abilities they have for extending and re-envisioning library services for communities are important.

Given this range of library technologies, and for the purposes of this dissertation, it is useful to focus on library technologies with implications for information access to user communities. The availability of often free Internet access in public libraries, for instance, is often discussed as an important tool in addressing the “digital divide” (B. P. Lynch, 2002). Various community technology initiatives in libraries are also being promoted by organizations, such as the Bill and Melinda Gates Foundation. This organization has donated computers to public libraries and provided grant support to library community technology projects through its U.S. Libraries and Global Libraries programs (Gates Foundation, n.d.). Projects considered to be innovative that address information access and development goals, such as the development of rural libraries in Nepal and a nationwide library-based program for Internet access in Chile, have received funding from the foundation (Bill and Melinda Gates Foundation, 2007). I bring up these

examples not as idealized models of library community technology development. Rather, my intention is to illustrate how the library is increasingly being envisioned a center of focus for community technology development in terms of international development and foundation aid.

Public libraries are also involved in the development of community information networks focusing on developing computer and Internet skills and serving the information needs of non-profit agencies, for instance (Durrance, 2005). In terms of academic libraries, involving and participatory technologies are allowing for more interaction with users, especially in the case of digital reference services. The electronic library is also the “virtual library” and efforts have been underway in academic library and public library settings to more effectively *bring* the library and its services to virtual users.

While it is important to understand the role of technology and community technology initiatives in libraries at an institutional level, it is also useful to look at some of the meta-discourses about information and technology in the field. Writing in the context of public libraries, in *Civic Space/Cyberspace* (2001), Redmond Kathleen Molz and Phyllis Dain analyze the roles and visions for libraries in the information age. While writing with reference to American public libraries, however, much of what Molz and Dain discuss is directly applicable to different types of libraries. Their work is at the center of a long-standing debate concerning libraries and technology – while the relationship between libraries and information technology goes back several decades, the increased prominence of the Internet in the last decade has intensified this debate. The

authors acknowledge the importance of the Internet and other information technologies for libraries, but are not fully convinced that technology is *the* driving force in public libraries today (Molz & Dain, 2001). Rather, they argue that technology is one of the driving forces in libraries, but values predominantly define the public library – they cite the value of the public library as a hallmark of a democratic society, as a community-based institution ensuring the public’s right to know and a defender of the free life of the mind (p.185).

This discussion about values reflects back to an earlier discussion – ideas of service and access remain central to missions of both public and academic libraries. In the context of the information age, however, the authors do point out the more prominent role for libraries in the evolution of the national information infrastructure – as both providers and consumers of information, as public access points to the information infrastructure, and as responsible agents for the protection of the public interest in access to information (p.168). Thus, the discourse of information and its access has become central to the roles of libraries as well. This discourse of information, moreover, is deeply related to information and communication technologies (ICTs).

The increasing information discourse of libraries is discussed in *Librarianship and the Information Paradigm* (1997), where Richard Apostle and Boris Raymond present two distinct trends in traditional library discourses – the “library service paradigm” and the “information paradigm.” These paradigms are juxtaposed to represent two oppositional modes of thinking in the library world (Apostle & Raymond, 1997). Writing largely in the context of Canadian libraries, these authors see the information

paradigm related to the narrow context of “professional information managers” and “information work” that does not fully take into account many of the non-information related work of libraries. They disagree with the idea that librarians can be equated with professional information managers, and see discourses such as the information society contributing to the convergence of the information and library service paradigms.

Apostle and Raymond mention literacy education, conservation of texts, and readers’ advisory, for instance, as library activities that are not traditionally defined as “information” activities. They are concerned that discourses of the information society, information technology, and the information economy have obscured the traditional service ethic of libraries. The tension that these authors mention is part of an on-going struggle to define the roles and ethics of libraries in an age of information technology. Despite their misgivings about the dominance of the information paradigm in libraries, however, information (and its relation to the information society) has become the dominant professional discourse of libraries.

In addition to Apostle and Raymond (1997), Walt Crawford and Michael Gorman (1995) decry what they see as an over-emphasis on the latest technological trends affecting the field, what they call a “madness of technolust.” These authors feel that the discourse of technology and “techno-enthusiasts” has affected the profession in a negative way. On a similar note, John Buschman (1993), in *Critical Approaches to Information Technology in Librarianship*, discusses what he sees as a troubling trend in which information technology in libraries is increasingly linked to an entrepreneurial spirit. In this scenario, libraries can potentially shift from a role of public service to a

type of business approach in which they are competing with private information service providers for “clients” (Buschman, 1993a). Related to these ideas, the discussion now shifts to some of the aspects of the dominant information society vision that are directly affecting libraries.

1.2.5 The Information Society: Determinism and Commodification

Information society policy and ideology, as discussed earlier in the chapter, is a contested terrain in the context of globalization. The information society concept has a long history, and in WSIS, it has been linked with the worthy goals of building an inclusive world that turns the digital divide into “digital opportunities” and “respects and reaffirms all parts of the Universal Declaration of Human Rights” (WSIS, 2005). This utopian vision of the information society sounds admirable, but several critics find fault with a construction of an information society that is rooted in technological determinism, global capitalism, increasing corporate power over media and information content, and economic globalization (Webster, 2002). The information society is a discourse that is highly politicized, and may not serve library public service goals in the long run. The rest of this section focuses on two major areas for concern in the information society debate for libraries – technological determinism and information commodification.

Technological determinism, in this case, refers to a concept that reduces complex social and economic problems into technological ones (Warschauer, 2003). This conceptual framework makes technology the sufficient or necessary condition for social change, and ignores other social, cultural, political, and economic factors (Gunkel, 2003). Technological determinism oversimplifies the relationship between technology and

society, and is often not an adequate explanation for social change (Gunkel, 2003). Alternative socio-cultural factors can account for technological change, and are pushed into the background as causal factors.

Why should technological determinism be of import to this discussion? For instance, the technological “fetishism” (Pyati, 2005) that permeates the ICT-heavy vision of WSIS obscures some of the cultural, democratic, and public space functions of libraries. In addition, libraries are mentioned mainly as access points to technology in the WSIS documents (Pyati, 2005). The other cultural, social, and educational aspects of libraries are reduced to purely technological concerns and access to ICTs. An opening exists for re-framing this technological and neo-liberal discourse to the advantage of library service goals, and this will be a focus of the theory development component of the study.

In addition to the concerns raised previously – technological determinism, policies of deregulation and privatization, expansion of capitalist market ideologies, etc. - a variety of other related information society issues have a direct bearing on libraries. A couple of these factors include the commodification of information and the realities of economic globalization. The ideology of neo-liberalism, for instance, has become associated with dominant forms of globalization. In *The Terror of Neoliberalism* (2004), Henry Giroux offers a strident critique of neo-liberalism, what he describes as a virulent and brutal form of market capitalism (Giroux, 2004). He further describes this phenomenon as:

Wedded to the belief that the market should be the organizing principle for all political, social, and economic decisions, neoliberalism wages an incessant attack on democracy, public goods, and noncommodified values. Under neoliberalism everything is either for sale or is plundered for profit (p. xiii).

Given the confluence of neo-liberalism and information society ideologies, the commodification of information and privatization of library services naturally follows from this logic.

Commodification of information is certainly not a new debate, but has an undeniable importance in the context of the information society. For instance, in “From Culture to Information and Back Again: Commodification as a Route to Knowledge,” (1994) Dan Schiller discusses - in contrast to claims of post-industrialists such as Bell whereby the value of information rests on its qualities as a resource - that the value of information instead stems:

uniquely from its transformation into a commodity – a resource socially revalued and redefined through progressive historical application of wage labor and the market to its production and exchange (p. 41).

In addition, he insists that the information commodity has become the prime site of contemporary expansion within and for the world market system (Schiller, 1994). The context of commodification is important to understand the threats to values of free, unrestricted access to information that lie at the heart of certain library ethics. Commodification of information can be related to the market ideologies of dominant visions of the information society.

In terms of economic globalization, the context of global capitalism is an inevitable part of this discussion. The information society, as a dominant discourse, has links to larger features of capitalist, transnational globalization. This link can certainly be studied further, but the information society of WSIS and the EU can be reasonably conflated with larger movements in transnational globalization. Transnational globalization is intimately linked with organizations, such as the World Bank, International Monetary Fund, and World Trade Organization (WTO).

In order to understand how the greater context of transnational globalization can directly affect libraries, a brief overview of the WTO's potential impacts on libraries will be useful. The WTO, as the major promoter of "free trade" in the global economy, is one of the prime agents and advocates for free-market and neo-liberal ideologies (Rikowski, 2005). In *Globalisation, Information, and Libraries* (2005), Ruth Rikowski discusses two provisions in WTO that can have a potential impact on libraries – the General Agreement on Trade in Services (GATS) and Trade Related Aspects of Intellectual Property Rights (TRIPS). In terms of GATS, Rikowski states that:

The GATS concerns the liberalisation of trade in services, thereby placing more and more service sectors in the marketplace. As such, it threatens public services in general and the state-funded provision of libraries in particular (p. 35).

This statement is at the center of Rikowski's warning to the library profession – namely, that GATS has the very real possibility of accelerating the privatization of library services. With regard to TRIPS, the immediate consequences for the library profession are not as clear as with GATS; however, a strengthening of global intellectual property

regimes has the potential to favor ownership rights over access to information rights (Rikowski, 2005). Though not happening on a large scale currently, possibilities exist for country governments to “outsource” library services to private companies (Rikowski, 2005). With this scenario, the confluence of information commodification and economic globalization can result in a radical transformation of libraries on an international scale. This possibility, moreover, is not such a distant possibility, as Rikowski warns us.

1.2.6 Critical Theory: Useful Insights and Frameworks

Given this context of the information society and neo-liberal globalization, the intervention of critical theory for the development of alternatives and forms of resistance is important. Critical theory in this study is defined largely in terms of the Frankfurt School of critical theory, which has a specific historical development and trajectory. In this context, the Institute for Social Research (the first Marxist-oriented research institute in Germany), founded in 1923 in Frankfurt, Germany and composed largely of German-Jewish intellectuals, is of fundamental importance. This institute, during the time of its most influential director, Max Horkheimer, attempted to revise both the Marxian critique of capitalism and the theory of revolution in order to address those new social and political conditions which had evolved since Karl Marx’s death (Bronner & Kellner, 1989). The term *critical theory* did not emerge until 1937; however, after the majority of the Institute’s members had immigrated to the United States after Hitler’s victory, the term stuck and was used to define the general theory of contemporary society associated with Max Horkheimer, Herbert Marcuse, T.W. Adorno, Leo Lowenthal, and Frederick Pollock (Bronner & Kellner, 1989). The term represented a “code” of sorts, which belied

its roots in Marxist social theory, particularly in a time of increased hostility to socialist-inspired academic and political projects (Kellner, 1989).

Critical theory, in a general sense, is a form of normative social theory that is concerned with progressive social transformation and change, an interrogation of power dynamics in society, the connections between theory and politics, and a focus on the emancipation of those who are oppressed. Critical theory is distinguished from traditional, mainstream social theory through its multidisciplinary perspectives, its attempts to develop a dialectical and materialist social theory, and its goals for socio-political transformation (Kellner, 1989). In this particular study, critical theory is highly relevant to a critique of technocracy, techno-capitalism, and technological instrumentalism and determinism within libraries. Critical theory offers a multidisciplinary approach to society which combines perspectives drawn from political economy, sociology, cultural theory, philosophy, anthropology, and history, and offers an antidote to the often non-critical quantitative approaches within contemporary social science (Bronner & Kellner, 1989). Critical theory is open to development and revision and offers a well-articulated standpoint for thematizing social reality, but is not a single doctrine or unified worldview, but is rather a set of basic insights and perspectives (Bronner & Kellner, 1989). Emancipatory concerns within the context of oppressive socio-economic, political, and ideological conditions are at the heart of critical theory, based on a privileging of the freedom and autonomy of the individual.

The original critical theorists associated with the Institute never came up with a comprehensive social or revolutionary theory, but instead offered a set of “critical

visions” regarding the mutable character of history, society, and the future, with an emancipatory intent (Bronner & Kellner, 1989). These critical visions attack the conformity and materialism of mass society. It is only later in their work, though, that members of the Institute would take a more critical stance on the role of science, technology, and the notion of progress with which bourgeois society identified (Bronner & Kellner, 1989). This focus on technological rationality and logics is of prime importance to this dissertation research, as a critical theory of library technology is one such “critical vision.” Critical theory’s interrogation of techno-capitalism is of growing importance, mainly because of the increased prominence of culture, technology, media, information, knowledge, and ideology in more domains of social life (Kellner, 1989). Critical theory, through a dialectical process, can expose some of the contradictions and tensions in modern technocapitalist society, while providing progressive alternatives and liberatory possibilities.

However, in the fields of library and information science and librarianship, critical theory, in the tradition of Marx, Gramsci, Lukacs, and Marcuse (to name a few), is nearly absent. In particular, the work of Herbert Marcuse is highly pertinent to the development of library-based alternatives to dominant visions of the information society. It can be argued that Marcuse, of all the critical theorists of his generation, was the one who most systematically attempted to relate theory to politics and contrasted critical perspectives on the current social order with those of an emancipated future (Bronner & Kellner, 1989). Marcuse’s focus, for instance, on “technical rationality” as a tool of domination in *One-Dimensional Man* (Marcuse, 1964) is a useful construct for

understanding how discourses of information technology are being used to perpetuate modernist notions of information and capitalist logics of consumption in the library domain. Information science (IS), with its positivist, apolitical logic of processes, such as “information retrieval” and “information access,” is itself a creation of a post-World War II information revolution that is part of a larger political process of scientific modernism (Day, 2001). Much of the information revolution rhetoric from which IS derives its current increased sense of importance is based on what Webster calls “technocapitalism” (Webster, 2002).

Critical theory is especially useful to interrogate techno-capitalism (Kellner, 1989). In an information society that is increasingly being defined by capitalism, critical theory, as a theory of society grounded in a theory of capitalism (Kellner, 1989), is highly relevant as a tool of analysis. Critical theory investigates the mediations between different spheres of life, as well as the contradictions between these spheres, producing a “mediated totality” (Kellner, 1989). The contradictions are part of a dialectical tension, which can open up new possibilities and emancipatory alternatives. For instance, Marcuse’s vision, though scathing in its critique of technological society, offers hope in the dialectical process, as it “involves consciousness: recognition and seizure of the liberating potentialities” (Marcuse, 1964, p.222). In this particular context, contradictions and tensions exist between the potential for libraries to become further involved in a capitalist vision of an information society, and the potential for libraries to create democratic and progressive visions of an information society. In particular, Feenberg’s critical theory of technology (Feenberg, 2002) is discussed in later chapters as

a framework for developing a critical theory of library technology. It is argued here that critical theory has a particular relevance and salience to the study of the information society and libraries, and that any field that claims to study the creation, use, classification, and access of information simply cannot ignore the larger socio-political critiques of modern, technological society that critical theory, and especially Marcuse, proposes.

The growing commercialization of the Internet, and apolitical, “neutral” understandings of “information access” and “information retrieval” attest to the problems Marcuse describes. Marcuse’s vision and critical theory in general can help libraries in an information society embrace the notion of a critical theory of information and technology, in which centrist, liberal tropes like “democracy” take on a more progressive character.

1.2.7 Open Source Software and Libraries

The open source software movement is useful to examine as a case of a community-driven, progressive movement to define an information society. While other grassroots technology movements exist (blogs, wikis, community radio, etc.), open source software is a sustained grassroots technology movement with an international following and community, and is often linked to alternative, community-driven visions of an information society. For these reasons, the open source software movement in libraries presents an ideal model to study in this dissertation.

The open source movement has been gaining momentum for several years, and is dedicated to a notion of “free software” that makes software source code freely available

to the public. In contrast to proprietary software development, open source software development is grounded in the notion that when source code is open, programmers can read, redistribute, and modify the source code for a piece of software, thus helping the software to evolve (OSI, 2005b). The Open Source Initiative (OSI) is a non-profit corporation that manages and promotes open source software initiatives and also serves as a “quality seal” for certifying the open source nature of software products. OSI also maintains what it calls the “Open Source Definition,” which defines open source software according to the following criteria: 1) free redistribution; 2) open source code; 3) allowance of derived works; 4) acknowledgement of the integrity of the author’s source code; 5) no discrimination against persons and groups; 6) no discrimination against fields of endeavor; 7) free distribution of licenses; 8) license must not be specific to a product; 9) license must not restrict other software; and 10) license must be technology-neutral (OSI, 2005a).

The basic logic of the open source movement is the chance for more developers to have access to software code, which will allow more successful and “bug-free” software to be developed. The open source movement, however, is also part of a larger political movement addressing the intensification of copyright law in a stage of advanced capitalism. In *Free Software, Free Society: Selected Essays of Richard M. Stallman* (2002), the notion of “free software” is juxtaposed with open source software. Richard Stallman, a computer programmer who began his work at MIT, is the main founder of the free software movement. The main distinction he makes between the free software movement and the open source movement is in the value differences between the two

movements – he states that for the open source movement, the issue of whether software should be open source is a practical question and not an ethical one, whereas for the free software movement, open source is more of an ethical question which is part of a broader social movement (Stallman, 2002).

He notes that the two movements disagree on basic principles, but agree more or less on the practical recommendations, as proprietary software is their common enemy (Stallman, 2002). The definition of free software that Stallman advocates is a much broader political statement than the open source movement. The idea of “free” is not necessarily an economic argument, but is rather tied to the concept of “freedom,” which he states is the users’ freedom to run, copy, distribute, study, change, and improve software. This argument is related to individual liberties and rights arguments, and he defines four kinds of freedom for the users of software: 1) The freedom to run the program, for any purpose; 2) the freedom to study how the program works, and adapt it to one’s needs; 3) the freedom to redistribute copies (free or for a fee) to help one’s neighbor; and 4) the freedom to improve the program, and release your improvements to the public, so that the whole community benefits (Stallman, 2002).

The work of Lawrence Lessig is also important in understanding the terrain of copyright and intellectual property in the digital domain. In *Free Culture: The Nature and Future of Creativity* (Lessig, 2004), Lessig offers a follow-up on his book *Code: And Other Laws of Cyberspace* (Lessig, 1999). Much of Lessig’s arguments center on the idea that software code functions as a kind of law in today’s digital world – and access to code should be a fundamental part of democracy in the digital domain. He is concerned

with the extension of copyright and intellectual property laws that serve to stifle creativity and increase the concentration of power produced by concentrations in ownership in the digital world (Lessig, 2004). He promotes the idea of a “free culture,” which is not necessarily a culture without property, but is the opposite of a permission culture in which creators get to create only with the permission of the powerful, or of creators from the past. This free culture is a balance between anarchy and control, and avoids the extremism in property rights that he sees exemplified in today’s intellectual and digital copyright protections. The open source and free software movements fit into this framework of free culture, as they are at the heart of an advocacy effort to make the creation of digital culture as democratic and “free” a process as possible. These movements are also part of the agenda of activist organizations based in the global South that are focused on re-framing the information society to focus on the communication rights of marginalized populations (CRIS, 2005). Chapter 4 covers in more detail the open source and free software movements, and will explore their relation and intersection with libraries.

Libraries around the world have also begun utilizing open source software to help develop some of their services. An active open source library community exists, with groups such as OSS4Lib and Code4Lib serving as clearinghouses for various library open source projects (Oss4Lib, n.d.). Open source software is now being considered as a viable alternative to the often expensive proprietary library automation systems. For instance, a major open source software suite available for libraries is Koha. Koha is the first open source integrated library system (Koha, 2005), allowing libraries to have free

access to library automation software. The software is free, and follows the guidelines of the open source General Public License (GPL). Developed in New Zealand by a company called Katipo Communications Ltd, the software now has been adopted in several libraries around the world. For instance, in New Zealand, the Horowhenua Library Trust has implemented the Koha open source software, as well as the Nelsonville Public Library in Ohio.

Some of the major benefits reported by these libraries include major cost reductions and flexibility in the adaptation of the software to local needs (WebJunction, 2005). The Nelsonville, Ohio library is utilizing the Koha software for the following functions: 1) an online public access catalog (OPAC) of the library's holdings; 2) a database of library users; 3) issuing books to borrowers and returning books to the collection; 4) borrower requests for library items; 5) orders from vendors; 6) book budgets; and 7) transfers between library branches (WebJunction, 2005). However, as exemplified in the Nelsonville experience with open source software, this type of software is not always “free,” as it includes investments of time, labor, and technical knowledge. Thus, open source software is an option that has its pros and cons, a fact which will be important in the in-depth case study analysis.

While the open source software and library worlds are beginning to converge, the open source and open access movements are also ripe for convergence. Mentioned earlier in the literature review, the open access model has been associated with open access publishing, but not necessarily open source software. For instance, in “The unacknowledged convergence of open source, open access, and open science,” John

Willinsky (2005) is concerned with ways the open source, open access, and open science movements can complement and reinforce each other. This convergence, however, has not been widely acknowledged or understood yet. Citing the commonalities between these various “open” movements, he conceives of more democratic access to knowledge in university contexts which reflects an “open” approach to intellectual property (Willinsky, 2005b). He argues that universities “re-entering the world” with the intent to “serve the world” would do well to support faculty participation in open access archives and journals (Willinsky, 2005b). Willinsky’s article sets the context for the case study, in which both the open access publishing movement and the open source software movement are converging, with the nexus being the academic library of the case study. This open access-open source dynamic informs the analysis of the case study.

1.3 Research Questions

The research questions of this study follow from the concerns and issues presented earlier in this chapter. Specifically, the exploration of critical theory and critical theory of technology, and the examination of the case of open source software and libraries inform the research questions, which are the following:

- A. What are the dimensions of a critical theory of library technology that can advance library public service goals and develop an alternative vision of an information society?
- B. How can a critical theory of technology be applicable for libraries in defining and developing an information society? Can this framework advance a public

service ethic of libraries in an environment of increasing privatization and commodification of public services?

- C. Are open source and open access software initiatives a route for libraries to reclaim and shape ICTs for enhancing public service missions?
- D. What are some of the institutional and economic constraints that can hinder library-based development of open-source applications?
- E. What lessons does a case study of a library developing open source and open access initiatives in Canada show us about the potential to re-shape technology for democratic ends? What are some preliminary best practices we can identify in relation to library open source software development?
- F. Are there particular factors about a Canadian library culture (institutional or professional) that are promoting open source software development? Do these factors affect how libraries can utilize a critical theory of technology?
- G. What lessons can be learned from this Canadian case to help build and refine a critical theory of library technology? What does the test case tell us about the applicability of the theoretical framework as a mode of analysis?

These research questions are addressed throughout the dissertation, both implicitly and explicitly. Questions A and B are addressed in Chapter 3, “A Critical Theory of Library Technology.” Chapter 4, “Open Source Software in the Context of Libraries,” deals with questions C and D, which are specific to the open source movement in libraries. Chapter 4 also begins to address question E, with Chapters 5 and 6 addressing it as well. The last two questions are addressed in Chapters 5 and 6, while

Chapter 7, “Conclusion and Areas for Future Research” revisits all the major questions of the study.

1.4 Significance of Research

This study is significant in that it applies critiques of the information society to discourses of librarianship, utilizing critical theory to develop a critical theory of library technology framework. Critical theories of technology are rarely applied to the context of library technology. As a major critical theory-informed study, this research adds to the small, but important area of critical theory work in LIS. Critical theory in this study helps to shift the discourse of power in libraries, presenting new democratic models of engagement that emphasize community input and participation in the development of library technology.

This framework development and examination of the open source software movement in libraries can help aid libraries in the United States and other countries in developing strategies to combat some of the privatization ideologies of the information society and to create library-centered visions of an information society. In addition, this research is one of a few studies to analyze the uses of open source software in libraries, while developing a framework in the process. By looking at open source developments in a Canadian academic library, particular features unique to a Canadian library environment may also be studied for their potential lessons and applicability to libraries in the United States and elsewhere.

This research is unique because it is developing a theoretical understanding of the information society and library technology debates at an institutional level. Despite

perceptions that theory development does not often take place in library and information science, this is not necessarily the case (Pettigrew & McKechnie, 2001); however, many theories developed in LIS are not in the tradition of critical theory, and this study is an exception to this trend. The methodological technique consists of developing a theoretical model, and exploring this model in light of a model case. The theoretical framework, as discussed in the following methodology section, is multi-dimensional. This research serves as a test case in developing critical theoretical arguments that can inform institutional actions in the context of a global information society. A goal of the study is to help information institutions and policy actors to think critically about the social, political, ethical, economic, and cultural aspects of “building” an information society. Different elements of the theoretical framework developed here can be applied to other institutions, communities, and technological developments. This study is part of a larger research agenda that critically examines information practices in communities and institutions, while proposing theories of reflection and action that can offer more democratic and progressive goals.

On an institutional level, this research will be important for library administrators and the library community in general. Library administrators and professionals can use lessons and models developed from this research to help them utilize technology with user-centered and open approaches in mind. In addition, software developers and systems librarians may be interested in ways to use this research to develop innovative technology partnerships with a public service mission. On a larger scale, national governments might be able to incorporate progressive technological strategies proposed

in this research into national information policies that utilize libraries in democratic ICT development plans.

1.5 Limitations of Research

This research builds and explores the application of a theoretical model, and the nature of this particular approach has certain limitations. For instance, case study research has both a wide and an in-depth approach, but this method does not lend itself to wide generalizability of the results, particularly with the library open source best practices research. The insights gained in this case are specific to this particular case itself, and applicability to other cases needs to be inferred or hypothesized. The research goals in this study are less about making wide generalizations from the study, and are rather more about developing a model and framework for a broader research agenda.

Another limitation is the choice of the in-depth case study. The focus of the case study is an academic library, and certain differences exist between the goals of academic and public libraries. Much of the information society and library technology discourses, from which this study takes its impetus, are based in a context of public libraries. Thus, a basic limitation is the reliance on an academic library as a case study in a theoretical argument that is rooted in some of the discourses of public libraries. To overcome this limitation, I have emphasized the service-based nature of public and academic libraries. In addition, the context of open source software development applies both to public and academic libraries, with public libraries utilizing open source software as well. In the context of academic libraries, the spiraling cost of scholarly electronic publications and commercial vendor control of library technology are realities of the “information

society.” Other technological choices and actions will be different in the context of public libraries, according to the different set of issues and environments that they face. Thus, the flexibility of the theoretical model is a potential way to overcome this limitation.

Finally, the development of the theoretical model is a choice that depends on the one developing the framework. Although the author has cast his net wide, the dimensions of what to include and examine depend to a large part on his analytical lens and judgment. Any approach that builds a framework and model for analysis will thus inherently have bias. The use of critical theory as a method is by its very nature a normative project.

Chapter 2: Methodology

2.0 Case Study Methodology

This research utilizes a case study methodology. Case studies focus on one or a few instances of some social phenomenon (Babbie, 2004). Case study is by definition the in-depth study of a particular case, and the case study forms an object of study of a particular social phenomenon (Hamel *et al.*, 1993). This method is in complete harmony with the three key concepts that characterize any qualitative method – describing, understanding, and explaining (Hamel *et al.*, 1993). While focusing on a specific topic of inquiry, this method also has qualities of generalizability. The generalizability and validity of the case study method is based on:

(a) the quality of strategies selected in defining the object of study and in the selection of the social unit that makes up the ideal vantage point from which to understand it; as well as (b) the methodological rigor displayed in the description of this subject in the form of a sociological analysis that can be understood in action. This analysis must therefore be properly reproduced to test its generality through other cases selected on the same object of study and that incorporate the same strategic qualities, so that it may be understood. (Hamel *et. al*, 1993, p.40).

The case study method thus is a rigorous qualitative method. The important question to ask in any case study design, however, is “What is it a case of?” (Walton, 1992). In this study, it is a case of the open source movement in libraries, with an in-depth case study of a Canadian academic library (Simon Fraser University Library) developing open source software applications. Thus, the case study operates on two

levels – the overall case of open source in libraries and the in-depth case study. The choice of an in-depth case study allows for a more intimate and detailed analysis of a library open source project at an institutional level.

Theory is also an essential and implicit component of the case method (Walton, 1992), and in this particular study, a critical theory of library technology framework was developed and explored in relation to the in-depth case study. The advantage of the case study method for this particular study is the ability to develop a foundation for understanding the applicability and usefulness of a critical theory of library technology framework as a mode of analysis.

The role of the case study in this dissertation research is to serve as an introductory example for the application of the critical theory of library technology framework. Thus, the case study of open source software in libraries is a test case to help explore the dimensions of the framework, and to lay the groundwork for future studies of library technology. The validity of the model and framework, however, does not rest on the case of open source in libraries or the in-depth Canadian case study, since the dimensions of the framework are developed in the context of the dialectic of library technology, which is discussed in more detail in Chapter 3. The case study, however, can provide preliminary insights into the applicability of the framework, with future studies of library technology helping to refine the framework.

2.1 Model/Framework Building and Testing – Critical theory of library technology

The framework-building portion of the study relies on critical theory as a method. Critical theory is intrinsically global and historical, and attempts to provide the “big

picture” that portrays the fundamental outlines of socio-economic development and the ways in which the vicissitudes of capitalism structure social life and can in turn be replaced by a socialist society (Kellner, 1989). Thus, in utilizing critical theory as a method, this component of the study looks first at the totality and “big picture” of libraries and their relationship to an information society, and then examines the social, political, economic, cultural, and institutional dimensions and layers of this relationship. This study utilizes dialectical research to move from an examination of a whole to a particular part (Ollman, 1993), with the part in this research being the open source movement in libraries and the in-depth case study of Simon Fraser University (SFU) Library. With dialectical research, “one starts with the whole, the system, or as much of it as one understands, and then proceeds to an examination of the part to see where it fits and how it functions, leading eventually to a fuller understanding of the whole from which one has begun (Ollman, 1993, p.10). Thus, starting with the totality of libraries and the information society, the study looks at a particular case, and then uses this analysis to develop a fuller and richer theoretical framework.

This study develops a theoretical framework and model by analyzing and synthesizing strands of critical theory and technology studies, as well as social informatics and community informatics. The development of the framework also relies on critical theory as a method. Chapter 3 utilizes this method – by exploring the determinist and technophobic elements in the library technology debate, contradictions and openings for progressive theorizations are opened. Critical theory exposes the social character of technology (Feenberg, 1999), as technology can be shaped by social forces

and is not set on a pre-determined course. This indeterminacy allows for social and democratic forces to shape the future of ICTs and the future development of the Internet, for instance. Through this indeterminacy and the openings created by critical theory of technology, libraries and other social institutions can play a significant role in shaping technology for more democratic and progressive goals.

The critical theory of library technology framework draws particularly from Feenberg's critical theory of technology. This component of the study explores how a critical theory of technology orientation can be applied to the library context. Feenberg argues against technological determinism, and the idea that technology is a "neutral tool." Technology in this construct is not neutral, but rather embodies the values of a particular industrial civilization and of technocratic elites that promote this technology (Feenberg, 2002). Technological rationality also often becomes political rationality, reinforcing technologically mediated solutions that reflect dominant political and economic interests (Feenberg, 2002).

Feenberg's critical theory of technology is a "radical philosophy of technology" that seeks a democratization of technology and technically mediated institutions of society (Feenberg, 2002). While technology is value-mediated and not neutral, a certain "ambivalence" exists in technology, an indeterminacy that allows for it to be shaped by social forces (Feenberg, 2002). Thus, while technology reflects dominant political and economic interests, potential exists for technology to be shaped for democratic ends.

The relevance of Feenberg's critical theory of technology to libraries lies in the ambivalence of technology – while libraries are discussed in WSIS as merely access

points to technology, for instance, libraries can also be envisioned as active *shapers* of technology for democratic and progressive ends. This form of technological activism reflects a shift in orientation that envisions libraries as active agents in shaping technology for democratic ends and contesting ideologies of commoditization, privatization, and technological determinism. Thus, libraries themselves display “ambivalent” tendencies, and can be shaped either to reinforce dominant information society visions or progressive visions. This critical theory of technology orientation can help in separating the ideologies of the information society from the discourses of technology. While the information society of WSIS and other dominant discourses “package” together the ideologies of privatization and deregulation with ICTs, critical theory of technology posits that this does not have to be the case. The discourse of ICTs does not have to necessarily be part of a neo-liberal ideology, but can serve more progressive aims, particularly in democratizing access to information and knowledge. Libraries, in becoming active developers and shapers of ICTs for democratic and progressive ends, may help to combat some of the hegemony of the dominant information society.

The development of the framework emerges out of the contradictions exposed in the first part of Chapter 3. Using Feenberg’s critical theory of technology as its base, the critical theory of library technology framework addresses the dialectic of technology within the context of libraries. In response to the specific contradictions and knowledge voids plaguing models for library technology development, I argue for the relevance of other frameworks, in addition to critical theory, drawing from the areas of media and

technology studies, and social and community informatics. These areas of study form the “foundations” of the critical theory of library technology framework. Out of the unique perspectives of these foundations, levels of impact, orientations, and dimensions of analysis emerge. These dimensions of analysis address library technology discourses and development at the levels of: 1) policy and advocacy; 2) individuals and community; and 3) systems and institutions. The critical theory of library technology framework is thus a conceptual tool for understanding and reflection about what democratization means in the context of library technology, a tool for re-envisioning the roles of libraries in the information society, and an analytical lens for examining library technology development.

With the development of the framework, instances of library technology development are needed to begin exploring the application of the framework. Technological alternatives and demonstrations of a critical theory of library technology perhaps may be found in the open source software movement, whereby libraries may utilize and even develop open source software to provide creative technological services to their service communities and promote progressive, democratic access to knowledge and information. The case study component of the study, spanning Chapters 4, 5, and 6, explores this area in more detail, as well as some of the technological, economic, social, institutional, and political factors that affect library open source software development.

2.2 Description of the In-Depth Case Study

Simon Fraser University (SFU) is located in British Columbia, Canada, in the greater Vancouver area, with a main campus in the city of Burnaby, and two other

campuses in Harbour Centre (downtown Vancouver) and Surrey. SFU is a comprehensive university, offering a diversity of academic, interdisciplinary, and professional programs to a student population of approximately 25,000 students (SFU, 2005a). The university is currently over forty years old, having been established in 1965. SFU, in fact, was born in a period of ferment and flux, in the context of the Civil Rights movement and the Vietnam War, which lent support to its label as a “radical university” (Johnston, 2005). In addition, SFU was promoted from its beginning as an open and innovative university (Johnston, 2005). While the “radicalism” of SFU has been tempered over the years, the fact that the university views itself as an innovative institution may have some bearing on the case study. Specifically, it remains to be seen if this innovative ethos of the larger institution is manifested in the library as well, especially since the library is a leader in the development of library-specific open source software products.

SFU Library serves its university communities through the main Bennett Library on the Burnaby campus, the Belzberg Library on the Harbour Centre campus, and the Surrey Library on the Surrey campus. The library serves its academic community through a variety of ways, including collection development, reference services, library research skills classes, online tutorials, and various other information guides on its website, <http://www.lib.sfu.ca>.

The main focus of this case, however, is on the unique service that SFU Library offers, which is open source software development. Under the heading, “SFU Library Projects and Initiatives,” on the SFU website is the link for *Software@SFU Library*.

This project, *Software@SFU Library*, is the focus of the case study. SFU Library has been an active developer and advocate for open source software solutions for libraries since the mid-1990s, and the library develops, supports, and coordinates the development of two software suites, the reSearcher suite and PKP suite (SFU, 2005b). SFU Library developed and implemented the reSearcher suite, an award-winning integrated set of open source tools for locating and managing electronic information resources, designed for use by students and researchers in academic libraries (SFU, 2005b). reSearcher components are Citation Manager, CUFTS, GODOT, dbWiz and the CUFTS Knowledgebase, and were developed with the support of the Council of Prairie and Pacific University Libraries (COPPUL) and the British Columbia Electronic Library Network (BC ELN) (SFU, 2005b).

COPPUL is a consortium of twenty university libraries located in Western Canada, in the provinces of Manitoba, Saskatchewan, Alberta, and British Columbia (COPPUL, n.d.-b). These libraries are part of four-year degree granting institutions, and COPPUL, like other consortia in the library community, uses the collaborative power of libraries for various resource sharing activities, such as electronic journal licensing, collective purchasing activities, and interlibrary loans. COPPUL receives tiered fees from its member libraries to support its activities. One of these activities that COPPUL took part in was the initial development of the reSearcher software.

reSearcher developed out of a joint meeting of the Directors' Group and Systems Group of COPPUL, during a meeting in January 2001 in Victoria, British Columbia (COPPUL, n.d.-a). A steering committee was formed, known initially as the Virtual

Western Canadian University Library (VWCUL) Steering Committee, which managed the development of reSearcher in its first few years. COPPUL member libraries can use reSearcher, and hosting and technical support services for the software (managed at SFU Library) are paid for through their annual membership fees. While COPPUL provided the initial impetus for the development of reSearcher, SFU Library's programmers are technically the "owners" of the software (as far as ownership has any substantive meaning with regard to open source software). Some reSearcher components are deployed through the aid of COPPUL, but SFU Library has also approached individual libraries within the consortium for the development of other products, such as dbWiz. In this development model, libraries within the consortium that want to use software pay a tiered fee depending on the library size, in much the same way as COPPUL membership fees are calculated.

BC ELN, in contrast to COPPUL, serves thirty post-secondary libraries solely in the province of British Columbia – including large university libraries, small colleges, junior colleges, and institutes (BC ELN, 2007 -c). In another contrast to COPPUL, BC ELN receives a large portion of its funding directly from the province of British Columbia, in addition to funding provided by partner libraries. Some BC ELN products and services include system-wide access to research databases through discounted site licensing; the development of union databases; online document requesting and rapid delivery services; and a virtual reference service (BC ELN, 2007 -a). In addition, BC ELN's core values and principles include collaboration, trust, innovation, leadership, and sustainability (BC ELN, 2007 -b). Related to BC ELN's interest in these core values and

in promoting equitable access to information throughout British Columbia, it collaborates with SFU Library in providing technical support services and training sessions for member libraries using reSearcher.

Citation Manager was developed in 2001 as a web-based, centrally maintained facility for users to create citation lists or bibliographies (Wade, 2006). In this regard, Citation Manager is similar to commercial online bibliographic management software such as RefWorks. While this software is being used by certain client libraries, SFU Library recently purchased RefWorks, and the future development of Citation Manager is in doubt. To address the issue of Citation Manager's future development, SFU Library had a report commissioned in June 2006 to explore issues surrounding other potential uses for the software (Wade, 2006). However, this report concluded that a re-development of Citation Manager for other functions would not be cost effective, and since the library now has RefWorks, any upgrades to the bibliographic management functions of the software would not be useful (Wade, 2006). Thus, Citation Manager's development is currently at a standstill.

The CUFTS and GODOT software deal in large part with the management of electronic collections. These two software packages are closely related, and are the most popular of the reSearcher software suite. CUFTS is a knowledgebase of over 375 full-text resources, and provides electronic resource management services, an integrated serials database, and MARC records (SFU Library, n.d.-a). Electronic resource management is a topic of great importance for academic libraries, as electronic resources (electronic journals, etc.) make up an increasingly large part of library collections.

Managing electronic resources is a complex issue, for when libraries acquire electronic resources from publishers or vendors, they must understand, record, transmit, and inform others about the many financial, legal, interrelational, and access aspects of these arrangements (Digital Library Federation, 2004a). The acquisitions and licensing process is complex, and the Digital Library Federation, a consortium of libraries and agencies working on electronic information initiatives, is working on developing a standardized solution for electronic resource management initiatives. At the heart of electronic resource management is the ability to centrally store data about the diverse resources in a library's collection, such as licensing terms, renewal dates, contacts, and more (SFU Library, 2006). SFU Library, based on the recommendations of the Digital Library Foundation's report on electronic resource management, is currently working on a re-design of CUFTS for enhanced electronic resource management functionality (SFU Library, 2006).

The CUFTS knowledgebase of electronic resources is maintained by SFU Library, and GODOT allows for full-text link resolving. In other words, GODOT is launched from a link embedded in a library's citation databases and provides direct links to full-text collections, such as electronic journals, using the CUFTS knowledgebase (SFU Library, n.d.-c). Link resolving thus provides a route to the full-text of journal articles from journal databases. The dbWiz software is what is called a "federated searching" tool, which provides library users with a single interface for searching a wide range of library resources and databases, and returns results in an integrated result listing (SFU Library, n.d.-b). dbWiz simplifies the often complex information searching process

in different databases by providing one search interface that can be used to search a wide range of databases.

The PKP software suite, on the other hand, is open source software that supports scholarly publishing and communication. In contrast to the reSearcher suite, the PKP suite is a development partnership with the Public Knowledge Project (PKP) at the University of British Columbia (SFU-UBC). PKP suite components are Open Journal Systems, Open Conference Systems, and PKP metadata harvester. Open Journal Systems (OJS) has been adopted worldwide as an online publishing platform by hundreds of scholarly online journals (SFU, 2005b). OJS has been recently recognized as a SPARC Leading Edge Project, and has received funding from Canada's Social Sciences and Humanities Research Council (SSHRC), the Max Bell Foundation, the Soros Foundation, the International Network for the Advancement of Scientific Publishing (INASP), and the MacArthur Foundation (Synergies, 2006).

The Public Knowledge Project at the University of British Columbia is the original developer of this software package, but a memorandum of understanding signed on January 14, 2005 made SFU Library the home for future PKP software development. This memorandum of understanding affirms the "SFU-UBC Partnership for Open Source Publishing Software Development." In this agreement, the Simon Fraser University Library and SFU's Canadian Centre for Studies in Publishing (CCSP) agreed to enter into a partnership with UBC's Public Knowledge Project (PKP) to support the maintenance and ongoing development of Open Journal Systems (OJS), Open Conference Systems (OCS), and the PKP Harvester (PKPH) (SFU-UBC, 2005). This joint venture will

involve providing a permanent home for this suite of open source software in the SFU Library (SFU-UBC, 2005). A major portion of SFU Library's activities will be in managing the development of the OJS, OCS, and PKPH software, with SFU Library Systems staff taking on this responsibility. SFU Library is committing \$21,000 Canadian annually to provide on-going systems management and support for the software suite, and will work both with PKP and CCSP to coordinate and support efforts to apply for research and development grants to ensure continuing support and development of PKP software (SFU-UBC, 2005).

The Public Knowledge Project is a leading voice in open source and open access models in scholarly publishing. The Public Knowledge Project is a project funded by the Canadian federal government, that is committed to expanding the realm of public education by improving social science's contribution to public knowledge, in the belief that such a contribution is critical to both the public use of reason and deliberative forms of democracy (PKP, 2005b). PKP is involved with many activities, including major grant-funded activities related to increasing the research capacities of developing nations, as well as the development of prototype websites in collaboration with partners, with a focus on integrating research resources with more public information sources and more interactive environments (PKP, 2005a). The convergence of activities between the Public Knowledge Project and the SFU Library is of prime importance for the case study.

Another project that affects the case study is Synergies, which is a Canada-wide initiative. Synergies is a coordinated effort of several universities in Canada to transform social sciences and humanities research in the digital age – the principal members of the

Synergies consortium are the University of New Brunswick, Université de Montréal, University of Toronto, University of Calgary, and Simon Fraser University (Synergies, 2006). The major goal of Synergies is to enable Canada's 170 social sciences and humanities (SSH) journals to:

- a) make the transition from print to electronic, move towards a policy of open access without being driven into insolvency;
- b) be part of an aggregation of Canadian journals with distribution throughout the world;
- c) participate in partnership with similar projects being undertaken in the United States, Europe, and elsewhere;
- d) perhaps most importantly, ensure that they can continue to benefit from technological advances that almost on a daily basis change the way we create and mobilize knowledge (Synergies, 2006).

In relation to the case study, the Synergies initiative has the potential to greatly expand the development community of the PKP software. For instance, OJS is mentioned as a key component in achieving the goals of the initiative, with a "West Coast node" of the Synergies alliance composed of the Public Knowledge Project at the University of British Columbia, Simon Fraser University Library (which is the West Coast lead), the University of Victoria, and SFU's Canadian Centre for Studies in Publishing (Synergies, 2006). This West Coast node of the project will provide support and resources to other West Coast sites and participants who are interested in electronic publishing – services include assistance in the set-up and use of software, data conversion

and digitization, and online hosting services (Synergies, 2006). Thus, a major goal of Synergies is to provide OJS as an option for electronic publishing for Canada's SSH journals – another option for electronic publishing in this project is the Universite de Montreal's Erudit journal publishing services.

Synergies is being funded by the Canada Foundation for Innovation (CFI), an independent corporation created by the government of Canada to fund research infrastructure. The result is a grant of \$5.8 million for the nationwide project, of which OJS development will get a portion (Public Knowledge Project, 2007). In addition to *Synergies*, the upcoming "First International PKP Scholarly Publishing Conference" will take place from July 11-13, 2007 in Vancouver. This conference will be another opportunity to expand the PKP community, with programs planned for software developers and technical support specialists, journal publishers, editors, librarians, and researchers in scholarly publishing. Attendees will be able to attend a range of topical sessions on trends in scholarly communication and publishing, open access initiatives, open source software, academic and library communities, and future plans for OJS, OCS, and the Open Archives Harvester (Public Knowledge Project, 2007).

2.3 Data Collection & Analysis

The main forms of research data were obtained from structured interviews, documentary research, and theoretical model development. The main technique behind this collection of different sets of data is triangulation, in which multiple sources bear upon the research questions and focus of study, in order to enhance the rigor of the research (Robson, 2002). The triangulation employed in this research operates in the

following ways: 1) methodological triangulation (theoretical model building and case study); 2) data triangulation (interviews and document analysis); and 3) theory triangulation (theoretical model building).

2.3.1 Interviews

In order to gain information about the development histories, goals, and status of these projects, four informal e-mail interviews with key project leaders of prominent open source projects were conducted (see Chapter 4). These informal interviews are in addition to documentary research gathered about these projects. In this section, however, I describe the formal, in-depth, and rigorous qualitative interviews that form the main data source of the in-depth case study. Structured interviews were conducted with key members of the Public Knowledge Project, administrators and software developers at Simon Fraser University, members of SFU's Canadian Center for Studies in Publishing (CCSP), and selected clients of the reSearcher software. Clients of the software represent libraries within the two regional consortia who are using the reSearcher software. The interview format, while structured, encouraged open-ended responses in an effort to gather as much detail about the development and goals of the SFU Library open source software development projects.

The interviews were approximately sixty minutes in length, and were divided into three categories based on the type of interviewee – 1) administrators; 2) developers; and 3) clients. Dividing the interviews into three different groups helped develop multiple perspectives on the *Software@SFU Library* project. Interviews with administrators shed light on the management aspects of the project; interviews with developers brought out

the technical decision-making behind the project; and interviews with reSearcher clients helped to evaluate the project from an end-user perspective (see the appendices for the three sets of interview questions). A total of twenty-two interviews were conducted, comprising nine administrators, six developers, and seven clients.

Detailed interview logs capture the information generated in the interviews, and were coded and analyzed as themes and categories emerged during the process of the interviews and in the subsequent analysis of the interview transcripts. More detail on the coding process will be discussed further on in this chapter. Interviews serve several purposes, as they gather information regarding: 1) the goals of SFU Library's open source software development; 2) motivations for the development of the partnership to maintain and develop the PKP open source journal publishing suite; 3) goals for the long-range development of the PKP and reSearcher suites; 4) impact of SFU Library's *Software@SFU Library* program for other university libraries; 5) goals and impact of the PKP and reSearcher software suites; and 6) institutional, economic, cultural, political, and social factors leading to the open source software projects. Issues, themes, and ideas developed in the open-ended interview sessions will provide context and possibly new directions to explore in future studies. In addition to the interviews, observational notes from a PKP meeting on August 31, 2006 are utilized as an informal data source. This data source lacks the rigor of the in-depth interviews since it only reflects the observations from one meeting; however, when appropriate, it has been used as an informal way to compare and affirm findings from the analysis of the interview transcripts.

The coding process highlights and develops the themes that appear in the interview transcripts. Through the use of the qualitative software *HyperResearch*, all the interview transcripts have been coded. Themes and sub-themes were identified according to each interview category. These themes and sub-themes were developed by a close analysis of the transcripts and in relation to the interview questions. For instance, where questions about “successes” or “challenges” occurred in the interview protocols, the transcripts accordingly would discuss these themes in the appropriate places. However, other themes emerged from a close reading of the transcript data (see Chapter 5). Themes were reported if a minimum of three interviewees discussed that particular theme. Sub-themes were identified if two interviewees mentioned the sub-theme. Other ideas within a theme mentioned by only one individual were noted, but were not counted as sub-themes. Thus, often times the sum total of sub-theme “instances” does not add up to the total number of instances of a theme.

Each “instance” of a theme in the transcripts has been identified as a discrete, individual statement or idea, which can be a phrase or can even span a few sentences in length. Using the qualitative analysis software, reports were generated for each interview category, indicating the number of times certain themes appear in each interview category. Differences between the importance and frequency of certain themes in interview categories can be observed, giving insights about the social, economic, and institutional factors behind both software projects. The numbers, while indicating a certain degree of prominence for a theme, however, are not an absolute measure of a theme’s relative importance. In addition, certain themes have some overlap, and it is thus

not fruitful to draw firm conclusions from absolute numbers. The quotes identified in each theme and presented in Chapter 5 were chosen as representative samples of each theme. These quotes highlight the diversity and range of viewpoints within each theme and sub-theme. The following sub-sections describe the themes identified according to each interview category. Chapter 5 provides extensive narrative detail about the findings from the in-depth case study and discusses at length the sub-themes in each category.

2.3.1.1 Administrators

The nine administrators interviewed in this study are associated with various organizations that are involved in the *Software@SFU Library* Project – they represent Simon Fraser University Library, the Canadian Centre for Studies in Publishing (CCSP), the Public Knowledge Project, the British Columbia Electronic Library Network (BC ELN) and the Council of Prairie and Pacific Libraries (COPPUL). In terms of selection criteria, all the key and highest-ranking administrators from each of these organizations involved in the software projects were interviewed. Of the nine administrators, seven are men and two are women, and all are Caucasian. While information about their ages was not solicited, the majority of the administrators appear to be middle-aged, with an age range from their early forties to their sixties.

Some organizations have more than one key administrator interviewed, as the names for administrator interviewees were primarily identified from the *Memorandum of Understanding, SFU-UBC Partnership for Open Source Publishing Software Development* of January 14, 2005. As each organization is involved in different aspects of the reSearcher and PKP software suites, the interviews with administrators from these

institutions bring a multi-perspectival account of the factors involved in maintaining these projects. From the analysis and coding of the interview data, several themes emerge. Within each theme, major sub-themes (indicated in parentheses) are identified (see Chapter 5 for a fuller discussion).

- A. Organizational Motivation (Ease of collaboration and timing; Innovation and existing technical infrastructure; Changing roles of libraries; Open source and open access philosophical orientation)
- B. Personal Motivation (Open source and open access philosophical orientation; Technological interest)
- C. Project Management (SFU Library's role in the PKP partnership; Software development process – economic, technical, and management issues)
- D. Successes (Institutional successes; Economic successes; Technical successes)
- E. Challenges (Open source development realities; Management of the support infrastructure and community development; Technical competencies of client libraries; Institutional challenges)
- F. Collaboration/Community (Growing the user and developer communities)
- G. Innovation (New roles for libraries in publishing services; Innovation and pioneering aspects of reSearcher)
- H. Leadership (Leadership of SFU Library and PKP directors; Co-extensive leadership)

2.3.1.2 Developers

The six developers interviewed work on both the reSearcher and PKP suites – three of these developers work on reSearcher and three developers work on PKP. With respect to the PKP developers, two of these developers work outside SFU Library and are the major outside contributors to the PKP software. While the PKP software has outside software development contributors, reSearcher software development is currently limited to SFU Library. The six developers interviewed represent all the major developers of both projects, and thus constitute a complete sample of developers. Five of the developers are men, and one developer is a woman. All are Caucasian with the exception of one developer, who is Canadian of Asian ancestry. Information about their ages was not solicited, but the developers appear to range in age from their twenties to early forties.

The programmers at SFU Library are each responsible primarily for the development of one particular software product, but a certain overlap between project duties does exist. However, there is little to no overlap between the reSearcher and PKP developers – the main PKP developer at SFU Library and the reSearcher developers have little or no professional contact between each other. As such, while both the reSearcher and PKP projects are maintained at SFU Library, they are quite independent projects.

After analysis of the interview transcripts of the software developers, and in conjunction with the themes introduced in the interview questions, the following seven themes were identified, with the sub-themes indicated in parentheses:

- A. Personal Motivation (Open source and open access philosophical orientation)

- B. Project Management and Organizational Structure (Satisfaction with the project; Software development process)
- C. Collaboration/Community Development (Questioning the open source nature of reSearcher; Involvement in other library open source projects; PKP community building)
- D. Opportunities/Successes (Regional success of reSearcher; Customization, control and updates)
- E. Challenges (Packaging of the software and support; Open source development realities and library technical competencies)
- F. Innovation and value (Sustained development; PKP innovation)
- G. Leadership (Administration commitment to software development; PKP director and management team)

2.3.1.3 Clients

The clients of the *Software@SFU Library* program are member libraries of the COPPUL and BC ELN consortia, and librarians at these institutions were interviewed. All the clients use or have considered using the reSearcher software. A total of thirty-six libraries, mostly within these two consortia, use the software (SFU Library, n.d.-d). The majority of these libraries are either small college or junior college libraries, institutions often with limited systems and technical skills and staff. The task of conducting thirty-six in-depth interviews with librarians at these institutions was not feasible; thus, a representative sample of seven client libraries was chosen for the interviews. This representative sample thus includes a mix of colleges (the equivalent of junior colleges in

the U.S.) and university colleges (the equivalent of small, four-year degree granting colleges in the U.S.). One “client” in this sample actually serves as a negative example, as this institution (a large COPPUL library) chose not to use the reSearcher software three years ago.

Five of the clients are university colleges in the sample, one is a college, and one is a large university. Three of the clients are from the BC ELN consortium, and 4 are from COPPUL. All the clients of the software (with the exception of the large COPPUL library) share certain basic characteristics in that they are all from small or medium sized libraries with minimal technical expertise on staff. In terms of demographic characteristics, four of the clients interviewed are women and three are men. Since all of the client interviews were conducted over the phone, information about their race/ethnicity and ages was not available. The following are the themes associated with the clients, with the sub-themes in parentheses:

- A. Benefits (Responsiveness; Increased control and lower cost)
- B. Challenges (Lack of technical expertise; Sustainability of reSearcher)
- C. Project Management and Evaluation (Technical support; Management structure and importance of consortium)
- D. Agency and Inclusion (Communication and control; Feeling of partnership)
- E. Organizational Motivation (Economic motivation; Open source ethos)
- F. Personal Motivation (Open source philosophical orientation; Personal knowledge of open source)

- G. Software Evaluation and Support (Satisfaction; Critique; Technical support and responsiveness)
- H. Collaboration/Community (Growth of library open source community; Loyalty to project)
- I. Leadership and Innovation (Open source innovation; Co-extensive leadership)
- J. Suggestions for Improvement (Technical critique; Open source expansion)

2.3.2 *Documentary Research and Analysis*

In addition to the qualitative interview data, documents and reports detailing the use and reception of the SFU Software program in the context of the university and the PKP suite in the context of its user community were studied to develop a sense of the program's goals and the software's success. Any reports or documents that detail the development of the SFU reSearcher suite and the PKP publishing suite were used along with the analysis of the interview transcripts to understand the logic of the projects' development. These documents serve both as an additional source of data and also are a tool for verifying and comparing results from the analysis of the interview transcripts.

Some of these documents are internal ones, which were provided to the researcher from SFU Library administrators, developers and clients. Other documents which are publicly available on SFU Library's website were reviewed and include software demonstration modules and "screencasts". The following is a list of documents that inform the study and analysis:

- *Synergies* project application prepared for a Canada Foundation for Innovation grant - 2006

- *Citation Manager Re-development Project*, prepared by Steve Wade in collaboration with Todd Holbrook, Mark Jordan, Calvin Mah, Brian Owen, and Nina Saklikar - June 2006
- *E-Journal Access/Linking Task Force Report*, University of Manitoba – June 25, 2003
- *GODOT Administration Guide, Full-text Links from CUFTS, Interlibrary Holdings Locator and Requesting Version 2.0* – last updated March 27, 2006
- *The GODOT Cookbook* – last updated March 9, 2006
- *DbWiz, Open Source Federated Searching Version 2.0 Administration Guide* – last updated February 27, 2006
- *CUFTS Open Source Serials Management Version 2.0 Administration Guide* – last updated May 15, 2006
- *OJS/OCS Development Priorities*, document developed for the PKP meeting of August 31, 2006 – dated July 18, 2006
- – January 14, 2005
- *Estimated budget for the PKP Scholarly Publishing Conference, Excel spreadsheet*, document prepared by Brian Owen of SFU Library for the PKP meeting of August 31, 2006 – dated August 30, 2006
- *CUFTS Electronic Resource Management Expansion Proposal – Third Draft* – August 7, 2006
- *CUFTS Electronic Resource Management Expansion Proposal – Final Draft*, prepared for the Fall 2006 COPPUL meeting – September 2006

- *Software@SFU Library estimated budget, April 1, 2005 – March 31, 2006,*
Excel spreadsheet prepared by Brian Owen of SFU Library
- *OJS in an Hour, An Introduction to Open Journal Systems Version 2.0.1,*
Released July 8th 2005 – last updated July 13, 2005
- *CUFTS ERM Screencast, CUFTS Journal Database Screencast, CUFTS*
Knowledgebase Screencast, dbWiz Screencast, GODOT Screencast, Citation
Manager Screencast – Available at <http://researcher.sfu.ca/screencasts>

Chapter 3: A Critical Theory of Library Technology

3.0 Introduction

The “information society” presents a paradox for the library profession – while library interests advocate for the important role of libraries in developing an information society, this very same information society has given rise to a dominant framework of commoditization, privatization, and technocratic elitism. What are tools that we can use to help address this paradox? In this chapter, I develop the dimensions of a reconstructive and transformative critical theory of library technology as a means to address this paradox of the information society for libraries. By “critical theory,” I am not referring to traditional positivist understandings of theory, but rather to a critical theoretical framework for analyzing the power dynamics of library technology development, rooted in the tradition of the Frankfurt School of critical theory. While libraries are contesting forces of commoditization, from the addressing of gross economic inequities in scholarly publishing (SPARC, n.d.) to the development of open source software tools to meet their institutional and user needs, transformative social theory is not consciously invoked in relation to library advocacy and activism.

A transformative theory of library technology, in order to be effective, must address the twin concerns of technocracy and technological determinism, which permeate discourses of library technology. In essence, technological determinism claims that technologies have an autonomous functional logic that can be explained without reference to society (Feenberg, 1999). Technology, thus, has an intrinsic independence from the social world, and is based on two premises, which Feenberg (1999) calls

unilinear progress and determination by the base. In the case of unilinear progress, technological progress is presumed to follow a fixed course, while in the case of determination by the base, social institutions must adapt to the imperatives of the technological base (Feenberg, 1999). Technology is a neutral entity in a deterministic framework, with an internal logic free from the influence of society.

Technocracy relates to the accumulation of power and privilege in the hands of technological elites. Technocracy becomes institutionalized in bureaucracies, and technological and instrumental rationality guides the exercise of power by political and economic elites (Feenberg, 1999). The technocratic mindset elevates science and technology and scientific logics as the main sources of bureaucratic, political, social, and cultural control (Postman, 1992). However, rather than being understood as the triumph of an abstract “instrumental rationality,” technocracy is the way in which specific social groups gain control of society through their leading role in technical organization (Feenberg, 1995). Both technocracy and technological determinism are related – in both cases, technology is the primary focus of power and societal change.

With this fact in mind, critical theory provides a broader and more robust framework for analyzing and combating the technocratic forces that dominate the information society and library technology debates. The dominance of technocracy, moreover, can be combated through forces of democratic rationalization – in other words, new technology can be used to undermine the existing social hierarchy or to force it to meet needs it has ignored (Feenberg, 1999). For instance, Internet technologies, particularly in the realm of electronic publishing, are providing libraries with new ways

to provide access to scholarly information that can bypass traditional commercial publishers.

While libraries are in many ways combating technocracy, the field of library and information science does not adequately theorize technology. Without a transformative theory of technology, technocratic discourses of instrumental rationality and technological determinism will not be sufficiently challenged. In what follows, I present the case for an enhanced engagement with critical theory in the field, particularly in the realm of technology. I also present an overview and critique of technology discourses within LIS, including discourses of library automation, information retrieval, and digital libraries. Through this critique, I argue against false dichotomies that pit “library forces” with “information forces” in the library technology debate. While information technology is of course central to the role of libraries, a critical orientation that avoids the extremes of “technophobia” and “technophilia” (Kellner & Kahn, n.d.) is needed. Critical theory and critical theory of technology are what provide this critical orientation with regard to libraries and technology.

Finally, I discuss the foundations, levels of impact, orientations, and dimensions of the critical framework I am constructing. This re-envisioning of the field through a vigorous application of various critical social theories is what I term a “critical theory of library technology.” While providing a context for the various discourses of libraries and technology, this theoretical framework develops the dimensions for library technological advocacy and expands the discourse of technological expertise into the realm of libraries. As with any “critical theory,” this framework analyzes the power dynamics involved in

the development, production, and maintenance of library technology. Democratization of library technology is the goal of this framework – by democratization, I am referring to a more inclusive process that allows libraries and their user communities to have more input and control over technology development. This concept of democratization will be discussed further in this chapter as the critical theory of library technology framework is developed.

3.1 Theory and Critical Theory in LIS

The role of theory is generally underemphasized in LIS, as theory can have the unfortunate label of *impracticality* in such a professionally-oriented field. The perceived lack of theoretical traditions is a major issue of concern in the LIS field, as B.C. Brookes, one of the founders of information science, noted just over 25 years ago: “theoretical information science hardly yet exists” (Brookes, 1980). Moreover, in the context of library services, there have been recurring complaints about the lack of theory (M. K. Buckland, 1988).

More recently, in an article entitled “The Use of Theory in Information Science Research,” Pettigrew and McKechnie (2001) discuss the role of theory in information science research and their findings show that theory is being developed and utilized to a fair degree in the discipline. Pettigrew and McKechnie’s (2001) findings suggest that theory is playing a stronger role than previously thought in the IS literature, with their study showing that over 100 distinct theories mentioned in the literature were developed within information science. Information science thus may not be as theory-free as people

such as Brookes suggested. The use of theory can help to advance a field, and provide abstractions of reality that can help mediate understandings of a topic under study.

The use of theory in library and information science, however, must be examined more closely. Pettigrew and Fisher's work talks about theory in general, and does not explore questions as to why certain researchers used certain theories, and for what ends. Exploring these types of questions will be fruitful on several levels. For instance, it is argued here that theory in LIS has developed largely out of professional exigencies and mindsets. All disciplines to a greater or lesser extent have applied characteristics, but LIS can largely be classified as having a dominant professional focus. The "professionalized" nature of library and information science has several implications on its theory development.

For example, Day (2000) argues that professional discourses in LIS theory and practice tend to align themselves with dominant ideological and social forces by means of language. Information science and information retrieval are disciplines steeped in the rhetoric of modernity, and theories developed within them have aspects of scientific modernist outlooks. Library and information science professions, and professions in general, have often connected their rhetoric to dominant social institutions, language, and agendas, especially in modernist tropes. such as "management," "efficiency," "systems," and "science" (Day, 2000). The word "science" in library and information science is not there by chance – science and scientific knowledge still stand as the paragon of legitimate knowledge in the modern world.

In fact, science can be described as the legitimating trope “par excellence” in modernity (Day, 2000). For instance, the legitimization of the discipline was so vitally important to people such as Brookes (1980), who passionately advocated for a “very important role for a science of information, a role as yet unclaimed by any other discipline, and which is a logical and natural extension of the interests and activities of those who currently claim to be information scientists.” Brookes’s writing exemplifies a larger professional anxiety that the lack of science as a foundation for the study of information would lead to the demise of the discipline.

If a professional alliance with science is a mark of legitimization and modernity, the development of theory in information science has to be analyzed with this idea in mind. If aligning with scientific discourse is part of professional legitimization, as Day suggests, the theory that develops for a professionalized discipline, therefore, may show aspects of scientific legitimization. The argument made here is that theory in information science is largely instrumental – in other words, theory that is largely considered with “doing things better.”

In terms of library services, for example, Buckland (1988) presents the following areas that a theoretical framework can be applied to: inquiry; retrieval; becoming informed; demand; and allocation. Inquiry is the basic process motivating a patron’s use of the library, while retrieval is concerned with developing technological tools for accessing information (M. K. Buckland, 1988). He describes “becoming informed” in relation to the services and collections that libraries provide, while demand for library services and allocation of resources for providing library services are related to larger

social and political contexts. These frameworks for theory application in LIS are related to the functions of libraries, and are most applicable to practitioners in the field.

Popular understandings of theory within LIS also fall within positivist frameworks. This understanding of theory, as a deductively connected set of laws (Goldhor, 1972), is more prevalent in information science. However, others have argued that positivism has dominated much of library research (Harris, 1986), viewing library science as a young natural science, and framing the relation of laws and theories to practice as essentially instrumental. This positivist orientation has been criticized as not accurately describing the domain of the field, and imposing an artificial “value-neutral” perspective on library practitioners and researchers (Harris, 1986). Although the field is described as “library and information science,” there is little evidence to suggest that it should be “scientific” in the sense of the physical sciences, as a social science and humanities approach may be more appropriate for the field (M. K. Buckland, 1988). Much of library service deals with human activities and its evaluation needs to deal with relatively undefinable aspects of human behavior – thus, applying theoretical frameworks from the physical sciences is not appropriate, as library science is not a “hard science” (M. K. Buckland, 1988).

To counter these positivist trends, Harris (1986) argues for research that is holistic, reflexive, empirical and dialectical. Harris’s advocacy of a holistic approach comes out of his critique that research in the field is “ahistorical and deterministic” (p. 523) and he finds this attempt to develop general laws independent of their historical and

cultural location to be “clearly bankrupt” (p. 523). Moreover, this holistic approach recognizes that:

“library science” is not a separate discipline, but rather a mediating profession concerned with knowledge derived from all other disciplines, and researchers in this profession must be alert to, and prepared to draw upon, developments in the social sciences generally which promise to contribute to the solution of problems specific to libraries (p. 523).

His call for reflexive and empirical research is opposed to positivist attempts to “reconstruct social reality as consisting of brute data alone” (p. 523) and recognizes the socio-cultural embeddedness of the researcher. The emphasis on dialectical research is related to the Marxist tradition of getting beyond the “level of appearances” to explore the underlying social conditions, conflicts, and tensions that generate these appearances. His call for empirical/reflexive, holistic, and dialectical research is one of the earliest attempts at a critical theory approach in LIS. In particular, he deconstructs the positivist, natural science-inspired conception of theory, and opens up a space for critical theoretical frameworks from other disciplines. Harris highlights the multidisciplinary of the field, and plants the seeds of a critical theory framework upon which this research builds.

In addition, no one theory is appropriate for all the various aspects of library and information services – a diversity of activities exist, and finding a unifying theoretical perspective is not a useful task. Few theories exist that are specific to the field itself, but it can be argued that the combination of the theoretical aspects of library service is unique to the field of librarianship (M. K. Buckland, 1988). This multiplicity and embrace of

various theoretical perspectives in the field allow a critical theory of technology perspective to offer valid insights as well. However, theory/practice dichotomies still persist in the field.

Crowley (2005), for instance, discusses the need to bridge a conflict between theorists and practitioners in the field of library and information science. Keeping in tune with the professional emphasis of the discipline, he notes that many practitioners find theories developed in LIS programs at universities to be not useful and often irrelevant to their professional concerns. In response to this gap, he proposes his definition of “useful theories,” what he describes as mental constructions that reflect, to some degree, “how things work” in real-world contexts (Crowley, 2005). Crowley (2005) argues from the standpoint of cultural pragmatism that theory development is an ongoing process, and the true test of any theory is always analyzed experience. In his argument, the effectiveness of theory is highlighted, and common-sense perceptions should determine the acceptability of theory. This acceptance of theory as “useful” applies to critical theory as well. The cultural pragmatist approach that Crowley (2005) describes is open to “input from virtually every conceivable source, including critical theory” (p. 197) and other frameworks as well.

Related to Harris’s “holistic” approach to research and theory within the field of LIS, Crowley (2005), through his cultural pragmatism, offers another avenue for critical frameworks to be utilized in LIS. While acknowledging the strengths of critical theory in exploring the power relations within capitalist social, political, and ideological structures, he finds several shortcomings in having critical theory become a primary resource for the

development of useful theory outside of the U.S. university. Some of these shortcomings include:

- 1) The unwillingness of American society to support a Marxist tradition;
- 2) The difficulty of applying critical theory in the development of the interlanguages needed for discussions among academic practitioners and practitioners in off-campus contexts;
- 3) Critical theory's emphasis on conflict and change, rather than consensus;
- 4) The problem of critical theory in meeting the requirements that useful theory in the non-academic environment ought to a) predict, b) be in accord with experience, and c) solve practical problems more effectively;
- 5) The availability of an alternative revived pragmatism, an indigenous, non-Marxist philosophy that enabled John Dewey and others to carry out strong and repeated analyses of American culture (Crowley, 2005).

Despite these shortcomings, Crowley (2005) admits that critical theory has a “bright future within the national and global higher education communities both as a source of primary theory and as an aid to theoreticians operating from other perspectives” (p. 76). However, he thinks a “proverbial sea change” (p. 76) is needed for the larger American culture to view the findings of critical theory as acceptable for decision making in most off-campus environments. Critical theory can have value as a theoretical framework in LIS, but it appears that a large “gulf” still exists between practitioners and theoreticians.

This supposed gulf between the value of critical theory and the needs of practitioners deserves closer examination. The traditional division between “theory” and “practice” in the field of LIS can also be viewed as artificial and rather simplistic (Day & Pyati, 2005). Theory does not have to be a set of abstract concepts that is removed from the everyday practices of professionals. Positivist accounts of theory usually rest on foundational statements or first principles (Day & Pyati, 2005), and often link the field to natural and physical science frameworks. Harris (1986) and Buckland (1988), as well as a variety of other scholars, have articulated this critique. While critical theory cannot be classified as a positivist account of theory, Crowley (2005) has argued that critical theory faces challenges in being relevant for practitioner communities. This assertion does not accurately capture the nature of critical theory, and its practicality and usefulness for the field.

Behind this statement lies the assumption that theory lies in an academic and esoteric realm removed from the practical exigencies of professional life. However, it does not have to be the case that theory is the transcendental opposite of practice, with practice merely the implementation of theory (Day & Pyati, 2005). As Day (2005) discusses:

Theory is a mode of practice according to descriptive techniques, and the purpose of those descriptive techniques is to help us solve problems that occur when our usual habits (“practice”) of physically and linguistically acting or being able to act no longer work the ways that we think are most promising. “Critical theory,” then, in this somewhat formalized or operationalized sense, may be understood as

the activity of evaluating the analogical borrowings and judgments that we make in theory in regard to reality and rational consistency. Both “theory” and “critical theory” are eminently practical and both are necessary in times of cultural and technological stasis as well as change (para. 20).

Day stresses the inherent practicality of critical theory, and its ability to make critical interventions into current professional practices. The need for critical theory is especially apparent in this time of technological change and transition from physical libraries to digital libraries (Day & Pyati, 2005). Critical theory can help provide the framework for a re-imagination of the future, as it is both practical and empirical, considering problems of definition and value (Day & Pyati, 2005).

On a basic level, critical theory is the only appropriate framework to deal with technocracy and technological determinism, as it is concerned with interrogating technological rationality (Feenberg, 1999). Chapter 1 provided some of the historical background of the Frankfurt School of critical theory, and this dissertation extends a form of this critical theoretical tradition into the discourse of library technology practices. Critical theory, however, has been explored within the LIS field only to a fairly limited extent. Critical theory exposes the dialectic of technology, and creates openings for democratic interventions in technology development (Kellner, 1999). It provides an opening, as well, to interrogate technological rationality, which permeates technological development and determinist discourses (Feenberg, 2002). Technocracy, technological determinism, and technological instrumentalism are some of the major technological discourses affecting libraries.

3.2 The Need for Critical Frameworks in Library Technology

One area in which critical theory has not been extended is in the realm of information technology in librarianship, an area that remains under-theorized within the field. In general, the intellectual and professional responses to technological phenomena have been inadequate and uncritically accepting of the large amount of hype that information technologies receive (Buschman, 1993b). As Buschman (1993a) argues, a critical approach to information technology in librarianship is needed, as information technologies are fundamentally changing the library profession, but a more detailed understanding of these changes is needed. In a broad sense, the primary technologies of concern in the library world were previously paper and cardboard – the advent of the information age, however, has made information technology the primary focus (M. K. Buckland, 1988). Three major areas in which technology is affecting libraries the most are in purchasing, collections, and services (Buschman, 1993b). These three areas, while not exhaustive, encompass essential functions of libraries, as information technology has had a large impact in these areas.

Given the importance of information technology in librarianship, how is it being theorized within the field? The understanding of technology within LIS is largely instrumental in nature, with technology viewed as a “tool” for certain purposes and goals. Technology in this framework is thus both a technique (a way of doing something) and a useful physical resource that can serve as a tool or a means to accomplish something (M. K. Buckland, 1988). The implementation of technology has its capabilities and limitations, as certain tradeoffs exist – however, in this view, “improved” technology has

the effect of diminishing constraints on library activities (M. K. Buckland, 1988). This instrumental view does not necessarily regard all technologies as benign, but as “tools” technologies can be used for purposes, both “good” and “bad.” Technology appears as a “neutral” implement for value-specific purposes.

The instrumental view externalizes technologies, and frames them as fixed objects with a use and a purpose, a view that is problematic (Burbules & Callister, 2000). The instrumental view is troublesome because tools may have certain intended uses and purposes, but they frequently acquire new, unexpected uses and have new effects – in essence, our relationship with technology is not just one-way and instrumental, but is two-way (Burbules & Callister, 2000). The use of technology thus cannot simply be understood in an instrumental way, as much of the field of LIS does.

For instance, framing the Internet as a neutral “tool” in the continued development of library functions does not capture the complex social and technological field of the Internet. A non-instrumentalist view of Internet technologies in libraries takes into account the socio-technical environment that the Internet creates. One basic example concerning the Internet and libraries is online pornography. This development was largely unforeseen at the time of the Internet’s development, and has become a major unintended consequence of the Internet for public libraries. In addition, Internet technologies such as search engines and instant messaging have changed user expectations of libraries, leading to the development of new and evolving library service models. Thus, the Internet in libraries cannot be viewed merely as tool that is “good” or “bad,” but rather as a complex field with an associated set of unforeseen consequences.

Burbules and Callister (2000), writing in the context of educational technology, nonetheless have important insights about transcending “technocratic dreams” and arriving at a “post-technocratic perspective on technology” (p. 7) that are relevant for LIS. They identify various “technocratic dreams” and mindsets, such as the “computer as panacea” (p. 8) perspective, “computer as tool” (p. 9) perspective, and “computer as non-neutral tool” (p. 10) perspective.

These various technocratic perspectives are not useful, as they argue that the technocratic mindset maintains a clear distinction between the conception of a tool and the aims it serves. The post-technocratic, relational view of technology they propose acknowledges that the distinction between humans and technology is never clear-cut and moves beyond the technocratic mindset of using costs and benefits as the main way of evaluating technological change (Burbules & Callister, 2000). Their main point is that technological choices are never easy – the post-technocratic perspective they propose calls for thinking more carefully about the complex relations of cause and effect, about the anticipated and unintended outcomes of change, and about the difficulty of defining or separating the “good” and “bad” effects of technological change.

While these authors highlight the complex terrain of technological development and criticize the instrumental view of technology, they also point to another technological view that is also prevalent in libraries – that of the “technological enthusiast.” Related to the “computer as panacea” perspective, this viewpoint frames technology as a largely positive movement that is fundamentally altering the operations of libraries. This perspective is also largely driven by technological determinism. This technological

enthusiast position is found in discourses about the “demise of the library” and the “library of the future.”

The “library of the future,” when contrasted with the “traditional library,” makes libraries look like unchanging entities at the mercy of technological change. The long history of technological adaptation and change within libraries (Frumkin, 2002) is ignored in this view, as libraries have to quickly respond to technological changes or face “obsolescence” in the information society. This view of the library is technologically deterministic, and fails to capture the social character of technology, and the roles libraries have in shaping technology.

Thus, the technocratic worldview shapes many of the technological debates in the library world. While the *information paradigm* (Apostle & Raymond, 1997) discussion (see Chapter 1) does not specifically mention technocracy, the technocratic worldview is implicit in this framework. In addition, a certain anxiety about the information revolution and its consequences in the library world exist, especially amongst certain prominent library leaders. As will be discussed further on in this chapter, the “technophobia” of certain elements of the library profession is a direct reaction to the technocratic dreams of the techno-futurists.

Thus, a need exists to transcend the technocratic dreams of the technological enthusiasts and the technophobic attitudes in particular areas of the library profession. The next section explores the persistence of technocratic ideologies in library technology development, through an exploration of discourses of information retrieval, library automation, and digital libraries. The last section attempts to transcend the

technophilic/technophobic dichotomy through the presentation of a critical theory of library technology.

3.3 Information Retrieval, Automation and Digital Libraries

3.3.1 *Information Retrieval*

Information retrieval lies at the heart of information science, a body of knowledge and practices concerned with “retrieving” information for users. This area of the field is often associated with the “information science” component of LIS, as opposed to the “library” component. While an essential element of LIS, I argue that its discourse is largely shaped by a scientific modernist approach that adds to the technophilic/technophobic problematic in the field.

Information retrieval as a practice and form of knowledge has a specific historical reality, gaining popularity in the 1950s and 1960s, as computer science began to emerge as a dominant discipline. In fact, the term “information retrieval” was introduced by Mooers in the context of documentation (Swanson, 1988). Information retrieval, in its most common understandings, is firmly associated with the computer age.

The argument that I am presenting in this section is that information retrieval is best understood as a socially constructed, culturally conditioned form of knowledge, particular to a dominant mode of thinking rooted in scientific modernism. The work of Day (2001) in *The Modern Invention of Information: Discourse, History, and Power* provides the major thrust for this argument. Day argues that the popular, “scientific” understanding of information has been constructed by rhetorical devices, and that the information age as a concept has been constructed as a form of professional self-

advancement. He notes that the reification and commodification of the term “information” is an historical, socially constructed phenomenon, and information, from its earliest meanings, is concerned with the much more ambiguous process of “being informed.”

Information, which was first used to describe an action, an “act of informing,” took on a more reified definition in the post-World War II era. Day argues that this restrictive definition is problematic, in that language, culture, history, and affect can all be subsumed under a sanitized rubric of “information.” He further argues that “prophets” of the information age often have naïve and simplistic understandings of sense, knowledge, and agency in the world, and that traditional values for information use have developed without a critical understanding of historical agency and political economy.

Rather than being an “instrumental” critique in which the goal is to enhance the retrieval of information, this section explores some of the underlying social and cultural modes of thinking and representation implicit in the area of information retrieval. Certain positivist epistemologies underlie the thinking of information retrieval, and these modes of thinking need to be examined more fully for a deeper understanding of information retrieval. Opening up information retrieval to socio-political and socio-economic critiques is crucial in an age of increasing globalization and techno-capitalism.

The development of information retrieval has its roots in information science’s development in the post-World War II era. While some argue that information retrieval has always existed, even before the computer age, the argument taken here is that this assumption is both correct and incorrect. In the pre-computer age, people, of course,

made use of information, but were not “retrieving” information per se. Instead, using the Day argument of “informing,” information was more of a process, rather than a reified or commodified entity. The idea of “retrieving,” it is argued here, is specific to the “machine age” and the advent of computer technology.

In general, much of these ideas based in machine metaphors of human society and behavior can loosely be classified as the precursors of positivist social science epistemologies. The vast majority of work in information retrieval is based on positivist epistemologies – objective truth and knowledge are posited as the foundations of much of information science theory. For instance, the work of Brookes (1980) in “The foundations of information science,” posits Karl Popper’s World 3 as the source of “objective knowledge” with which information science should concern itself.

To elaborate further on the “machine metaphor,” this type of thinking is most associated with framing human agency and knowledge in an objective and atomistic way (Inden, 2000). For instance, in information retrieval research, individual searchers are taken to be the fundamental “units” of study, reducing information needs of groups and communities to additive elements of individual behavior. This type of thinking is illustrated in Brookes’ assertion that “the publicly observable growth of knowledge as recorded in the published literature reflects the ways in which individual minds think privately” (Brookes, 1980a). This example illustrates some of the positivist tendencies in information retrieval theory.

The goal of this section has been to open up information retrieval and information science to a radical critique. While not advocating that information retrieval is “flawed,”

or somehow “misguided,” the central idea is to open up information retrieval discourses to fundamental questions of ethics, power, culture, and political economy. The information retrieval paradigm, as it has developed over the last fifty to sixty years, has divorced itself from questions concerned with social context, power, and political economy. Rather, what has emerged is a “scientific” discourse surrounding information retrieval, which gives the discipline a veil of detached neutrality. This positivist, “scientific” understanding of the field stands in contrast to the “traditional” library forces in the field, a dichotomy which is neither useful nor helpful. In keeping with Day’s central argument, information retrieval can also be considered as part of an information society discourse steeped in scientific modernism. The construction of a “science” (or better yet, the attempts at the construction of a science) of information retrieval is part of a larger, post-World War II discourse on the information society and scientific modernity.

The role of critical theory in information retrieval will help to unpack the historical, social, and cultural assumptions of information retrieval. Current theories behind information retrieval do not provide this sort of critical self-reflection, and merely are concerned with the mechanics and evaluation of information retrieval, without regard for the social consequences and context of information retrieval itself. The ethics, social context, production, and semantics of information are areas from which information retrieval, and information science, in general, have stayed away. Critical theory provides a much needed lens to open up information retrieval to these wider topics of concern. A rapidly globalizing world, with information as a major rhetorical tool and metaphor for

progress and modernity, sorely needs critical theories to analyze the foundations of the information disciplines themselves.

3.3.2 Library Automation

Library automation refers to the introduction of computers and other information technologies to enhance and support the operations of libraries. Automation is most commonly associated with the online public access catalog, and internal library circulation systems. In the context of British and U.S. libraries, automation has evolved through three phases – 1) efficiency of internal operations; 2) access to local library resources; and 3) access to resources outside the library, with the fourth stage now focused on achieving interoperability between information systems necessary to build a global information infrastructure (Borgman, 1997). The development of the Internet has extended the reach of library automation, as library catalogs and information resources can now be accessed globally (Borgman, 1997).

Borgman's (1997) four stages of automation in British and American libraries offer a useful framework for understanding technological change within libraries. The rise of the Internet is enhancing the global impacts of library automation – activities such as interlibrary loan and the sharing of cataloging data are more easily implemented through the Internet. In addition, interoperability of data and technical formats becomes an increasingly important aspect of libraries – the interoperability challenge reflects the need for libraries to think globally (Borgman, 1997). The need for interoperability to exchange data with other libraries, system vendors, publishers, and governments requires the development of systems that meet international standards and are based on

cooperation, exchange, and resource sharing agreements; at the same time, however, libraries must design systems that meet the needs of their local communities (Borgman, 1997). This local/global dynamic in the provision of library services highlights the collaborative nature of technological development in libraries. The development of shared cataloging systems through the Online Computer Library Center (OCLC), the development of the MARC record, and interlibrary loan services, to name a few, are all examples of the collaborative nature of technological development in libraries.

I will focus at this point on the integrated library system component of library automation, and the challenges of the current situation in this area. According to Saffady (1999), the integrated library system is “a computer-based information system that uses a single bibliographic database and a set of interrelated application programs to automate multiple library applications” (p. 209). The integrated library system covers a vast array of different functions, and several commercial vendors today dominate this market. A minimal, but fully functional implementation of an integrated library system usually incorporates three application modules: cataloging, online catalog access, and circulation control, but most integrated systems today are modular in design (Saffady, 1999).

The surge in automation in libraries is linked to the creation of a marketplace for automated library systems, which occurred in the late 1970s and early 1980s – prior to this development, libraries wanting to automate had to fund their own development costs (Borgman, 1997). Dozens of commercial vendors now provide various integrated library system services to libraries. A shift thus occurred from in-house development of systems to the purchasing of commercial software, and from closed systems based on local

practice to open systems based on technical standards – in fact, libraries have pressured vendors to have open standards (Borgman, 1997).

Commercial vendors provide a variety of services to libraries in terms of integrated library systems. The online public access catalog remains the principal motive for implementing an integrated system, but other features can be added on, such as popular acquisitions and serials management software (Saffady, 1999). The integrated library system marketplace is not static, however. The web is creating opportunities, challenges and expectations that are fueling changes in the integrated library system (Pace, 2004). In particular, librarians are dismantling certain systems and creating new modules out of frustration with the inflexible technology of their proprietary systems, while vendors are creating standalone products both to harness newer technologies and invent new market shares (Pace, 2004). The integrated system market appears to be in flux, as different standalone options for certain functions are available, with libraries having a wider set of choices to meet their automation needs. However, a major challenge remains in the conversion of older “legacy systems” into existing integrated systems, and interoperability between different systems remains a pressing issue (Breeding, 2006).

The Internet is thus promoting more modularity of systems, and libraries have the option of choosing various standalone products to meet needs such as reference linking and electronic resource management – in the case of new technology, such as federated searching, integrated systems often are inadequate (Pace, 2004). The integrated library system market continues to be dominated by commercial vendors, and a major feature of

this market has been a wave of consolidations and mergers of companies (Breeding, 2006). Thus, slightly more than a dozen companies control the market, and successive waves of consolidations and mergers have reduced the choice of libraries in meeting their integrated system needs. In addition, the integrated system market is almost completely saturated, with profit margins becoming smaller (Pace, 2004). Thus, with competition in the market as well as profit margins decreasing, one has to question the continued responsiveness of commercial vendors to meeting library automation needs.

The demand for a diverse array of services and the interest in making OPAC interfaces more integrated with more mainstream web search tools (to attract a more web-savvy user population) have motivated some libraries to begin developing their own web portals. In addition, the open source movement has provided libraries the freedom to experiment with, develop, and offer innovative services (Pace, 2004). Chapter 4 will discuss in more detail the alternative development models the open source movement is posing for the field of library automation. However, a changing marketplace, increasing modularity of products, and a change in user expectations are fueling a shift in the integrated library system arena.

In particular, the presence of commercial search tools such as *Google* and *Amazon* are changing user expectations, and library automation processes will have to keep pace with these commercial entities (Dietz & Grant, 2005). Library automation for many years was concerned with internal operations; however, with the dominance of commercial search tools, it is important to understand how libraries integrate into the larger information landscape (Dietz & Grant, 2005) While commercial vendors still will

dominate the integrated system market for the near future, the advancement of the Internet and a frustration with the limitations and restrictions of vendor products have given libraries new opportunities to meet their users' needs. In addition, as Dietz and Grant (2005) discuss, the challenges commercial library vendors face in a changing information environment can be described as a failure of their industry to "address adequately a visionary role for the library of the future" (p. 40). This idea is important when discussing the framework of a critical theory of library technology.

Library automation processes are also shaping the development of digital libraries. As Borgman (1997) discusses, "Online catalogs, databases on public access systems, and many other online resources to which libraries provide access can be viewed as 'digital libraries'" (p. 227). As we move from online catalogs to online public-access systems to digital libraries, we are moving from the management of bibliographic data to the management of the content of information resources in digital form (Borgman, 1997).

3.3.3 The 'Electronic Library': Discourses of Digital Libraries

The term "digital library" has gained a great deal of popularity in the last decade, and is used in a variety of circles, including technical, research, and library spheres. Discussions about digital libraries are important, because the discourses of the "library of the future" are primarily centered on digital libraries. Tensions exist between a definition of digital libraries framed by researchers, and one framed primarily by librarians (Borgman, 1999). For instance, researchers focus on digital libraries as content collected on behalf of user communities, while librarians focus on digital libraries as institutions and services (Borgman, 1999).

Since a digital library is such an all-encompassing term, it should come as no surprise that a variety of definitions exist. As discussed in the section on library automation, library catalogs can also be thought of as digital libraries (Borgman, 1997), although this definition of a digital library is not the most popular. In general, digital libraries are not about digitizing or replacing traditional libraries; rather, they are about new ways of preserving, collecting, organizing, propagating, and accessing knowledge (Witten & Bainbridge, 2003). However, a persistent belief exists that digital libraries are replacing physical libraries. This belief is based on a limited perception that digital libraries are merely digitized content.

Witten and Bainbridge (2003), the developers of the successful *Greenstone* open source digital library software describe a digital library as, “a focused collection of digital objects, including text, video, and audio, along with methods for access and retrieval, and for selection, organization, and maintenance of the collection” (p. 6). This definition, these authors insist, applies equal importance to both the user and the librarian – the access and retrieval part of the definition refers to users, while selection, organization, and maintenance refer to functions of librarians. The roles of librarians and physical libraries in the maintenance and development of digital libraries are an evolving area. Librarians in general tend to see libraries as organizations that select, collect, organize, conserve, preserve, and provide access to information on behalf of a community of users (Borgman, 1999). Within this view, the digital library connotes the “future library” in which the institution is transformed to address the new environment in which it exists (Borgman, 1999).

If digital libraries are indeed “future libraries,” however, articulating the role of librarians and the importance of physical libraries in maintaining digital library collections and providing services remains an important task. This re-articulation of librarians’ roles in preserving and providing equitable access to digital libraries is especially important in the context of determinist claims that predict the demise of physical libraries and librarians. One example of academic libraries emphasizing their roles in managing digital libraries for specific user communities is found in the work of the Digital Library Federation (Digital Library Federation, 2004b). An international association of primarily academic libraries, this organization is concerned with creating an international network of digital libraries.

While an exclusive and relatively high-level group, this organization nonetheless advocates for developing technical standards and promoting best practices in digital libraries, from an academic library perspective. If digital libraries are defined as comprising the three areas of content, collections, and communities (Borgman, 1999), then the library community has an important role to play in shaping the world of digital libraries. The discourse of digital libraries is still being shaped, with commercial actors in a position to gain an upper hand in defining it. Thus, while libraries as physical institutions are undergoing great transformations through the development of digital libraries, articulating agency for librarians and libraries in this transformation is an important task. A critical theory of library technology articulates this increased sense of agency for librarians in defining digital libraries, and also opens up a space for librarians to work with user communities to develop community-driven visions of digital libraries.

3.4 Proposing a Critical Theory of Library Technology

It is apparent from the examination of library technology discourses that technological determinism, scientific modernist thought, and technological utopian/dystopian ideas are dominant. In addition, commercial interests predominate, particularly in the field of library automation. Technology, often viewed as an autonomous domain in society with its own logic of “progress,” is forcing libraries to adapt to its exigencies. Forces within the library profession have embraced this technological change and have gone so far as to say that “paperless information systems” will replace the physical library (Lancaster, 1978), while others who are more skeptical of the emphasis on technological change within libraries talk derisively of “technophiles” and “technolust” (Crawford & Gorman, 1995). A large gulf exists between these two extremes in the library world.

On the one hand, the claims of the “technological enthusiasts” (for lack of a better term) about the changing nature of library roles in an information age have merit. For instance, the increasing dominance of electronic information, and the ways of managing this information have changed the roles of libraries. The prime role of information technology and the Internet in affecting large segments of society, including the library world, cannot be denied. Managing copyright issues in the digital environment and shaping the concept of access in an increasingly digital information environment are increasingly important roles for libraries (Nunberg, 1998). Yet a technological determinist strand remains, especially amongst those who view the “library of the future” as one that is increasingly defined as a “library without walls,” with electronic

information as its main component (Bloch & Hesse, 1993). These dreams of an “all electronic future” lead to questions about the “future of the book” (Nunberg, 1996) and the “future of libraries” (Nunberg, 1998). The very survival of libraries appears to be at stake in this discourse; thus, according to this logic, a “demise of the library” may be imminent if libraries do not adapt to the fast changing information technology and digital environment.

Those who counter the information society enthusiasts in the library world argue that we are not in an epochal, transformational time, but are rather at an important point in the evolution of libraries (Gorman, 2003). This evolution of libraries acknowledges the role of libraries as important management sites of digital information, but does not view the library’s future as wholly determined by information technologies. Information technology and the Internet are certainly transforming libraries, but this transformation is part of a long process of technological change and adaptation within libraries.

Library leaders, such as Gorman (2003; 2005), articulate strong critiques of information science and warn about the harmful consequences of the “all electronic future” for libraries and access to knowledge. These critiques are passionate and articulate a well-argued assault on technocratic mindsets in the library world. However, these critiques lack a theoretical framework to make them coherent. In addition, these critiques tend to fall back on a notion of the “traditional” library, which stands opposed to the “library of the future.”

This understanding of the “enduring” and “traditional” library is also problematic. An enduring and traditional library can easily become the opposite of the dynamic and

adaptive “library of the future” of the technocrats. The “library of the future” is defined in large part by the technocrats and the technological enthusiasts – reclaiming what this “library of the future” will look like from a non-technocratic perspective becomes an important site of struggle. This study is one attempt to develop a theoretical space for library technology that challenges the technocratic dreams of the technological enthusiasts.

This “futurist” view fails to capture the social character of technology, and the roles libraries have in shaping technology. In addition, technology is viewed as having a pre-ordained path. Thus, the potential for Internet technologies to challenge existing economic structures, divisions of labor, and power structures is not highlighted. What does it mean for technology to have a social character? The social character of technology lies in its *ambivalent* process of development, whereby technology is not a destiny but a scene of struggle (Feenberg, 2002). Technology must be able to “work” in particular situations, but the social character of technology lies not in the logic of its inner workings, but in the relation of that logic to a social context (Feenberg, 2002). Technology is not neutral or value-free, and reflects dominant political and economic interests.

Thus, while the Internet is affecting the roles of libraries, this realization of the social character of technology transcends the deterministic assumption that Internet technology has its own autonomous logic of development. Moreover, the notion of a “traditional” library adds to the misconception that libraries are not taking part in various “scenes of struggle” over the development of information technologies and the Internet.

In fact, libraries by their nature demonstrate ambivalent tendencies, as they have been able to adapt to societal pressures, developing into community spaces for democratic engagement. The continuous adaptation of libraries in surviving and defying the predictions of the techno-enthusiasts points to their essential ambivalence.

How can we theorize the agency of the library in technological development, without falling into the trap of technocracy or the derisive critiques of the *technophobes* in the library world? How can we transcend the technophobic and technophilic elements of the technology debate, as well as the “information science” versus “library science” dichotomies? As discussed earlier in this chapter, critical theory provides the strongest critique of technological rationality and technocracy, two major themes which permeate the discourse of library technology. A critical theory of technology thus attempts to develop a “dialectical optic” that avoids one-sided approaches in theorizing and evaluating the genesis of new technologies and their often contradictory effects (Kellner, 1999).

Transcending the instrumental view of technology and developing a theoretical framework that allows for a radical democratization of library technology is needed. This radical democratization challenges the social structures around technology that promote expanding systems of hierarchical control (Feenberg, 1995). An expansion of the *technical public sphere* (Feenberg, 1995) is needed, one in which wider democratic participation can have a bearing on library-based technological decisions. The increasing corporate domination of information technology in the library world and technocratic logics of development can thus be acknowledged and combated.

A definition of the purpose and ontology of the library should serve as a basis for establishing a theoretical framework for understanding library technology development. Thus, in light of the discussion about library values, ethics and goals mentioned earlier (see Chapter 1), let us take the definition of the library to be that of an institution concerned with access to and preservation of recorded knowledge and information in service to a community of users. A critical theory of library technology framework, therefore, must address the development of library technology to further the ideals of democratic and equitable access to information and ICTs for user communities. Information equity can be defined as the:

..fair or reasonable distribution of information among individuals, groups, regions, categories, or other social units, such that those people have the opportunity to achieve whatever is important or meaningful to them in their lives (Lievrouw & Farb, 2002).

Lievrouw and Farb (2002) discuss equity both as a matter of the traditional definition of the “information rich and poor” (vertical equity), and as a matter of the nature of information and the varying capacity of individuals to benefit from it (horizontal equity). A critical theory of library technology framework needs to address both these vertical and horizontal aspects of equity with regard to information access.

I propose this framework in light of the discussions of this chapter, as it arises from the dialectic of technology within libraries. The dialectic of technology mediates between the techno-enthusiast and technophobic poles of the library technology debate, exposing contradictions and openings for progressive action. This dialectic exposes an

environment of technological determinism, technocratic agendas, and increasing corporate control of information technology. A framework emerging from this dialectic needs to address these issues affecting library technology. Thus, I draw upon areas of study that provide the most pertinent layers of analysis for the development of this framework. This preliminary framework establishes the structure for critical inquiry – future research will help further develop the dimensions of this model. The model is both a conceptual tool for helping the field think more critically about technology and to re-envision the library as a prominent technological voice in society, as well as an analytical tool for exploring library technology activities and movements.

The construction of the framework proceeds first by identifying areas of study and critical orientations that address the contradictions and openings exposed by the dialectic of library technology. I argue for the relevance of these areas of study in combating the determinist and technocratic agendas plaguing the field of library technology. These areas of study are labeled the “foundations” of the critical theory of library technology framework (see Table 1). The foundations of the framework provide conceptual tools for re-envisioning library technology in a more progressive, democratic, participatory, community-oriented, open, and collaborative fashion. A re-envisioning of library technology within this framework is part of a reconstructive, transformative project of library technology.

These foundations also develop the use of the framework as an analytical tool for the study of library technology actions. For the framework to have an impact as an analytical tool, however, it is important to understand the levels at which it can have an

impact. Based on the foundations, I argue that library technology actions should be viewed at various “levels of impact.” These levels of impact should address the social, technical, institutional, economic, and political contexts of library technology, and are defined in the realms of: 1) policy and advocacy; 2) individuals and communities; and 3) systems and institutions (see Table 2).

For each level of impact, I distinguish different “orientations” that describe idealized norms for guiding library technology development. These orientations are derived from the foundations of the framework and the dialectic of library technology. For the *policy and advocacy* level of impact, a “progressive & democratic” orientation is emphasized, which combats technocracy and addresses issues of power in the development of library technology. In the case of the *individual and community* level of impact, a “participatory and community-oriented” orientation is emphasized, arguing for community input in the development of library technology. For the *systems and institution* level of impact, it is associated with an “open and collaborative” orientation, emphasizing institutional collaboration and economic challenges to the dominant, hierarchical forms of technology development.

Finally, I briefly describe how the dimensions of this framework can be applied to studies of library technology development. The framework provides the guidelines for a critical orientation in the study of library technology, but it also remains flexible and adaptive to different critical theoretical orientations. Thus, researchers who find other critical social theories that are useful to the study of library technology can incorporate

these theories into the overall “umbrella” framework of a critical theory of library technology.

A Critical Theory of Library Technology Framework – Part I: Foundations

Table 1

Foundations	Description
<i>Technology as fundamental basis of library development</i>	<ul style="list-style-type: none"> • Technology and technological change lie at the heart of library development • New media and technologies inherent to library’s continual transformation • Library as a dynamic institution
<i>Social and community informatics</i>	<ul style="list-style-type: none"> • Library technology as part of a socio-technical construct • Contextualizing library-based information and technology initiatives in broader social environments • User community agency and participation in library technology development • Culturally appropriate technologies • Local control
<i>Critical theory of technology</i>	<ul style="list-style-type: none"> • Critique of library technology in relation to its political, economic, ideological, and societal contexts • Library technology as a “site of struggle” • Shaping of technology with library values and ethics in mind • Interrogation of power dynamics in libraries

A Critical Theory of Library Technology Framework – Part II: Analysis

Table 2

Level of Impact	Orientation	Dimensions of Analysis
<i>Policy & Advocacy</i>	<i>Progressive & Democratic</i>	<ul style="list-style-type: none"> • Challenges technocracy, techno-capitalism, technological determinism, corporate hegemony of ICTs and Internet, etc. • Addresses issues of power in the development of library technology • Political challenge • Ideological challenge
<i>Individual & Community</i>	<i>Participatory & Community-Oriented</i>	<ul style="list-style-type: none"> • Community input and participation in the development, production, management, and maintenance of library technology • Utilizes participatory aspects of technologies • Local control • Social and cultural challenge
<i>Systems & Institution</i>	<i>Open & Collaborative</i>	<ul style="list-style-type: none"> • Values institutional collaboration • Builds on existing library strengths of resource sharing and cooperation • Challenges hierarchical models of technology development • Economic challenge

3.4.1 Foundations

A critical theory of library technology, following in the tradition of the Frankfurt School of critical theory, is multi-disciplinary in its approach, and addresses the power dynamics of library technology practices. As critical theory moves from the universal to the particular in its analysis, this framework also moves from the larger context of the information society to the particulars of library practices and services. The framework builds connections between these contexts, and also provides a lens to understand the techno-capitalist pressures facing many libraries today. In addition, the framework links theory to practice, providing a space to re-shape determinist and instrumentalist discourses.

The foundations of the critical theory of library technology framework provide the conceptual tools for a re-envisioning of library technology. As a form of “critical theory,” this framework is by its nature a multi-perspectival approach. Critical theory is compatible with a multi-perspectival approach, which allows a diversity of perspectives to articulate a complex, multi-dimensional social reality (Kellner, 1989). The social reality, in this case, is concerned with the technological roles and services for libraries in an information society. The foundations of the framework are thus multi-disciplinary, and are open and flexible enough to incorporate other critical social theories and approaches as well (e.g., feminism, post-colonialism, etc.).

The first area I draw upon for the foundations of this framework is from the work of Marshall McLuhan and other scholars, such as Walter Ong, who study the *technologies* of printing and literacy. In particular, McLuhan’s description of the

“electric age” and the “extensions of man” has application to a study of library technology. My goal through drawing upon scholars, such as McLuhan and Ong, is to highlight the importance of technology as the basis of the library’s ontology. This understanding of technology as integral to the library’s functioning is not new, but this framing counteracts determinist’s claims about technology’s disruptive impacts on libraries. The second area I focus on is the social informatics and community informatics perspective, as articulated by Kling (2000), Warschauer (2003), and others. A social/community informatics orientation also problematizes the determinist position by emphasizing the social contexts of technology. Community informatics brings a community technology perspective, which interrogates the relationships between culture and technology. This perspective opens the library technology discussion to questions of multiculturalism, cultural relevance, and other critical theoretical orientations that deal with equity for marginalized populations.

Lastly, I bring critical theory of technology into the discussion, drawing primarily on the work of Feenberg (1995; 1996; 2002) and Kellner (1999). While social informatics brings a critical perspective to studies of technology in social contexts (Kling, 1999), critical theory of technology extends this critical orientation by interrogating ideologies of technology and the relationship of technological discourses to social and economic power.

A unifying theme for these three areas of inquiry is the democratization of library technology development. What does democratization mean in this context? The term “democracy” has a wide range of meanings, and it can be defined in the following ways:

competitive democracy, participatory democracy, and discourse or dialogue democracy (Lievrouw, 1994). Competitive democracy is meritocratic in nature and mirrors existing technocratic power structures, while participatory democracy reflects what most Americans mean when they say “democracy,” and is based on the premises that all legitimate/recognized groups’ claims should be represented fairly, and that political participation should be as broadly based as possible (Lievrouw, 1994). Discourse or dialogue democracy has evolved from the work of social theorists, such as Jurgen Habermas, and rests on the premise that citizens must have the right and ability to engage with others in open discourse about issues that affect them (Lievrouw, 1994).

Specifically, with regard to democratization of technology, true democracy must protect public access for entities and persons hitherto excluded from consideration, while also ensuring that new elements and voices be integrated harmoniously with the structure of the network (Feenberg, 2002). Democracy is a matter of maintaining the permanent possibility of contestation in technological decision-making (Feenberg, 2002). In the context of this study, libraries and their user communities can be considered as groups that have been previously excluded from larger discourses of technological power. A critical theory of library technology framework envisions libraries having a greater voice in technological decisions and more control over their technological development. According to Feenberg (2002):

Opening technical development to the influence of a wider range of values is a technical project requiring broad democratic participation. Radical

democratization can thus be rooted in the very nature of technology, with profound consequences for the organization of modern society (p. 34).

This statement speaks to the dialectic of technology, as the very same technologies that are part of a technocratic framework can also open up radically democratic possibilities. He adds that “a fundamentally different form of civilization will emphasize other attributes of technology compatible with a wider distribution of cultural qualifications and powers” (Feenberg, 2002, p. 35).

In addition, Feenberg (1999) discusses democratization in the technical sphere as a movement, what he calls “deep democracy.” He states, “As distinct from ‘strong’ democracy, I will call a movement for democratization ‘deep’ where it includes a strategy combining the democratic rationalization of technical codes with electoral controls on technical institutions” (Feenberg, 1999). Thus, democratization works at both the systems and institutional levels of technological development. Deep democratization offers an alternative to technocracy, as popular agency is normalized and incorporated into the standard procedures of technical design (Feenberg, 1999). The popular agency in this case can rest with librarians and their user communities in the direction of library technology development. However, in any type of democratization of technology, technical leadership has a distinct place in the division of labor, as it will always remain separate from the mass, and cannot be replaced by popular action (Feenberg, 1999). Despite this reality, popular agency can reduce some of the operational autonomy of experts, and in the case of open source software, might help expand the realm of

technological expertise within the library community. Chapters 4, 5, and 6 will explore this idea in more detail.

In terms of a critical theory of library technology framework, I am defining democratization in terms of participatory and discourse democracy, and Feenberg's "deep democratization." Through participatory democracy, libraries and communities can have a voice in the development of library technology, and discourse democracy envisions a more interactive form of library technology development. A vision of an enhanced discourse and participatory democracy parallels the transformation of an information environment from one that is *informing* to one that is *involving*. Informing environments are reliant on traditional mass media and information systems and are focused on information consumption, while an involving environment is reliant on discursive information systems and media, and information seeking and communication (Lievrouw, 1994).

For instance, new media and internet technologies are providing new possibilities for interactivity, activism, and democratization, as evidenced by technologies such as mobile phones and blogs (Kahn & Kellner, 2005). Rather than a traditional view of the media environment as a site for the production, distribution, and consumption of media products, an alternative view is emerging that sees the environment mainly as a venue for participation, speech, interaction, and creativity (Lievrouw, 2006). This alternative view is reflected in interactive tools, such as blogs and wikis. Thus, a more participatory view of information technology within libraries might involve the use of these types of interactive technologies to build ties with user communities and professional

collaborators both within and outside the library community. Internet technologies are providing a more interactive and communication-oriented element to traditional “informing” activities, and libraries can take greater advantage of this element to develop new forms of collaboration and service models for their user communities.

In addition, other important issues need to be addressed within a critical theory of library technology framework. For instance, how can determinist and technocapitalist formulations of library technology be challenged? What are ways to overcome the technophilic/technophobic divides in the field? The following discussion addresses these questions by focusing in turn on each major area that contributes to a critical theory of library technology.

A) Technology as a Fundamental Basis of Library Development

Any critical theory of library technology needs to embrace the technological changes affecting libraries, while maintaining a balance between a critical engagement with technology and the techno-futurist visions of an “electronic library.” Buckland (1992), in *Redesigning Library Services: A Manifesto*, reflects this balance when discussing the effects of information technology on libraries. In addition to being both visionary and practical, Buckland’s book argues that regardless of one’s personal feelings on the matter, the management of electronic information is an increasingly important role for libraries (Gorman, 1992). He also provides a useful framework for understanding technological development within libraries, as he divides the technological bases of library operations and materials into the paper library, automated library, and electronic library (M. Buckland, 1992). While paper itself can be considered a technology, the

automated library and electronic library directly involve information technologies. Buckland's electronic library avoids the extremes of the technological futurists, but also acknowledges the importance of managing electronic information.

The discussion of a paper library and Buckland's framework sheds light on the evolution of technology within libraries. It can be argued, for instance, that writing is one of the first "information technologies," as writing ushered in the modern concept of information (Hobart & Schiffman, 2000). The modern library, as an institution concerned with preservation and access to documents (M. K. Buckland, 1988), thus has its origins in the development of writing, and particularly the development of printing. The development of writing, literacy, and the printing press, and their effects on human development have been widely discussed by various authors (Hobart & Schiffman, 2000; McLuhan, 1964; Ong, 1982). Without focusing on the details of these arguments, a general agreement exists about the significance of the written alphabet – in particular, McLuhan (1964) discusses the rise of the phonetic alphabet and its power in shifting oral, pre-literate societies into the visual space of the written word. With the advent of the television, radio, and other new media technologies, McLuhan (1964) describes a "return to orality," in which more participatory, oral-based communication has a resurgence within the context of a print literate society.

While writing ushered in a movement from aural to visual understandings of language, the development of printing suggested that words had become "things" far more than writing ever did (Ong, 1982). Writing had reconstituted the originally oral, spoken word in visual space, while print embedded the word in space more definitively

(Ong, 1982). The development of printing also made possible various other revolutions such as the European Renaissance, the Protestant Reformation, the development of modern capitalism, and European colonial domination (Eisenstein, 1979). In addition, printing brought about changes in family life and politics, diffused knowledge on a massive scale, made literacy a serious objective, made possible the rise of modern sciences, and otherwise altered social and intellectual life (Ong, 1982). Needless to say, the development of printing has been one of the definitive events in the creation of Western modernity.

The critique by Ong (1982) and McLuhan (1962; 1964), however, is focused on printing's ability to further individualize a human being's experience, furthering a break from the shared, communal experience of oral cultures. As McLuhan (1962) discusses, "print, as it were, translated the dialogue of shared discourse into packaged information, a portable commodity" (p. 164). The spontaneity, non-fixity of communication, and communal experience of oral societies were forever altered by the development of the phonetic alphabet and printing. Ong's (1982) discussion of "secondary orality" parallels McLuhan's (1964) "return to orality" by acknowledging the power of electronic technologies to create new forms of orality. As Ong (1982) states, "the electronic transformation of verbal expression has both deepened the commitment of the word to space initiated by writing and intensified by print and has brought consciousness to a new age of secondary orality" (p. 135). However, this secondary orality is not to be confused with a return to oral, pre-literate culture:

This new orality has striking resemblances to the old in its participatory mystique, its fostering of a communal sense, its concentration on the present moment, and even its use of formulas. But it is essentially a deliberate and self-conscious orality, based permanently on the use of writing and print, which are essential for the manufacture and operation of the equipment and for its use as well (p. 136).

Ong continues with this description of secondary orality, and links it with McLuhan's "global village." This global village is the understanding that new electronic technologies are developing a new sense of the communal, as these technologies span the globe, giving immediacy and a feeling of interdependence (McLuhan & Powers, 1989).

How does this discussion pertain to a theory of library technology? The development of writing and printing technologies, and the development of new electronic and information technologies parallel the development of the library. The modern conception of the library is not possible without the development of printing – the conception of libraries as stewards of recorded documents and information is fundamentally based on printing. However, the rise of electronic and information technologies has also been the story of library development, with libraries often at the forefront of technological advances. Libraries in fact have always been interested in and engaged with technology, as they were early adopters of computers, especially through the automation movement (Gorman, 2000). In addition, the discussion about "secondary orality," highlights the need for libraries to accommodate non-literate, oral cultures into their services – this reality is more pertinent in developing countries, and former IFLA president Kay Raseroka has mentioned this as an important goal (Raseroka, 2003). The

implications of a “return to orality” for library services remains to be seen, as the idea of a “library without walls” needs to be extended to encompass oral cultures as well.

The discourse of the “electric age” and the use of ICTs in libraries opens up new service models and opportunities for information access. In addition, McLuhan’s “global village” anticipates the networked information realities of libraries. Moreover, authors such as McLuhan (1962) and Ong (1982) do not talk about a simple linear progression to an “electronic age” – rather, print-based technologies and other electronic technologies co-exist and interact in different ways. This reality parallels the situation for libraries, in which both print-based and electronic materials play essential roles in service models. The information and electronic age, therefore, is not something that is merely “happening” to libraries; the technological changes and movements that McLuhan and others describe are part of the library’s ontology as well. In particular, McLuhan’s (1962) use of the term “electric age” parallels discussions about the “electronic library.” In addition, his discussion about technologies as “extensions of man” has the most promise in its application to a critical theory of library technology (McLuhan, 1964).

Specifically, this “extensions of man” thesis complements Buckland’s (1982) discussion of the automated and electronic library. McLuhan (1962) discusses how “with the arrival of electronic technology, man extended, or set outside himself, a live model of the central nervous system itself” (p. 53). Thus, technology extends human capabilities. For example, the automobile is an extension of human locomotion, the radio of human aural capacities. While McLuhan discusses the extension of technology in relation to human capabilities, this analogy can be extended to institutions such as libraries as well.

For instance, both the automated and electronic library are “extensions” of primary library functions. The automated library is concerned with library operations and processes, whether circulation or online searching. The electronic library, with its focus on the management of electronic documents, is an extension of vital information access functions. Using the “extensions of man” thesis, technological development is not imposed on libraries, but rather comes from within as an extension of fundamental library processes and goals. The nature of this technological development depends on the characteristics of the social actors that participate in the development, and the purposes for which the technology is applied.

In the framework I am proposing, technology is not the defining characteristic of the library, but technological change is a fundamental part of the library’s ontology. Technological change lies at the heart of the library, from the development of printing onwards. Technology is thus not an intrusion on a library’s function, but an essential part of its being. Therefore, determinist critiques that frame technology as an outside force affecting libraries are undermined, as technological change and adaptation lies at the heart of the library’s *being*.

B) Social and Community Informatics

Other areas of inquiry that challenge the deterministic thesis are the social informatics and community informatics approaches. Technology and the social world are not seen as separate in these models, and are in fact intertwined. While a social informatics perspective is often associated with studies of socio-technical systems within organizations, the related field of study known as community informatics takes insights

from social informatics and applies them to community technology settings. These terms are often used interchangeably, but for the purposes of this discussion, I will focus on the social informatics approach of Kling (1999) and the social/community informatics approach of Warschauer (2003). I choose these scholars as representative examples of these approaches – Kling, in particular, stands as one of the primary “founders” of the social informatics approach.

Social informatics is the body of research that examines the design, uses, and consequences of ICTs in ways that take into account their interaction with institutional and cultural contexts (Kling, 2000). As Kling (1999) discusses:

One key idea of social informatics research is that the “social context” of information technology development and use plays a significant role in influencing the ways that people use information and technologies, and thus influences their consequences for work, organizations, and other social relationships (p. 9).

Thus, technology is not abstracted from the social environment, but is co-constituted with the social world. In fact, one of the interesting and durable findings from social informatics research is the analytical failure of technological determinism (Kling, 1999).

While the concept of technology as a socio-technical construct is now generally understood in many studies of technological change, it is useful to revisit social informatics as a framework in developing a critical theory of library technology. Specifically, Kling’s (1999) description of social informatics as having an analytical orientation and a critical orientation is helpful for this study. The analytical orientation

refers to studies that develop theories about information technologies in institutional and cultural contexts or to empirical studies that are organized to contribute to such theorizing (Kling, 1999). The critical orientation refers to examining information technologies from perspectives that do not automatically and “uncritically” adopt the goals and beliefs of the groups that commission, design, or implement specific information technologies (Kling, 1999). Both an analytical and a critical orientation are taken up in this study. However, where critical theory differs from a social informatics perspective is in the definition of what a *critical* approach entails. This point will be discussed in the next section.

Community informatics approaches are especially pertinent in studying issues such as the “digital divide” (Warschauer, 2003). The digital divide (NTIA, 2000), which refers to inequities in the use of and access to ICTs and ICT-driven content by different populations in society (the “haves” and the “have-nots”), has been a serious policy concern over the last decade. Libraries are playing an important role in combating the digital divide, often providing free access to the Internet for populations which otherwise would not have access (B. P. Lynch, 2002). The extent and the degree to which libraries are “combating” the digital divide is a debatable point and an area of on-going research; regardless, the Gates Foundation has made the donation of ICTs to public libraries a central part of its strategy to deal with the digital divide (Gates Foundation, n.d.).

Underlying the traditional framing of the digital divide, however, are determinist assumptions which presume that just access to technology and the Internet will solve problems that are essentially social in character. The problem with technological

determinism in studying the digital divide is the fact that the social aspects of the digital divide are obscured in favor of technology-based solutions, when in fact the digital divide is a social policy issue. The logic of the digital divide, based on a technologically deterministic view that social problems can be addressed through providing computers and Internet accounts can be problematic (Warschauer, 2003).

Warschauer, in *Technology and Social Inclusion* (2003) furthers this line of critique and uses the *Falling through the Net* studies as a jumping-off point to explore the notion of the digital divide in various countries such as India, Brazil, Egypt, China, and the United States. His empirical research for this study includes long-term ethnographic research and short-term, intense field observations, along with interviews and the utilization of secondary data sources on the digital divide. The results of his research led him to the conclusion that 1) access to ICTs is embedded in a complex array of factors encompassing physical, digital, human, and social resources and relationships, including relevant content and language, literacy and education, and community and institutional structures; 2) the binary division of information haves and have-nots is not accurate, but is rather a gradation based on different degrees of access to information technology; 3) technology and society are intertwined and co-constitutive, making technologically deterministic ideas inaccurate; and 4) the digital divide framework provides a poor road map for using technology to promote social development because it overemphasizes the importance of the physical presence of computers and connectivity to the exclusion of other factors that allow people to use ICTs for meaningful ends (Warschauer, 2003). In addition, he discusses the importance of “social inclusion” as an important factor in

understanding how to combat the digital divide – communities need a host of local resources, skills, opportunities, and relevant solutions to help them effectively participate in society and control their own destinies (Warschauer, 2003).

Thus, when libraries are providing access to ICTs, it is important to understand the difference between technological access and social access. A social informatics perspective helps provide a distinction between these two types of access. Technological access refers to the physical availability of suitable technological equipment, while social access refers to “know-how” – a mix of professional knowledge, economic resources, and technical skills for using technologies in ways that enhance professional practices and social life (Kling, 2000).

If libraries are merely providing technological access to ICTs, these efforts may not be sufficient in tackling digital divide issues. A range of social access issues exist, which can take the form of technology training sessions and capacity building for the public. Many public libraries in fact are implementing more holistic Internet access strategies that take account of social access issues. Various studies have addressed library-based programs focused on social inclusion and coping skills for immigrants, for instance, and have addressed the need for libraries to take a more active role in community archiving activities (Caidi & Allard, 2005). A critical theory of library technology orientation, however, develops a more consciously active role for communities in having input and greater involvement with library technology development.

Library technology systems, such as digital libraries, can be designed in cooperation with communities – the community informatics strand of the critical theory of library technology framework allows for this possibility. A social and community informatics approach thus offers a foundation for understanding the socio-technical constructs of library technology. In addition, the community technology and participatory development aspects of a community informatics approach emphasize the importance of culturally relevant and community-driven technology projects.

While addressing the democratization of the Internet and information technologies is an important task of critical theory, insights from community technology and participatory development studies highlight the important role of culture in studies of technology. Critical theory opens up a dialectical space for a progressive re-conception of technology and questions the capitalist context in which information technologies develop. Studies of participatory development, however, highlight the role of community input and the importance of multiple cultural ontologies in decisions regarding technological development. These types of participatory technology development projects conceptualize a model of engaging communities to develop and articulate their own goals of information access (Srinivasan, 2006b). These projects can also be extended to meet the needs of indigenous and ethnic communities (Srinivasan, 2006a).

This model of community engagement in technology projects complements the social informatics perspective, and argues that technology projects must reflect community visions (Srinivasan, 2006b) and local cultural ontologies. In the context of marginalized ethnic and indigenous communities, numerous studies have shown the

empowering benefits of ICTs for these communities (Srinivasan, 2006a). However, not all ethnic communities benefit equally in terms of ICT adoption and use, as various cultural, technical, and political factors can be barriers. In addition, some ethnic communities have not stepped up to fully embrace ICTs for their information and communication needs (Chu, 2004). For instance, in the case of the Chinese community in Peru, “Chino Peruanos” have not used the Internet to develop a web-based community due to challenges manifesting at the national socio-political consciousness level, the technological level, and the community practice level (Chu, 2004). Thus, culturally relevant interventions are important, but without socio-political consciousness and technological capacity, community technology initiatives may not be successful. Community technology initiatives in the context of libraries should not therefore be seen as “fixes” for particular problems, but rather as part of larger socio-technical, political, economic, and cultural contexts.

To illustrate the importance of designing culturally relevant ICTs and information systems for ethnic communities, it is useful to look briefly at the introduction of a geographic information system (GIS) for land management in India (Walsham & Sahay, 1996). Walsham and Sahay (1996) discuss how this GIS project was ultimately unsuccessful. Various factors exist for this failure, but the ultimate cause was that the ontology and data model of the system did not match with local cultural practices and ontologies. This example provides a lesson about the failures of many such “technological transfer” projects from the developed world to the developing world. This

reality needs to be kept in mind when theorizing library technology development in the global South.

In this case, the GIS data model, developed out of a Western culture of map usage and scientific applications, invests heavily in high quality spatial data that is not readily available in developing countries. In addition, the coordination of various user groups to make effective use of the data requires a culture of organizational coordination not present in the Indian government. India is not a map-based culture, and Indians, scientists and educated people included, rarely use maps in their daily life (Walsham, 2001). A GIS system imposes a culture of map use that is not present in Indian society. However, one cannot say that map usage will not become popular in India; map use may increase over time. But, investing in a data model that does not match the ontology of the local culture will not result in a successful ICT introduction. In fact, the likelihood that people will be resistant to new GIS technology reduces when the transition is made in a gradual rather than sudden manner (Walsham & Sahay, 1996). More proactive interaction between the users and the developers can help design better GIS decision models (Walsham & Sahay, 1996). Thus, a participatory technology development framework that matches local cultural realities can produce better outcomes.

This participatory development framework can be applied to the design of digital libraries, for instance. Libraries, as institutions with electronic collections, can include the active participation of communities in the creation of community archives and community-based digital libraries of collections relevant to a particular community. This orientation also opens up other critical cultural perspectives into the design of library-

based technological systems, including various multicultural and postcolonial critiques of science and technology and the politics of “technology transfer” in the developing world (Harding, 1998; Rahnema & Bawtree, 1997; Third World Network, 1993). Many of these multicultural and postcolonial critiques argue against the Western bias of technology systems, and the associated capitalist and modernist power structures that often accompany the introduction of these systems. This aspect of a critical theory of library technology is especially important when addressing library development in the global South and for marginalized/oppressed communities. In addition, spaces for addressing critical power/knowledge (Foucault, 1980) issues about the roles of physical libraries and digital libraries in developing countries can also be opened up in this framework. Thus, other critical theories that are relevant to this foundation can be added to future critical studies of library technology.

C) Critical Theory of Technology

Critical theory and critical theory of technology give a more transformative social character to the framework I am proposing, beyond the critical orientation that social and community informatics provides. Critical theory of technology discusses the essential *ambivalence* of technology (Feenberg, 2002), its ability to be shaped by social forces for progressive ends. This concept of ambivalence can also be applied to the library itself – libraries can also be shaped for progressive and more democratic ends. Specifically, a critical theory of technology orientation maintains that while the Internet and ICTs have developed under capitalist hegemony, these socio-technical constructions are sites of

struggle and contestation. Developing more progressive visions of technology requires theorizing a dialectic of technology (Kellner, 1999).

The dialectic of technology refers to the often contradictory forces present in technology – for instance, while technology develops in a context of technocapitalism, Internet technologies also offer the possibility for wider democratic participation and progressive activism (Kahn & Kellner, 2005). Various activist groups have used blogs, wikis, and other social networking tools to mobilize in numerous progressive and anti-war movements, and this technologically-mediated activism serves as a challenge to corporate hegemony of the Internet (Kahn & Kellner, 2005). The Internet, thus, remains a contested space, where progressive forces have opportunities to shape the nature of this technologically-mediated space.

Information society discourses and their associated ideologies and policy formulations also present several important questions about the future of the Internet. In a basic sense, will the Internet follow a dominant information society path and become increasingly consumed by commercial interests, or will more progressive and democratic forces shape the Internet? The answer to this question depends, to a large degree, on the nature of networked technologies, and the possibilities they open for undermining forces of commoditization and increasing corporate control over the Internet. Rather than being a “completed” product, the Internet remains an unfinished project, as its democratization is a work in progress (Feenberg, 2006).

Thus, the continued growth of the Internet requires that Internet politics be re-theorized from a standpoint that is both critical and reconstructive (Kahn & Kellner,

2005). The technocratic vision of the information society, with its deterministic and neo-liberal logics, needs to be challenged for more democratic conceptions of the Internet to emerge. These challenges are occurring in various communities that have formed around the use of Internet technologies. Several communities are at the forefront of various struggles for Internet democratization, and are organized around issues as diverse as medicine, music sharing, open source software, libraries, video games, and online education (Feenberg, 2006). Thus, libraries are part of this larger struggle as well. I argue that libraries can play a significant role in this critical and reconstructive theorization of Internet technologies and politics.

However, to understand how technology is a scene of democratic struggle, the example of the Minitel in France is instructive. A program based on the technocratic ideals of French government bureaucrats, the telephone company distributed millions of free terminals called “Minitels” as part of a national videotex service in the 1980s. The Teletel program, in which the Minitels were distributed, was viewed as a link in the chain of French national identity, and was designed to bring France into the information age by providing a wide range of information services (Feenberg, 1995). Despite the ambitious technocratic plans of this project, the Minitels were viewed with suspicion by a population wary of a conservative government; despite the vast amount of information the Minitels presented, little of this information was actually utilized (Feenberg, 1995). In fact, not until the Minitel was hacked and turned into a communication device did it become a popular device – not however, as an informational tool, but as a tool of highly personal, anonymous communication (Feenberg, 1995).

The case of the Minitel in France is one example of how technology that is rooted in technocratic ideologies was ultimately subverted and radically altered. What was a one-way informational device became a communication device. The significance of the Minitel is in its contestation and eventual triumph over technocratic logics. Rather than being an isolated case, many such “battlegrounds” for combating technocracy exist. One such “battleground” is the domain of the library – an institution transformed by the Internet and expanding on its mission of information access in the Internet age. Libraries are increasingly associated with information society policy agendas, but due to their professional ethics and the power of Internet technologies, they are in a position to shape an information society in line with their more service-oriented and non-commercial ethics and values.

For example, libraries are playing a role in democratizing access to scholarly publications through electronic publishing and open access efforts. Critical theory of technology provides the framework to envision libraries as using the power of Internet technologies to advocate for their economic interests. In response to various economic pressures (as part of the greater context of the “information society”), for instance, academic libraries are taking on important roles with regard to the scholarly publication process. The development of institutional repositories and exploration of electronic and open access publishing models have made academic libraries important players in the debate over the future of scholarly publishing (Willinsky, 2006).

3.4.2 Levels of Impact, Orientations, and Dimensions

The foundational principles of the framework define the conceptual tools and knowledge needed for the field and profession to think more critically about library technology development. However, for the framework to have an impact as a lens for analysis, we need to understand on what levels it can be applied. Critical theory of technology's focus on democratization informs how we can envision this framework in action. With democratization of technology as a guiding principle, the framework needs to address technology at technical, institutional, social, cultural, political, and economic levels. Technology, therefore, cannot be merely reduced to its technical design or technical codes, as a wide range of technocratic power structures and logics are built around it (Feenberg, 2002). Technology has a fundamentally social character, which is not tied to the logic of its inner workings, but rather to the relation of that logic to a social context (Feenberg, 2002). To address this reality of technology as a socially-mediated construct and logic of power, I propose that a critical theory of library technology framework address library technology at the following levels of impact: 1) policy and advocacy; 2) individual and community; and 3) systems and institution. These levels of impact address library technology in all its technical, institutional, social, cultural, political, and economic forms. These levels of impact intersect and can be applied to different aspects of a particular case.

Each of these levels of impact has associated orientations and dimensions of analysis, based upon the foundations of the critical theory of library technology

framework. For the *policy and advocacy* level of impact, it is useful to understand how *progressive and democratic* actions taken in this level are. This *progressive and democratic* orientation draws directly from the critical theory of technology foundation, and is focused on challenging technocracy, techno-capitalism, technological determinism, and corporate hegemony of ICTs and the Internet, for instance. This orientation also addresses issues of power in the development of library technology, focusing on who develops library technology and guides library technology discourses. Ultimately, this orientation is a political and ideological challenge, as it seeks to expand in a conscious way the power of libraries in affecting larger technological discourses in society.

The policy and advocacy level of impact can address areas of activism related to issues such as the Digital Millennium Copyright Act (DMCA), net neutrality, E-rates for public library Internet access, and open access publishing initiatives. Some of this advocacy and policy work is in fact already being conducted by the American Library Association's (ALA) Washington office and other library professional organizations. However, the critical theory of library technology framework makes explicit the stakes and dimensions of this type of technological activism. This level and orientation can also work on an institutional level as well, addressing issues of power in the guidance and development of library-based technology initiatives to meet user community needs. For example, community activism and organizing can affect how much community input is taken into consideration when designing technology-based services for user communities.

The individual and community level of impact ideally should focus on and be oriented towards *participatory and community-oriented* technological decisions. This

orientation is related to the social and community informatics foundation. This orientation emphasizes community input and participation in the development, production, management, and maintenance of library technology, and utilizes the participatory aspects of technologies. Whenever possible, local control in the guidance of technology development is preferable, and is related to community mobilization around library technology initiatives.

This level of impact can address issues related to the development of community-based information and technology services, such as library-based online community networks, online catalogs, and digital libraries. The *participatory and community-oriented* focus of this level of impact ideally should emphasize community input and involvement in the design of technology-mediated services such as online catalogs. Usability testing, user feedback, and development based on the self-defined needs of user communities are all part of this orientation. This orientation and level are at their core a social and cultural challenge, as it seeks to consciously take into account social and cultural values of librarians and their user communities in the development of library technology.

The systems and institution level of impact ideally should have an *open and collaborative* orientation to technology development. This orientation is based on the technology as fundamental basis of library development and the social and community informatics foundations, and argues for institutional resource sharing and cooperation in the development of library technology. Collaboration is a value and reality for much of the library profession, and this orientation builds upon these traditional strengths. This

orientation also draws from critical theory of technology, as an open and collaborative approach to systems development counteracts dominant hierarchical models of information technology development, presenting a potential economic challenge to the corporate-dominated technological status quo.

While not necessarily an endorsement of “open” initiatives such as open source software, for instance, this orientation challenges hierarchical models of technology development, and sees value in investing in the technical skills of library staff. While technical experts will continue to exist, critical theory of technology discusses the need for a democratization of expertise and democratic interventions into the technological decisions of experts (Feenberg, 1999), and open and collaborative initiatives can help in this regard. Inter-institutional collaboration might occur as well with community organizations or government agencies, and non-traditional library partners. Openness in this case is defined in terms of collaboration. However, institutional collaboration may not always be relevant for certain projects. With this point in mind, openness can also be described as an institutional orientation towards sharing best practices and lessons learned from library technology initiatives with the wider professional community.

3.4.3 Framework as Analytical Tool

The critical theory of library technology framework I have developed and described is a conceptual tool that presents idealized dimensions for guiding, examining, and re-envisioning library technology actions. In another sense, this framework can serve as an analytical tool in exploring and examining individual cases of library technology

development. This analysis can occur in various ways, and can address all three levels of impact.

However, it is important to note that a critical theory of library technology is an idealized framework, and the extent to which any case fits or does not fit the framework requires its own interpretation. Thus, judging a particular case a “failure” or a “success” is not necessarily appropriate, as no “perfect fit” exists. Rather, this framework allows one to explore areas for improvement and change that can guide an individual case towards the idealized goals of this framework. The framework provides the guidelines of a reconstructive project for re-envisioning library technology development and advocacy, and as such is not a project of critical deconstruction.

How might this type of analysis work? For instance, each level of impact, along with its orientation and dimensions of analysis can be applied in turn on a case of library technology development. Let us take, for example, a hypothetical case of a public library-managed online community network for a Bangladeshi immigrant community in the city of Artesia, California. This online network aims to meet the basic needs of this group for social engagement in the wider civic life of the community. The following provides a brief example of how the framework can be used as a mode of analysis. Chapter 6 provides a detailed application of the framework.

Let us explore briefly how each level can be applied to this analysis. First, we have the *policy and advocacy* level – does the development of this network reflect progressive and democratic tendencies? To understand if this project is determinist or fits a technocratic agenda, it is important to understand the power structures behind this

initiative. For instance, who is funding the project, the political influences behind it, and its ideological agenda need to be determined. In addition, one has to ascertain if the online network is meant to address locally-derived concerns of agency and power. For instance, is the project part of a larger advocacy agenda related to community-based information needs?

While the framework can be used to analyze the online network at the policy and advocacy level, it can also be used to inform the development of this project. For instance, librarians can work with the community to identify needs and develop collaborations with other organizations involved with this community. With this broader contextualization of community needs, the project can potentially be more actively linked to a larger policy and advocacy agenda.

On the *individual and community* level, one can understand if community input and agency are involved in the development of this network. Some questions to explore include: 1) Is the program focused more on “top-down” or more “grassroots” concerns?; 2) Does the technological decision-making structure allow for significant local control?; and 3) Are the electronic information resources relevant to the needs (content, language, etc.) of the community?. In addition, it could be useful to see if participatory technologies are utilized in the online network for community feedback and input. On the project development level, a process that includes community input and participation at various levels of the development process should be undertaken. The form of this input and participation will vary, but creating openings for greater community involvement should be given a priority.

On the *systems and institution* level, understanding how open and collaborative the technological development is will be useful. For instance, some questions to consider include: 1) How is this particular library developing the technology – is it working in collaboration with other libraries? How are costs allocated for project development?; 2) Are non-library institutions such as community organizations, private companies, or technology non-profits involved in systems development?; and 3) Is the project investing in the technical skills of library staff?. Furthermore, it may be useful to explore how this particular library or library system contributes its experiences and knowledge to the wider library community.

It is important to understand that this hypothetical example is not meant to be purely a critique of a project potentially “falling short” of the framework. Rather, the framework provides an analytical lens to ask critically-informed questions about library technology actions. Ultimately, the framework can help us understand and frame in a more robust, conscious way the democratic implications of library technology initiatives, as it emphasizes positive outcomes, areas for growth, and lessons and best practices we can learn. The framework helps to overcome the opposing poles of library technology discourses and is critical because of its insistence on framing library technology in an idealized progressive and democratic light. At its core, the framework offers a democratic, reconstructive project of library technology.

The open source movement in libraries provides a useful example to begin exploring the application of the framework. Towards this purpose, this dissertation examines the open source movement in libraries. On the surface, it appears that the open

source movement in libraries is progressive and democratic, as it challenges proprietary models of software development. From an individual and community level, it also appears to be participatory and community-oriented, as librarians potentially have more control in guiding their technology development. Finally, from a systems and institution level, open source offers opportunities for open (non-hierarchical) and collaborative (multi-institutional) technology development. The case study offers an opportunity to apply the critical theory of library technology framework on a real library technology project.

Chapter 4: Open Source Software in the Context of Libraries

4.0 Introduction

As Chapter 3 has established the dimensions of a critical theory of library technology, it is useful to begin exploring technological movements in libraries with this framework in mind. The open source software movement within libraries provides a pertinent case study for exploring this framework, particularly with regard to its potential ability to give libraries more control over their software development. Open source software is also often part of wider movements for more grassroots and democratic technology models in the development of a global information society. In addition, some have suggested that the “hacker culture” of the open source programming world and the traditional “gift culture” of the library community complement each other, and the collaborative nature of open source software mirrors the many resource sharing activities of libraries (Clarke, 2000). This idea needs to be explored in more detail, especially with a critical theoretical lens. The benefits of open source software can potentially reduce costs, give users more control, and increase software performance (Courant & Griffiths, 2006). Open source software certainly appears to give libraries more control over technological choices and an ability to bring library values to software (Frumkin, 2002); however, the technological, institutional, and social dimensions of this phenomenon need to be explored in further detail.

The open source community within libraries is growing, with various applications developed for both academic and public libraries, as well as the presence of library-based groups dedicated to the promotion of open source software (code4lib, n.d.; Oss4Lib,

n.d.). The size of the library open source community is seen in a growing list of publications focusing on library-based open source software developments (Chawner, 2006), and it appears that the library open source community is approaching a level of “critical mass” in its development. However, despite the seeming match between OSS and library values of sharing and collaboration, little research has focused on understanding how and/or whether open source software can enhance library service ethics and goals. This chapter explores the open source movement within libraries and suggests preliminary avenues for best practices research in library-based open source software development. The case study in Chapters 5 and 6 provides an in-depth exploration of a critical theory of library technology framework in relation to open source development in libraries, as well as library open source best practices.

The first section of the chapter discusses Weber’s (2004) and Raymond’s (2001) frameworks for analyzing open source software development, and the second section examines the field of prominent open source library projects with these frameworks in mind. I have chosen to focus on Weber’s and Raymond’s frameworks largely due to their prominence in studies of the open source movement and development process. These library open source projects are discussed in relation to their applications, funding/economic structure, and management/development structure, within the context of Weber’s and Raymond’s frameworks for understanding open source development. Institutional, economic, political, and social factors are analyzed in relation to the projects’ successes and shortcomings, in an effort to highlight best practices. With these various projects in mind, the next section discusses the open source movement within

universities, as it provides important lessons for libraries in the development of open source software, particularly for academic libraries. The fourth section discusses the open access publishing movement within libraries, as it is often discussed in relation to the open source movement, and has particular relevance for the case study. Finally, the concluding section explores the critical theory of library technology framework in relation to the open source movement in libraries, and previews the case study.

4.1 Analyzing Open Source Software Development

The open source movement can be described as a fundamentally different way of organizing work and of defining property (Weber, 2004). Open source refers primarily to software, and a style of development that relies on large-scale collaboration efforts in the development of code. Code, the building block of software, is not proprietary in the open source development process. One major difference between commercial and open source products, therefore, is how value is created in the development process – in proprietary software, value is created in ownership of software code and development, whereas in open source software, value is created in the distribution of the software (Weber, 2004).

Open source software development, by its very nature, is a distributed and collaborative effort (Weber, 2004). From a political economy perspective, open source presents an interesting set of questions regarding: 1) the motivations of individuals to develop the software; 2) coordination of software development; and 3) managing complexity (Weber, 2004). Despite the fact that open source software seems to run counter to the logic of prevailing economic rationalities, it is a fairly successful system of development. The open source process views property more as a form of distribution, rather than a

traditional understanding of exclusive ownership. As Steven Weber (2004) argues, “Open source radically inverts this core notion of property. Property in open source is configured fundamentally around the right to distribute, not to exclude” (p.228). The result is a widely distributed system based on a freedom to modify software and make it freely (not necessarily free, as in without monetary costs) available to users.

4.1.1 Open Source Successes: Insights from Weber

Weber (2004) states that the open source process is more likely to work effectively in tasks that have these characteristics (but states that they are general hypotheses in need of further testing):

- Disaggregated contributions can be derived from knowledge that is accessible under clear, nondiscriminatory condition, not proprietary or locked up.
- The product is perceived as important and valuable to a critical mass of users.
- The product benefits from widespread peer attention and review, and can improve through creative challenge and error correction (that is, the rate of error correction exceeds the rate of error introduction).
- There are strong positive network effects to use of the product.
- An individual or a small group can take the lead and generate a substantive core that promises to evolve into something truly useful. (p. 271).
- A voluntary community of iterated interaction can develop around the process of building the product.

Moreover, the open source process is likely to work more effectively when agents have these characteristics:

- Potential contributors can judge with relative ease the viability of the evolving product.
- The agents have the information they need to make an informed bet that contributed efforts will actually generate a joint good, not simply dissipated.
- The agents are driven by motives beyond simple economic gain and have a “shadow of the future” for rewards (symbolic and otherwise) that is not extremely short.
- The agents learn by doing and gain personally valuable knowledge in the process.
- Agents hold a positive normative or ethical valence toward the process. (p. 272).

These characteristics will be important to keep in mind with regard to the discussion and analysis of Chapter 6. It has to also be noted, moreover, that open source generally has had more of an impact in large projects such as operating systems and less in end-user applications (Weber, 2004).

Weber (2004) also goes on to state that, with regard to future studies of open source software:

One of the next steps in research on open source should be to build analytic models that try to specify conditions that favor or hinder these experiments...The first is the relationship between problem-solving innovation and the location of tacit information, information that is not easily translated into communicable form....The second is the importance of principles and values, in contrast to efficiency as an organizing concept (p. 267).

This statement reflects upon some of the goals of this study, particularly as this research is using a theoretical model to study the open source movement in libraries. In addition, the principles and values of the library community as well as the open source process need to be analyzed in relation to each other.

When discussing open source software, however, one must avoid the simplistic understanding that “closed” software is somehow “bad” and “open” software is “good” (Weber, 2004). The open source software phenomenon inhabits a complex terrain, with many commercial users taking advantage of this software model as well. For instance, the “success” of open source is seen in its wide use in web servers, databases, and web programming languages (Weber, 2004). Open source is a model of software development in which source code is freely available, and is driven largely by practical interests. While prominent free/open source software leaders such as Richard Stallman (2002) have argued largely in ideological terms about the need for software to be “free” to use, modify, and distribute, others in the movement such as Raymond (2001) have stressed the practical benefits of the open source process in creating better software. In this viewpoint, open source software is understood as a process of systematically harnessing open development and decentralized peer review to lower costs and improve software quality (Raymond, 2001). The presence of a large number of distributed developers can provide a more effective quality control and “de-bugging” process, as “given enough eyeballs, all bugs are shallow” (Raymond, 2001, p. 30).

The open source development process poses several intriguing questions about the nature of distributed development. For instance, what mechanisms help coordinate these

types of projects? What prevents the development process from becoming chaotic and uncoordinated? The open source process seems to defy conventional wisdom in that developers are contributing to a public good without traditional incentives of financial reward, development is often rapid and coordinated despite the large distribution of developers, and the complexity of projects is effectively managed.

Weber (2004) believes that the answers to these questions lie in the understanding of a combination of individual incentives, cultural norms, and leadership practices. Individuals contribute code for a variety of reasons, with a belief in open source ideology one reason, but with pragmatic technical achievements often taking precedence. Open source developers often take pride in their coding and technical achievements, and credits are given to them in the development of code (Weber, 2004). Thus, a form of technical rationality dominates the open source development process – the technical logic of a certain piece of software often determines the direction of the software’s development (Weber, 2004).

4.1.2 Open Source Successes: Insights from Raymond

On the topic of cultural norms, Raymond’s (2001) description of the open source community as a “gift culture” is a useful example. Gift cultures are, according to Raymond, “adaptations not to scarcity but to abundance. They arise in populations that do not have significant material-scarcity problems with material goods” (p. 81). He justifies this analogy by stating that there is no serious shortage of disk space, network bandwidth, and computing power, and software is freely shared. In a gift culture, social status is determined not by what you control, but by what you give away – in the case of

open source software, abundance creates a situation in which the only available measure of competitive success is reputation among one's peers (Raymond, 2001). Thus, reputation is determined by the technical competence of developers and the quality of the code that they contribute to projects. As open source continues to become more of a factor in developing countries, however, it will be useful to investigate how cultural norms in open source development might change or persist.

Raymond (2001) describes the open source development process as different from traditional hierarchical development models. He describes the traditional mode of software development as a "cathedral" model of development, while the open source process resembles more of the development model of a "bazaar." In other words, rather than having the central planning model of the cathedral, the success of the seemingly less-structured open source development process lies in its "collection of selfish agents attempting to maximize utility, which in the process produces a self-correcting spontaneous order more elaborate and efficient than any amount of central planning could have achieved" (Raymond, 2001, p. 52).

Much of the discussion about the open source movement focuses on its advantages over proprietary models of development. One major advantage often discussed is the level of customization and control over software development for users in comparison to closed source software (Raymond, 2001). This advantage is reflected in an open source philosophy which promotes a large beta-tester and co-developer base and treats beta-testers as the most valuable resource in the open source community (Raymond, 2001). In addition, open source software also offers more security and a

rapid development cycle because of the collaboration that occurs among a variety of programmers from different institutions and locations around the world (Clarke, 2000).

Raymond (2001) also uses the example of Linux, the major open source operating system software, and the role of Linus Torvalds as the development coordinator of this large open source project, to demonstrate the importance of individual leadership and vision in these projects. As he states:

I think the future of open-source software will increasingly belong to people who know how to play Linus's game, people who leave behind the cathedral and embrace the bazaar. This is not to say that individual vision and brilliance will no longer matter; rather, I think that the cutting edge of open-source software will belong to people who start from individual vision and brilliance, then amplify it through the effective construction of voluntary communities of interest (Raymond, 2001, p. 54).

In this understanding of the open source development process, an important role exists for the visionary leader. However, for an open source project to be successful, a large and viable user and developer community needs to develop around it. The leadership of a smaller project is akin to ownership, and a project leader typically starts a project by articulating a goal, writing some code that demonstrates promise and viability, and inviting others to join in the work (Weber, 2004). The leadership structure of a larger project can expand beyond the original leader, but if a leader decides not to work on a project, the presumption is that someone else will pick up the project if it is worth picking

up (Weber, 2004). In general, however, it appears that the best open source projects invite users to share in the development and support process (Chudnov, 2006).

4.1.3 Management of Open Source Development

Another advantage of open source software often discussed is that of cost – as “free software” most open source products are free to download and install. However, this fact does not mean open source software is free of costs, as maintenance costs and technical knowledge are needed (Clarke, 2000). Despite the maintenance and other usage costs of open source software, it has been observed that the total cost of owning open source software is lower than that of proprietary software (Clarke, 2000). This idea of cost will be explored in more detail with the in-depth case study in Chapters 5 and 6.

The frameworks Raymond (2001) and Weber (2004) present highlight an important point about the management of open source development. Specifically, one has to distinguish between how code contribution is managed within a project and the project’s financial and management structure. Two large open source projects are worth a brief mention with regard to their code development and administrative structures – Apache and Linux. Apache dominates the web server market, and Linux is the major open source operating system with nearly forty percent of large American companies using Linux in some form (Weber, 2004). The success of these projects depends on a large pool of developers distributed across the world, with many developers contributing code on a volunteer basis. However, the administrative structures of these projects ensures their financial sustainability.

The Apache Software Foundation was incorporated as a non-profit corporation in 1999, and now serves as an organizational umbrella for a range of web-relevant open source projects (Weber, 2004). An Apache Software Foundation board of directors is responsible for the overall direction, coordination among the different projects, legal issues, and other kinds of central services that benefit the individual projects (Weber, 2004). The Apache Foundation thus manages and guides the development of the project. On a financial level, Apache development can be described in terms of a cost-sharing mechanism. For instance, Apache development conforms to a model in which competing software users find it to their advantage to cooperatively fund open source development because doing so gets them a better product at a lower cost (Raymond, 2001). A network of webmasters has been able to pool their resources for a large project with wide benefits, rather than to compete against each other.

Linux, on the other hand, has a more semiformal organization for decision-making about code, and decisions are made based on a semi-hierarchical “pyramidal flow” (Weber, 2004). Thus, in the final analysis, the last word on Linux’s code management structure rests with Linus Torvalds, the project’s founder. Raymond (2001) describes Torvalds’ style of development as, “release early and often, delegate everything you can, be open to the point of promiscuity” (p. 21). He further argues that the success of Linux, while owed in large part to Torvalds’ vision, is sustained through the effective construction of voluntary communities of interest (Raymond, 2001).

While voluntary communities can sustain large open source projects, what are models for financial sustainability? Raymond (2001) discusses seven different models

for sustainable funding of open source projects – two non-profit and five for-profit. I will not go into the details of these seven models, but will instead focus briefly on one financial model, the “give away the recipe, open a restaurant” model. In this model, open source software is used to create a market position for services (Raymond, 2001). For example, in the case of Linux, Red Hat Software is one of the leading distributors of the software. Red Hat packages services and provides a model in which technical support services are provided by a separate company. Will this type of model work in the case of libraries? Various open source code and financial management models may be applicable to the library community. The next section explores the open source movement in libraries.

4.2 Open Source Software in Libraries: Prominent Movements

Having discussed some of the major characteristics of the open source movement and open source development process, I now turn to discussing specific applications of open source software in libraries. Why would libraries be interested in utilizing open source software? Many of the advantages discussed in the earlier section – cost, customization, a rapid development cycle, more “bug-free” software – certainly apply. In addition, the context of the largely commercial library automation and vendor market discussed in Chapter 3 has played a role in pushing libraries to consider open source software. A consolidation of major library automation vendors over the years has reduced the number of choices libraries have for their automation needs (Breeding, 2006), while a changing information environment dominated by Internet technologies has given libraries new choices in meeting the information needs of their users (Pace, 2004).

Thus, different models of development such as open source software can be appealing to libraries – libraries, just like much of the IT world, are moving toward the greater adoption of open source software (Dietz & Grant, 2005). Moreover, on an ideological level, open source software, as a purportedly democratic and grassroots technology movement, might have symbolic and practical appeal for libraries trying to wrest control away from commercial vendors.

Libraries are taking up open source software as a way to reduce the costs of expensive commercial products, and to take ownership over their own technology development. In addition, it has been argued that the library profession's values line up with open source software (Frumkin, 2002). However, little research has focused on best practices for open source software development in libraries. This research begins the process of identifying library open source software best practices.

Open source software potentially allows libraries to contribute to software development, which can empower libraries and bring library values to software (Frumkin, 2002). The March 2002 issue of *Information Technology and Libraries*, in fact, is dedicated to examining the possibilities for open source software in libraries. One of the major themes occurring in this issue is that open source software offers opportunities for resource sharing and for libraries to take more control of their technology situations (Frumkin, 2002). In addition, the open source movement allows for libraries to contribute to technology development, pool resources, and save time and money (Frumkin, 2002).

Before discussing specific library open source projects, however, it is important to understand that open source products are as commonplace as Web server applications (e.g., Apache), databases, programming languages, and operating systems such as Linux (Weber, 2004). Libraries interact and use many of these products, and are thus open source users on a web infrastructure level. In addition, many commercial library vendor products utilize some open source tools and applications (Chudnov, 2006).

4.2.1 Library Open Source Communities

Active communities focused on library open source projects also exist – for instance, Oss4lib and Code4lib are two major websites serving as clearinghouses for library-based open source projects. Dan Chudnov, a prominent library open source leader, started Oss4lib in 1999 and maintains it. The stated mission of Oss4lib is build “better and free systems for use in libraries” and the site maintains a listing of free software designed for libraries and tracks news about related issues of interest (Oss4Lib, n.d.). The Oss4lib mailing list and website, dedicated to open source software in libraries, examines these issues in more detail and is an active community dedicated to finding open source solutions for libraries. In terms of library-specific open source products, over 100 of these have been announced on the oss4lib.org website, but fall into these basic categories: A) metadata tools; B) protocols; C) OPAC/ILS (integrated library systems); D) repositories; E) public services tools (e.g., library reserves applications); F) bibliographic management; and G) information retrieval (Chudnov, 2006).

Code4Lib is a related website, and a Code4Lib annual conference now takes place – this conference is described as a “loosely structured conference for library technologists

to commune, gather/create/share ideas and software, be inspired, and forge collaborations (code4lib, n.d.). This conference is an outgrowth of the Access Conference in Canada (code4lib, n.d.). The Access Conference takes place annually, and is the major Canadian library technology conference. It does not focus on open source issues exclusively; rather, according to the description from the conference's website, it is "an eclectic group of technically savvy people who get together every year to share fresh challenges, projects and solutions related to advances in information and library communities" (Access Conference, 2006b). A related event at this conference is the Access "Hackfest," which is an event where library programmers discuss projects. The conference website describes Hackfest as a "day-long adventure in which coders and library-side folks get together in a relaxed and non-pressure atmosphere to tackle challenges and find solutions, in a mash-up sort of way" (Access Conference, 2006a). The context of the Access Conference and Hackfest is important to keep in mind in relation to the case study in Chapters 5 and 6.

4.2.2 Advantages of OSS for Libraries

A paradigm of software development that allows customization and is based on a distributive notion of property can potentially appeal to libraries, which could utilize open source values and principles to better meet their institutional and user needs. The collaborative aspect of open source software development mirrors the information and resource sharing ethics of libraries (Clarke, 2000). Clarke (2000), in an unpublished master's thesis entitled *Open Source Software and the Library Community* discusses how the library and open source community's principles and values are similar, arguing that

open source software is the best way to accomplish the library's goals and to ensure that the library remains a relevant institution in the future. Clarke's (2000) research provides an important framework for understanding the open source movement in libraries.

For instance, he notes that open source software created by librarians would have the advantage of incorporating the experience of librarians, something that most commercial vendors do not do. This benefit of open source software goes back to the issues of customizability and user input. Software developed by and for librarians and library users conceivably will produce software more attuned to the specific needs of libraries. A practical consideration of open source software is the fact that since libraries share many of the same problems, releasing home grown software to the library community allows for a collaboration that fosters the development of solutions to shared problems (Clarke, 2000). In addition, the sharing of open source solutions can quickly lead to enhanced communication with peer institutions, providing another collaborative opportunity for libraries with a long tradition of resource sharing in other forms (Chudnov, 2006).

Another advantage of open source for libraries is that the response time for changes to a library's system can be faster than proprietary software (Clarke, 2000). Library vendors often have multiple library clients, and attending to the technical needs of one particular library understandably can take time. Cost advantages have also been seen with library open source products, as libraries do not have to pay often expensive vendor fees (Clarke, 2000). However, this point is debatable and is rooted in some of the challenges of open source software in libraries, which I will discuss later.

Some of the major successes thus far in library open source software are found in standards and protocol implementations such as OAI-PMH (Chudnov, 2006). Various library-based applications exist with differing levels of success and promise; however, the potential for more open source development in libraries appears encouraging. This growth in open source development within libraries is driven largely by the modularity and “layering” of open source components (Chudnov, 2006). Different open source components can be built upon each other – for instance, open source servers can be built on open source network infrastructure, and open source applications can be built upon open source servers (Chudnov, 2006). In addition, Dan Chudnov, one of the leading library-based open source advocates (and founding member of the Oss4lib community), sees potential in libraries partnering with non-library institutions in the development of software. For instance, he argues that librarians need to think of their software needs less as library-specific issues, as many non-library search interfaces and web application frameworks can be relevant for libraries (Chudnov, 2006). By not restricting library open source development to just librarians, more collaborative solutions might be possible.

4.2.3 Challenges of OSS for Libraries

Despite the promise of open source software in libraries and some of its successes, some important challenges remain. One major challenge is the lack of technical skills among staff members in many libraries (Clarke, 2000). Larger libraries with skilled systems staff may have the requisite technical expertise; however, many smaller and less financially robust libraries face daunting technical challenges. In addition, the development of a significant library community around open source projects

remains a concern, especially since the development of a user and programmer community remains central to the success of open source projects (Clarke, 2000).

While communities such as Oss4lib and Code4lib exist, it is an open question if enough skilled and committed programmers exist in the library community to sustain larger library specific open source projects. On another note, a main challenge and key to the future success of open source in the library community depends on a shift in budgeting priorities (Clarke, 2000). Specifically, much of the financial resources expended on commercial vendors would have to be reallocated for investment in staff. More technical staff members could be hired, or this investment could take the form of technical competency building for existing staff.

Some of the advantages for libraries in adopting open source software are little or no upfront costs; however, proper expertise is needed to modify the code to meet local practices or requirements (Muir, 2005). In addition, open source products can develop faster because there are multiple sites working on enhancements, developers are usually closer to the end user, and troubleshooting is spread across a large number of sites (Muir, 2005). However, potential drawbacks to open source software include the issue of who actually provides support, needs for technical expertise, and the hidden costs that go into having staff spend time supporting, tailoring, and enhancing software (Muir, 2005). Regardless, open source software can benefit libraries by lowering initial and ongoing costs, eliminating vendor lock-in, and allowing for greater flexibility (Corrado, 2005).

Open source software, in conjunction with open access, and open standards movements, can be beneficial to libraries in the long-run. For instance, open source and

open standards can help libraries provide patrons with easier access to open access materials and other resources, as open standards make it possible to create interoperable systems to access the literature in various open access journals seamlessly (Corrado, 2005). Though there may be no reason to fear open source for libraries, the choice of open source software depends on whether or not the product meets a library's automation needs as well as its support needs (Balas, 2005).

4.2.4 Library Open Source Projects

Now that I have given a sense of the open source terrain in the library community, it is useful to take a more in-depth look at a few prominent projects. This survey will highlight the important institutional, technical, and economic factors that maintain these projects. Several factors need to be considered when analyzing and comparing different library open source projects. These factors, in the broadest sense, include: 1) software application; 2) funding/economic structure; and 3) management/development structure. The diversity of applications and management structures reflects the wide range of open source projects in the library community.

In terms of software application, the open source movement has the potential to make great changes in libraries should it produce an integrated library system that earns a level of acceptance on the same order that Apache did in the Web server market (Breeding, 2002). The ILS is an essential component of library operations, and a viable open source system will go a long way towards making open source software a more realistic option in library software development. Libraries could potentially play a more active role in the development of technology services to the public if more ILS software

is open source. The *Koha* ILS software (Koha, 2005), developed in New Zealand, is one of the major ILS open source projects currently existing, but is yet to have wide acceptance. I will discuss shortly some of the specifics about another prominent ILS open source project, *Evergreen*. Despite the complexity of developing an open source ILS and the lack of widespread acceptance thus far (Breeding, 2002), however, this application provides an example of a service-based fee structure that Raymond (2001) discusses. For instance, a company called *LibLime*, whose stated mission is to make open source software available to libraries (LibLime, 2006), provides support services for libraries planning to use the *Koha* and *Evergreen* open source ILS software. This example illustrates Raymond's (2001) "give away the recipe, open a restaurant" model, and shows just one possible adaptation of an open source management style for libraries.

The role of library institutions in the development of software also varies from minimal (in the case of *Greenstone*) to active (e.g., *Evergreen*, *DSpace*, *MyLibrary*). Also, while all projects are open source, it is not always the case that development takes place as part of a larger development community. In addition, basic challenges exist surrounding the nature of the technical support structure of library-based open source software projects. For instance, will support take place mainly through library-managed listservs and bug reporting websites, or will other "spin-off" entities provide support? However, basic open source philosophical viewpoints and development realities tie many of these projects together.

I will look briefly at four library open source projects in more detail: *Evergreen*, *Greenstone*, *MyLibrary*, and *DSpace*. These projects have been chosen because of their

prominence in the library open source community. In addition, the wide variety of these projects illustrates the different types of applications, economic structures, and management/development structures present in library open source projects. *Evergreen* is an open source integrated library system developed by the Georgia Library PINES consortium. *Greenstone*, developed in New Zealand by the University of Waikato, is a slightly different project than other library open source projects because of its specific application for digital libraries. *MyLibrary* developed originally out of the North Carolina State University Libraries and is focused on creating library-specific web portals. *DSpace* is one of the major open source institutional repository (IR) software tools, developed by the Massachusetts Institute of Technology (MIT) Libraries.

4.2.5 Evergreen – Georgia Library PINES Program

The *Evergreen* project is one of the more ambitious open source integrated library system projects, and for this reason has garnered attention in the library community. The Georgia Public Library Service is developing this open source ILS for use by the Georgia Library PINES Program, a consortia of 251 public libraries (LaJeunesse, 2006). The goal for this project is to have a statewide integrated library system for the wide variety of public and academic libraries in Georgia. According to Brad LaJeunesse (personal communication, September 25, 2006), one of the leading figures in this project and a PINES system administrator, *Evergreen* was conceived because no product in the marketplace existed that fit the needs of PINES. The major requirement for PINES is having software that enforces both uniformity and allows for a certain level of local

control and administration (LaJeunesse, 2006). This type of flexibility allows the software to be used across the diverse types of libraries in Georgia.

LaJeunesse (personal communication, September 25, 2006) also comments that the software meets the needs of PINES because it is designed by PINES system administrators and librarians. This statement relates to the issue of enhanced customization of open source software. He adds that the development process has included focus groups and discussions with librarians. In an e-mail correspondence with LaJeunesse, he explained to the author how the librarians decided on the functionality of the software, and the entire development process has incorporated feedback from librarians (B. LaJeunesse, personal communication, September 25, 2006). LaJeunesse (personal communication, September 25, 2006) believes that internal support and management have been key to the project's success. In addition, he points to the presence of a "wonderful and motivated staff" and a "top-notch software development team" as important factors in sustaining the project (LaJeunesse, 2006). The *Evergreen* project, while at an early development stage and dealing with a large and complicated application of an ILS, nonetheless has had its successes. LaJeunesse (personal communication, September 25, 2006), in fact, believes that no major setbacks have occurred with the project, but the greatest challenge will be adoption on a larger scale. As other users outside the PINES consortium begin using *Evergreen*, more opportunities for outside code development and feedback can occur.

Returning to our three categories for analyzing library open source projects – software application, funding/economic structure, and management/development

structure - *Evergreen* presents an interesting case. The ILS application of *Evergreen* is ambitious – many in the library community remain skeptical over the development of an open source ILS. This skepticism is fueled by the fact that the complexity of library automation systems often exceeds the pool of programmers, and many volunteer programmers often do not have the time allotment, project management infrastructure, and other resources needed for the concerted development efforts required to build and maintain an ILS (Breeding, 2002). However, Georgia PINES has been able to release *Evergreen*, and this points to two major factors in its apparent success – its funding structure and management structure. A consortium is funding its development, and it enjoys the full support of management. While outside developers are not contributing much code yet (LaJeunesse, 2006a), the project appears to have a viable management and economic structure for meeting the needs of its member libraries. The next example, *Greenstone*, offers a contrast to *Evergreen* in that it is not developed by a library; however, it provides another model of successful open source development.

4.2.6 *Greenstone*

The *Greenstone* digital library software is produced by the New Zealand Digital Library Project at the University of Waikato. It aims to enable users, particularly in universities, libraries, and other public service institutions worldwide, to build their own digital library collections in the fields of education, science, and culture (Witten & Bainbridge, 2005). This software has been particularly successful in developing countries, as it is distributed in cooperation with UNESCO and the Human Info NGO. Digital libraries, as discussed in Chapter 3, are collections of digital information

organized for retrieval and community use. Digital libraries are often conceived as extensions of physical libraries, as they are in some sense “electronic” and “virtual” libraries.

In contrast to the other examples discussed here, however, *Greenstone* did not originate within a library, but librarians have been an important class of users who have provided feedback and usage reports for the software (D. Nichols, personal communication, September 22, 2006). In addition, various “librarian” interfaces are used to create and maintain digital library collections (Witten & Bainbridge, 2005). These back-end interfaces are designed to help librarians and others in the construction and organization of digital information collections. In an e-mail discussion, Dr. David Nichols, one of the *Greenstone* project participants based at the University of Waikato, discusses how the software is designed to be simple to download and install (D. Nichols, personal communication, September 22, 2006). This ease of installation has been a direct result of the UNESCO partnership, which has moved the software into a development direction that takes account of conditions in the developing world (D. Nichols, personal communication, September 22, 2006). The software is freely distributed, and is put on CD-ROMs for use in non-networked and standalone environments.

However, despite the success of *Greenstone* in the developing world, a major challenge remains growing the developer pool on a global scale, beyond the confines of the University of Waikato (D. Nichols, personal communication, September 22, 2006). Contributions to the codebase are still largely restricted to the computer science department at the University of Waikato. This is a challenge similar to what the

Evergreen project is facing, and appears to be a common theme among other library open source projects. On an economic/funding level, the involvement of various New Zealand institutions and UNESCO has certainly been instrumental in the project's success. Also, the nature of the application – digital library development – allows it to be used in various environments (beyond just libraries). In addition, its portability in the form of a CD-ROM and ease of implementation have facilitated its success in the developing world.

4.2.7 *MyLibrary*

While *Greenstone* focuses on managing collections of digitized information across various institutional platforms, the *MyLibrary* project is a web portal designed especially for libraries. *MyLibrary* is a user-driven, customizable interface to collections of Internet resources, and its purpose is to reduce information overload by allowing patrons to select as little or as much information as they desire for their personal pages (MyLibrary, 2005). The idea of customization for the user drives this project, and the project was conceived in 1997 at the North Carolina State University (NCSU) Libraries. A driving force behind this project is Eric Lease Morgan, with whom I corresponded via e-mail. As a librarian and also the lead programmer in this project, Morgan and two other librarians at NCSU saw the emergence of personalized services such as “MyYahoo” during the peak of the “dot.com boom” and decided to extend this idea to the library realm (E. Morgan, personal communication, October 3, 2006). Morgan was part of the Digital Library Initiatives Department at the library, and believes the “forward thinking” nature of the library allowed them to develop MyLibrary primarily as a set of

services for users (E. Morgan, personal communication, October 3, 2006). Thus, rather than focusing on developing collections, this project is primarily geared towards user services.

The success of the project is seen in a number of libraries that are using the software – some notable examples include Cornell University, Los Alamos National Laboratory, and Open University. Morgan (personal communication, October 3, 2006) also discusses that a fair number of *MyLibrary* “imitators” exists, and that imitation is the “sincerest form of flattery.” The development of the product is continuing apace, with new versions being released on a regular basis. However, Morgan no longer works at NCSU Libraries and is now based at the University of Notre Dame. When he left NCSU Libraries, it was decided that the copyright for the software would remain with NCSU (Morgan, 2006). Morgan remains the lead programmer on the project, and primary development is now based at the University Libraries of Notre Dame.

Despite the successes of the *MyLibrary* project, certain challenges are important and on-going. According to Morgan (personal communication, October 3, 2006), the lack of computer programming expertise in the library community is a pressing concern. *MyLibrary* is not an easy piece of software to download and install without adequate programming skills, and technical support is maintained through a mailing list Morgan oversees (E. Morgan, personal communication, October 3, 2006). Morgan (personal communication, October 3, 2006) believes *MyLibrary* allows librarians to take greater control over their computing environments, but does not think enough librarians understand these technologies and are thus unable to fully take advantage of them. The

time needed for on-going development of the software remains a challenge – Morgan, as the main programmer, has to divide his time spent on *MyLibrary* with his other responsibilities at the University Libraries of Notre Dame.

In my correspondence with Morgan, he did not specifically mention growing the outside developer community as a major challenge, but it appears that a wider development community could result in a faster development cycle. The *MyLibrary* experience also points to an important fact about much of open source software development – programming time is often given on a volunteer basis, and challenges exist in balancing this volunteer work with other job demands. The initial management structure of *MyLibrary* at NCSU Libraries, however, gave the project an “official” status beyond a volunteer project. But sustaining this project beyond the original development team would require other library-based programmers to dedicate their time and expertise to the project. However, as Morgan (personal communication, October 3, 2006) discusses, the level of programming skills within the library community remains fairly low.

4.2.8 *DSpace*

Arguably one of the most widely used library open source products is *DSpace*, an institutional repository (IR) development software, managed by the MIT Libraries. Institutional repositories allow for scholarly materials in digital format, whether published or unpublished, to be made widely available – in essence, an institutional repository is a set of services that a university offers to the members of its community for the management and dissemination of digital materials created by the institution and its

community members (C. A. Lynch, 2003). Institutional repositories can also host academic journals, as in the case of the University of California eScholarship Repository (Hughes, 2004). While other repository software is proprietary (as in the case of eScholarship), *DSpace* is a viable open source software option for institutional repositories.

DSpace is widely used, with over one hundred and fifty major research institutions utilizing it, and is supported by a large, distributed and sophisticated set of technologies (M. Smith, personal communication, November 24, 2006). *DSpace*, according to official documents about the project's development, has four major aspects as: 1) a project; 2) a research program; 3) a service; and 4) an institutional repository (DSpace, n.d.). *DSpace* the project refers to its on-going development, while the research program and service aspects of *DSpace* are also on-going activities. *DSpace*, as a piece of IR software, is being used by various institutions around the world. The development of this project is notable for a few reasons, specifically for its high-profile funding. The Mellon Foundation provided funds for the project, and Hewlett Packard (HP) Labs provided technical expertise (DSpace, n.d.). The director of the MIT Libraries helped initiate the project, and *DSpace* was developed by the MIT Libraries in conjunction with HP Labs. *DSpace* officially launched in November 2002.

The goal of this project from the beginning was to create an infrastructure for storing the digitally born intellectual output of the MIT community, and to make it accessible over the long-term to the broadest possible readership (DSpace, n.d.). Feedback from stakeholders, such as faculty, was solicited at an early stage, and

librarians are responsible for deploying, running, and maintaining the *DSpace* system and services into the future. Other academic libraries also partnered with MIT Libraries at an early stage of the product's development, to serve as early adopters and provide feedback about the strengths and weaknesses of the software (MIT Libraries, 2004). The choice of developing a freely accessible open source system that institutions and organizations can run with relatively few resources is due largely to the philosophical standpoint and mission of the MIT Libraries (DSpace, n.d.).

IR software is an increasingly important tool in the academic library community for managing electronic content and it is thus not surprising to see the success of *DSpace*. The management and economic/funding structure of this project is also noteworthy, however. Open source software, as mentioned earlier, is not “free” by any means – the *DSpace* example illustrates how seemingly “free” open source software is developed with the aid of generous amounts of foundation and private sector money. In fact, many open source projects in higher education would not have gotten off the ground without foundation support, most notably from the Mellon Foundation and the National Science Foundation (Young, 2004). Librarians have played a key role in the implementation and promotion of this software, but outside financial support has also been key to its success. Thus, *DSpace* shows the importance of a sound financial backing for open source projects, while many other library-based open source projects are not as financially “fortunate.”

However, the on-going financial sustainability of the project remains a challenge, a reality that is common to other open source projects. The business analysts, hired

through Mellon Foundation grant money, helped define two levels of services that MIT Libraries would provide with regard to *DSpace* – Core Services, which are free of charge, and Premium Services, for which the library could charge fees (DSpace, n.d.). Premium Services are still being defined, but could include demands such as extra storage space and customizing services for special needs. This differentiation of service levels is indicative of the challenges in recovering the expenses of open source projects. This distinction is based on a decision regarding when “free” technical support ends. The case study in Chapters 5 and 6 also illustrates the challenge of deciding when services should be free and when they should have a price tag. *DSpace* is currently in transition to be governed by a new non-profit 501c3 entity with separate management (Smith, 2006). The creation of an independent management structure is similar to other prominent open source projects such as Apache, and future decisions regarding levels of service could potentially be taken up by this type of organization.

4.3 Towards Best Practices in Library Open Source Projects?

This review of a few prominent library open source projects has outlined some of the challenges these projects have in common, and some important differences. Are there lessons we can begin to draw out in order to understand library open source best practices? For instance, a common theme that arises in these projects is leadership, both on an individual and organizational level. As Raymond (2001) correctly observes, the initial development of an open source project often depends on the vision of an individual, but will only be successful through sustained effort at community

development. Community building is thus an important theme in developing a set of best practices for library open source projects.

Building community includes both users and code contributors – thus far, it appears for the projects I have discussed that code contribution is not occurring beyond the initial development group. However, user communities appear to be growing, especially in the case of the *DSpace Federation*. It remains an open question if, as user communities continue to grow, that developer communities will grow along with them. Developing a strong community of users and developers can help ensure the technical sustainability of open source projects.

On the theme of sustainability, the financial viability of projects remains important. Different models of sustainability are presented in these examples, from consortium-funding models, to foundation support, individual library support, and international agency support. Financial sustainability is also linked to the management structure of the projects. Developing financially sustainable library open source projects may require one of these models, or a combination of them. On another note, establishing the means for technical support is also an important issue. For instance, will an outside company (in the case of *LibLime*) provide technical support, or will project coders do it? In addition, it needs to be determined which services will be free, and which services will have a fee associated with them.

Any set of best practices will thus need to include the various issues of funding and management structure, leadership, code development, community building, and technical and financial sustainability. These issues are not necessarily particular to

libraries, and affect other service institutions seeking to utilize open source software. The next section looks at the open source software movement in higher education, which will illustrate some important lessons for the library open source movement.

4.4 Open Source Software Movements in Higher Education

The open source movement in libraries has momentum, but other institutions such as universities are seeing the benefits of more open source promotion and development. Academic libraries are based in universities and colleges, and it would be useful to examine some prominent open source movements in higher education to contextualize the open source movement in academic libraries. This fact is even more pertinent since the case study focuses on an academic library.

Open source software has been the focus of high-level study, as a July 2006 report funded by major foundations and universities explored the potential of open source software in higher education (Courant & Griffiths, 2006). This *Organization for Open Source Software* (OOSS) study addressed the concern that proprietary software does not have the features of cost-effective customization for higher education environments. Many university leaders feel that commercial software products, often designed with business customers in mind, are not geared for the needs of higher education (Young, 2004).

The report concluded that many college and university leaders are dissatisfied with many proprietary solutions, and their dissatisfaction can be grouped under three headings: 1) cost; 2) performance; and 3) control (Courant & Griffiths, 2006). These three points summarize some of the primary perceived benefits of open source software.

Proprietary software is often expensive, and the consolidation of many commercial vendors has left administrators fearful that these companies will have unfair market advantages. Open source is appealing because of the potential control it gives to users over the development of the software.

Another important finding from the report is the distinction it draws between the characteristics of open source software and the manner in which it is produced. The report refers to the community-based volunteer model (in the cases of Apache and Linux) as “community development,” and notes that it is also possible to produce software with open source code through a centrally managed and funded process, which it refers to as “directed development” (Courant & Griffiths, 2006). This distinction is also important in the case of library open source projects – from the examples discussed earlier, the continued sustainability and development of these projects remains an on-going concern. The report also discusses how many higher education administrators are skeptical that a decentralized development process will work. In addition, the report concludes that as of now no proven organizational model for open source higher education software development exists (Courant & Griffiths, 2006).

Open source software also requires investments of staff time for installation and customization, and colleges that lead open source projects say they spend millions of dollars on staff time (Young, 2004). According to Young (2004), in an article entitled “5 Challenges for Open Source” in a September 24, 2004 issue of the *Chronicle of Higher Education*, the open source movement in higher education faces challenges in these five areas: 1) building a community; 2) agreeing on what open source means; 3) securing

budgets for “free” software; 4) getting colleges to switch; and 5) working with companies, not against them. Community building is key to open source projects, and agreement on open source refers to gaining consensus on the various open source licensing schemes. The transition to open source from proprietary systems can be a time-consuming task, and the need to “work with companies” reflects the reality of the mixed open source/proprietary environment of the software world. For open source to succeed in higher education, interoperability with commercial products will need to be a prime concern.

Thus, while potential exists for wide collaborative development efforts for open source software development in higher education, effective management of these efforts remains an important issue. In addition, the authors of the report discuss how “vigorous and active leadership” from the highest levels of administration is needed to advance the agenda of open source software in higher education (Courant & Griffiths, 2006, p. 5). Different models for the management of open source projects exist, and while the Apache and Linux development models are considered a less desirable model of “community development,” they nonetheless offer some insights about collective decision-making in open source projects.

The OOSS could potentially become a type of coordinating body for open source higher education software development, similar to what is seen with Apache (Courant & Griffiths, 2006). Also, another issue of concern is managing the technical support for these types of projects. A variety of different management models exist, and certain open source projects in higher education are developing momentum.

One of these projects is *Sakai*, an online collaboration and learning environment software platform, currently supported by a wide range of universities around the world (Sakai Project, n.d.). *Sakai* is one of the leading and more prominent higher education open source initiatives, and provides a variety of course management tools. A large project, it is also a target of skepticism regarding its organizational and development structure, and long-term sustainability (Courant & Griffiths, 2006). While *Sakai* is becoming a more widely supported project, other open source course management systems such as *Moodle* (Moodle, n.d.) are gaining in popularity. On an international level, the organization *OSS Watch*, based in the United Kingdom, promotes awareness and understanding of the legal, social, technical, and economic issues that arise when educational institutions use open source software (OSS Watch, 2006). One of the major issues in managing open source software projects in higher education, for instance, is the issue of licensing, as the question of who actually “owns” open source software is an important one (Courant & Griffiths, 2006). This organization operates in an advisory capacity to UK institutions of higher education, and does not have administrative functions.

Individual universities also have open source initiatives of their own – a notable example is the University of Toronto’s *Project Open Source/Open Access* (University of Toronto, 2006). This university-wide initiative aims to develop a networked community of scholars, students, and members of the broader community interested in the phenomenon of open source and open access. An example such as this one highlights the importance of the open source movement in higher education. At this point, it will also

be useful to discuss briefly the open access movement, as it is often discussed in conjunction with open source software.

4.5 Open Access and Libraries

One of the defining challenges of the academic library environment over the past decade has been the so-called “scholarly publication crisis.” In essence, the increasing volume and costs of scholarly publications, particularly in science, technology, and medicine, has made it very difficult for academic libraries to support the collection needs of their user communities (ARL, 2000). This crisis is based on the successful transformation of knowledge into a capitalized commodity and economic driver (Willinsky, 2006). Major academic journal publishers over the last decade have merged, and the resulting corporate publishing concentration, with its focus on knowledge capitalization and shareholder value, has seen journal prices rise well above inflation rates, and university libraries cannot keep up (Willinsky, 2006). Consequently, many economically less well off libraries and academic institutions have had to massively cut journal subscriptions, with academic libraries in the developing world particularly at a disadvantage.

Scholars such as Stevan Harnad are challenging this system, and the “open access” movement has taken hold. The open access movement is about providing unrestricted access to scholarly information – John Willinsky (2006) describes the open access movement in terms of what he calls the “access principle”, which is:

a commitment to the value and quality of research [that] carries with it a responsibility to extend the circulation of this work as far as possible, and ideally to all who are interested in it and all who might profit by it (p.5).

He goes on to point out that scholars and researchers have a vested interest in making their scholarship as widely read and available as possible, as a certain “vanity factor” pervades the academic publishing industry, with a scholar’s reputation built on how widely read and cited they are. In addition, he argues that the “access principle” is part of a long-standing principle of libraries, from ancient times to the small-town libraries that flourished in 19th century America that gave access to knowledge to the common person. Does the open access ethic resonate with the values and ethics of libraries? This is an intriguing question, but it appears that while libraries may be promoting their values in the open access movement, much of the motivation may be related to basic economic concerns about creating viable, less expensive competing publishing models to conventional commercial models.

Open access can take many forms, and open access electronic publishing is often cited as an example. Internet technologies have allowed the wide dissemination of scholarly research – allowing libraries, scholars, and publishers alike to re-envision models of scholarly publication. Open-access (OA) literature is digital, online, free of charge, and free of most copyright and licensing restrictions, and what makes it possible is the Internet and the consent of the author or copyright-holder (Suber, 2004). Open access is compatible with peer review and is not free to produce – it is not focused on whether scholarly literature can be made costless, but whether there are better ways to

pay the bills than by charging readers and creating access barriers (Suber, 2004). The two most common forms of open access are open access repositories and open access journals. While it is a topic that has been gaining momentum in recent years, open access represents a growing consciousness around the need to make knowledge and information as widely accessible as possible (Willinsky, 2006). In fact, the very possibility for open access has been greatly enhanced by the presence of digital technologies (Willinsky, 2006).

Libraries have been active on both the open access repository and journal fronts, as academic libraries see the benefit of alternative publication models since they face both a pricing and permissions crisis. The pricing crisis means that libraries must pay increasingly steep prices for journals, while the permissions crisis means that libraries are hamstrung by licensing terms and software locks that prevent them from using electronic journals in the same full and free way as print journals (Suber, 2003). As Peter Suber (2003) argues, librarians can do a lot to alleviate these crises, as they have the best understanding of the problem and can promote open access publishing in their institutions.

Open access has various implications for libraries, and might entail potentially new roles for libraries. For instance, in the mixed open access-traditional publishing environment, entrepreneurial libraries will find new ways to serve their patrons (Schmidt *et al.*, 2005). In relation to libraries' expanded roles with relation to institutional repositories, another role that libraries may take is to encourage open-access publication by subsidizing authors' fees in open access venues (Schmidt *et al.*, 2005). Funding open

access publication provides a new perspective on the library's traditional role as the institutional purchaser of scholarly information (Schmidt et al., 2005). Thus, the open access movement provides various sets of opportunities and challenges for libraries, but may present a set of expanded opportunities for libraries to shape the terrain of scholarly publishing.

The open access movement can also complement the open source movement, as open source tools can be used to access open access electronic journals and institutional repositories (Corrado, 2005). The case study, for instance, shows an example of open source journal publishing software being used to enhance open access to scholarly information. In addition, the open access movement parallels the open source movement in that it may give libraries more control over their technological options. Open source provides the tools for managing electronic information and library processes, while open access is an option for libraries to have more control over the economics of scholarly journal publishing. The last section previews the case study, in which both the open source and open access movements play a role, and revisits the critical theory of library technology framework.

4.6 Open Source Software in Libraries: A Critical Theory of Library Technology?

Now with an overview of some prominent library open source projects, it is worthwhile to revisit the dimensions of a critical theory of library technology. In other words, how can this theoretical framework be applied to the open source movement in libraries? The four examples discussed earlier provide a sense of the diversity in library

open source projects. Some of these projects have application across library types, while some are geared more to academic libraries.

The critical theory of library technology framework can be utilized as an analytical tool to study the open source movement in libraries. Thus, this movement can be studied at the levels of 1) policy and advocacy; 2) individual and community; and 3) systems and institution. On the policy and advocacy level, it is important to understand the progressive and democratic orientations of the movement. For instance, is the open source movement in libraries linked to larger advocacy agendas for greater library-based control of technology? Does a consciousness of the political and grassroots democratic aspects of the open source movement exist in libraries, or are more practical reasons driving the movement?

On the individual and community level, one has to question the participatory and community-oriented aspects of the movement. Specifically, does open source create a more participatory technology development process in libraries? Does technical expertise become more democratized, or do new technical hierarchies develop? Finally, on the systems and institution level, it is useful to explore how open and collaborative the open source process in libraries is. Does open source build on existing library strengths of resource sharing and cooperation? Does it challenge hierarchical models of technology development? These questions will be important when discussing the application of the framework to the in-depth case study in Chapters 5 and 6.

The library open source examples I have discussed in this chapter have been discussed briefly in relation to Weber's (2001) and Raymond's (2004) frameworks.

Some of the major themes and challenges surrounding library open source software development have thus been highlighted, including areas for best practices research. However, a more in-depth case study will provide greater insight into the nature of a successful library open source project. In addition, an in-depth case study will offer an opportunity to rigorously apply the critical theory of library technology framework to a specific library open source project.

The in-depth case study provides an example of a successful regional project sustained without generous foundation support. In addition, the wide range of open source products it provides to other libraries makes it unique and innovative (C. Awre, personal communication, September 29, 2006). Is this type of regional development of library open source software a model for development in other parts of the world? This remains to be seen, but the international *eIFL.net* organization has shown interest in the SFU software for use in developing countries. *eIFL.net* is a foundation that strives to lead, negotiate, support and advocate for the wide availability of electronic resources by library users in transition and developing countries (eIFL.net, n.d.). While not specifically developing open source software, *eIFL.net* provides comprehensive information about open source options for libraries and supports library consortia in many developing countries.

Simon Fraser University Library in British Columbia, Canada, the focus of the case study, has been developing open source software for several years. One of its current projects is the dbWiz federated searching tool, which is open source software that allows *meta-searching* from a single interface and returns an integrated set of results

(Mah & Stranack, 2005). The success of dbWiz reflects the benefits of federated searching, the open source model, and library collaboration (Mah & Stranack, 2005). In addition to dbWiz, SFU Library also develops electronic resource management tools. The transforming information environment in libraries, with electronic resources making up a greater portion of library collections, necessitates having tools to manage increasing amounts of electronic information (Fowler, 2004).

The Open Journal Systems (OJS) open source project is also part of the case study – originally developed at the Public Knowledge Project (PKP) at the University of British Columbia, this open source journal publishing software is now being developed and hosted at the Simon Fraser University Library. This software has the potential to reduce the time and energy devoted to the clerical and managerial tasks associated with editing a journal, while improving the record-keeping and efficiency of editorial processes (Willinsky, 2005a). In addition, while not necessarily promoting open access publishing, OJS has the ability to facilitate open access to scholarly information. The community of journals deploying OJS continues to grow, with over 140 registered users on the PKP Support Forum worldwide (Willinsky, 2005a).

OJS has been a successful open source product, with several hundred journals using this software (Public Knowledge Project, n.d.-b). Much of the user base for OJS, in fact, comes from the developing world, with over 200 journals in Africa using the OJS software through the African Journals Online program (Public Knowledge Project, n.d.-a). This large amount of uptake in the developing world is not surprising given the economic challenges of accessing commercially controlled scholarly information in that

part of the world. The open source nature of the product (free to download) certainly makes it an attractive product for users, as traditional corporate models of scholarly publishing can be bypassed.

The breadth of applications and regional success of this library-developed open source project make it a useful case in the application of the critical theory of library technology framework as a mode of analysis. While the other prominent library open source projects discussed earlier have their differences, certain common challenges persist. Thus, an in-depth exploration of this case will also provide a preliminary set of best practices in the development of library open source projects. More in-depth research of other projects is needed in this study of best practices. The following chapters, Chapters 5 and 6, will now address the in-depth case study.

Chapter 5: The Case Study Part I: Findings

5.0 Introduction

This chapter presents the findings from the analysis of the interviews of the in-depth case study. Interviews were conducted with key administrators, developers and clients of the software projects. The interviews with administrators have provided more information about the management aspects of both projects, while interviews with developers have brought out more details about the technical decision-making behind the projects. The interviews with reSearcher clients have provided insights into end-user perspectives of the software.

The findings are discussed according to the themes and sub-themes that have emerged during the analysis. Numbers in parentheses next to each theme indicate how many times each instance of a theme occurred in the transcripts. Through these findings, we can begin to explore the successes and challenges of these projects, as well as the institutional, social, and economic factors associated with them. Findings are presented according to each interview category (administrators, developers, and clients). For each interview category, a brief summary of all the themes is presented at the beginning, with each theme subsequently discussed in more detail. Thus, within each interview category, the themes and corresponding sub-themes are discussed at more length, with tables for each theme highlighting key and representative quotes and ideas. These findings provide the context for the open source best practices and critical theory of library technology analyses in Chapter 6.

5.1 Administrators

The nine administrators represent key leaders of SFU Library, the Public Knowledge Project (PKP), the Canadian Centre for Studies in Publishing (CCSP), the British Columbia Electronic Library Network (BC ELN), and the Council of Prairie and Pacific University Libraries (COPPUL). The eight themes that emerge from the analysis of the administrators' interviews are: a) Organizational Motivation; b) Personal Motivation; c) Project Management; d) Successes; e) Challenges; f) Collaboration/Community; g) Innovation; and h) Leadership. Organizational motivation relates to the institution-specific goals for becoming involved in the open source projects, while personal motivation refers to individual reasons for involvement in the projects. Project management is a broad theme encompassing aspects of the software development process, while successes and challenges are themes that evaluate specific aspects of the software products. Collaboration/community is a theme concerned with the growth of the user and development communities, while innovation and leadership are themes focusing on specific factors underlying the projects' successes. The following subsections will discuss each theme and its sub-themes in more detail, and provide a summary of each theme and its sub-themes in a table format.

A) Organizational Motivation (107)

The theme of organizational motivation is more significant in relation to the management of the PKP software, as principal members of SFU Library, the Public Knowledge Project, and the Canadian Centre for Studies in Publishing came together to make a partnership. However, organizational motivation with regard to reSearcher is also

important – for instance, SFU Library administrators and the heads of the two consortia, COPPUL and BC ELN, provide information about their organizations’ role and interest in maintaining the reSearcher software. The four major sub-themes of organizational motivation are: 1) Ease of collaboration and timing; 2) Innovation and existing library technical infrastructure; 3) Changing roles of libraries; and 4) Open source and open access philosophical orientation (see Table 3).

Table 3: Organizational Motivation (Administrators)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Ease of collaboration and timing (10) 	<ul style="list-style-type: none"> - Right timing for PKP development - Ideal partner; prior collaboration
<ul style="list-style-type: none"> • Innovation and existing library technical infrastructure (29) 	<ul style="list-style-type: none"> - Operation and systems rigor for software - Library perspective to software development
<ul style="list-style-type: none"> • Changing roles of libraries (18) 	<ul style="list-style-type: none"> - Library participation in first-tier publishing - Library providing technical support for software
<ul style="list-style-type: none"> • Open source and open access philosophical orientation (23) 	<ul style="list-style-type: none"> - Library not necessarily taking a strong ideological stance in relation to open source software - Some personal belief in open source and open access, but no official organizational stance

In terms of “ease of collaboration and timing,” the PKP project appears to be a success in large part due to the convergence of various factors. These factors include the increasing technical competencies of SFU Library, the development of a new version of the OJS software, and increasing dialogue between an SFU Library administrator and the PKP director. The *Synergies* project has also figured prominently in bringing the PKP software collaboration to fruition. Thus, the idea of this partnership being a result of “right timing” appears in the interview transcripts. In terms of reSearcher, the sub-theme

of timing is important given the fact that the link resolving component was initially developed because no commercial link resolving product was available at the time development on the product began.

In the case of the SFU Library, an administrator discusses how the “library is an ideal partner” for the management of the OJS software, as it has been giving support to SFU users for a long time through its development of the reSearcher software. On a basic level, this administrator states that since the library already had the technical infrastructure and programmers for maintaining the software, it was a logical choice to be involved in developing the PKP software, bringing “operation and systems rigor to the OJS software.” The sub-theme of innovation and existing technical infrastructure at SFU Library reoccurs in the interviews with various administrators. With regard to the changing roles of libraries, an SFU Library administrator discusses how hosting and providing services for OJS software moves the library into “first-tier publishing,” in contrast to the “second-tier publishing” of institutional repositories. In terms of open source and open access philosophical orientation, some administrators profess a preference for these movements; however, none of the organizations takes any official advocacy position with regard to either of these movements.

B) Personal Motivation (61)

A range of personal motivations is behind these administrators’ involvement in the PKP and reSearcher projects (see Table 4). The sub-themes are: 1) Open source and open access philosophical orientation and 2) Technological interest. The first sub-theme relates to the degree of interest the administrators express in the open source and open

access movements. All the administrators have a basic interest in open source and open access, but their level of commitment varies. Some of the more technologically “hands-on” administrators show the highest degree of interest in the open source movement.

Table 4: Personal Motivation (Administrators)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Open source and open access philosophical orientation (42) 	<ul style="list-style-type: none"> - No need to proselytize for open source - Disagreement about open source advocacy roles for SFU Library - Philosophical compatibility between open source and libraries
<ul style="list-style-type: none"> • Technological interest (16) 	<ul style="list-style-type: none"> - Involvement in “leading edge technology” - “Not a serious techie,” but with an interest in technical issues - “Self-taught” hacker

One of the SFU Library administrators, for instance, sees the benefits of open source, but feels that there is “no need to proselytize” for open source, especially for the larger libraries in COPPUL which have the technical skills and financial resources to invest in commercial products. In addition, the SFU Library director has a deep interest in an expanded role for libraries in technology development, but is not “religious” about the open source movement and does not rule out a return to purchasing commercial software to meet the needs that the open source software is currently fulfilling. The other sub-theme, technological interest, relates to the interest of certain administrators in being involved in hands-on technological development through reSearcher and PKP.

C) Project Management (202)

Project management is a broad theme, encompassing economic factors such as the development framework for the software and how the administrators envision their

organizations' future involvement in the reSearcher and PKP projects. Various economic factors are also discussed. In general, most of the administrators feel the PKP partnership is a successful one, and is exceeding their individual expectations. The sub-themes that emerge are: 1) SFU Library's role in the PKP partnership; and 2) the software development process, encompassing economic, technical, and management issues (see Table 5).

Table 5: Project Management (Administrators)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • SFU Library's role in the PKP partnership (48) 	<ul style="list-style-type: none"> - PKP software development a "relatively informal agreement" - Library giving PKP project "heft" and an institutional home, permanence, and stability
<ul style="list-style-type: none"> • Software development process – Economic, technical, and management issues (100) 	<ul style="list-style-type: none"> - OJS development driven largely by PKP director - COPPUL member fees going towards the hosting and support of reSearcher software - "Smorgasbord sustainability" - OJS is a "high priority" at SFU Library - Economic viability of maintaining development and support

The PKP software development, as described by three administrators, is based on a relatively informal agreement, as a memorandum of understanding was signed in the early part of 2005 between SFU Library, the CCSP, and PKP. The motivation of the PKP director and the opinion of key SFU Library administrators for having the library host the software is to give it an institutional home, permanence, and stability. In terms of the software development process, it appears that the PKP director, through his

visionary leadership and grant funding sources, largely drives the development of the PKP software.

reSearcher development, on the other hand, goes through a more structured process, with feedback from partner libraries and consultation with the regional consortia. The support of the consortia is essential for reSearcher, as COPPUL member annual fees go toward the hosting and support of the reSearcher software for member libraries. The fees member libraries pay are adjusted according to institutional size. In the event that the consortium is not interested in funding a software project, a development model (most recently undertaken with dbWiz) involves approaching libraries individually for funding.

In addition, one administrator discusses how with many software projects, a type of “smorgasbord sustainability” exists, with money coming from different sources. This is the case with the reSearcher software, as well as with the PKP software, which depends to a large degree on the grant money of the PKP director. In relation to future economic goals, he sees cost recovery for software development through hosting and support services, grants, and increasing the number of participants in the project.

D) Successes (93)

The successes administrators describe fall into three basic sub-themes: 1) Institutional successes, 2) Economic successes, and 3) Technical successes (see Table 6). Project successes apply both to the reSearcher and PKP software. All of the administrators remark that the partnership to manage the PKP software has thus far been a great success, and that the uptake of the OJS software has been quite high. In terms of other institutional successes, a couple of SFU Library administrators discuss the fact that

a relatively mid-sized library (in comparison to larger ARL libraries) is playing a significant role in library software development. In relation to the reSearcher software, administrators in general feel that the software has been successful within Western Canada, and point to recent international interest in the software as a sign of its increasing popularity.

Table 6: Successes (Administrators)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Institutional successes (35) 	<ul style="list-style-type: none"> - Mid-sized library playing a significant role in software development - Synergy between reSearcher and PKP projects - PKP partnership going “amazingly, wonderfully well”
<ul style="list-style-type: none"> • Economic successes (11) 	<ul style="list-style-type: none"> - Production of reSearcher at a reduced rate for SFU and its partner libraries - BC ELN libraries dropping their commercial software in favor of reSearcher - Cost savings for member libraries - reSearcher sustainable
<ul style="list-style-type: none"> • Technical successes (40) 	<ul style="list-style-type: none"> - “Every application in reSearcher is as functional as most, if not all commercial competitors” - Libraries in the consortia are participating more in the software development process - PKP having a synergistic effect with reSearcher

With regard to economic successes, one administrator pointed out that BC ELN member libraries recently dropped their commercial subscriptions in favor of reSearcher. Another administrator also discussed the cost savings for consortium libraries and the fact that reSearcher is a sustainable project right now. On the sub-theme of technical successes, a couple of administrators discuss the synergistic effect of having both the

reSearcher and PKP software projects together. A hope is expressed that the success of PKP worldwide can push reSearcher development to a wider level. One SFU Library administrator in particular feels that reSearcher is as good, if not better than its commercial equivalents, and the idea is expressed that the reSearcher development process is more participatory than commercial development processes.

E) Challenges (127)

Challenges can be divided into these major sub-themes: 1) Open source development realities, 2) Management of the support infrastructure and community development, 3) Technical competencies of client libraries, and 4) Institutional challenges (see Table 7). Open source development realities refers to the misconception from library partners that open source software should work “out of the box” without major difficulties. In addition, an incident during 2003 when five large COPPUL libraries did not choose reSearcher for their link resolving needs figures prominently. This incident appears to have been based on a perception that the reSearcher software was not mature at the time. One administrator commented that larger libraries tend to go with commercial products, as they often have their own systems expertise and needs for complex functionalities that open source may not be able to provide.

Other open source development realities discussed include the fact that some technical skills are needed for the full utilization of open source, as well as a “tolerance for ambiguity.” Many of the SFU Library administrators mention that while open source may entail less money up front, a lot of investment is needed in what boils down to a long-term, collaborative process.

Table 7: Challenges (Administrators)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Open source development realities (41) 	<ul style="list-style-type: none"> - Five major COPPUL libraries not choosing reSearcher in 2003 - reSearcher “not mature” at the time, “experimental” homegrown product - Misconception that with commercial vendors it is easy to pay money and “have problems go away” - Open source – less money up front, but investment of time needed in a collaborative process
<ul style="list-style-type: none"> • Management of the support infrastructure and community development (11) 	<ul style="list-style-type: none"> - “Dumb luck” to be able to maintain level of support with growing number of users - Need for a wider community of users and developers - Technology transfer – Denmark and the Netherlands
<ul style="list-style-type: none"> • Technical competencies of client libraries (10) 	<ul style="list-style-type: none"> - No code development being done at client libraries due to a lack of technical capabilities, infrastructure, and resources - Wide range of technical competencies of member libraries remains a challenge - Open source “definitely needs in-house technical support” and a “tolerance for ambiguity”
<ul style="list-style-type: none"> • Institutional challenges (51) 	<ul style="list-style-type: none"> - Making the development process of reSearcher and OJS more mainstreamed - Larger libraries tending to go with commercial products - “Transformation of the library” has not yet happened

For the management of the support infrastructure and community development sub-theme, one SFU Library administrator remarks that it has been a case of “dumb luck” thus far that the library has been able to maintain its level of support with a growing

number of users. Other administrators discuss the need for a wider co-developer community, and some express hope in the recent uptake of the software in institutions in Denmark and the Netherlands. Through this form of “technology transfer,” it is hoped that these institutions can become future regional hubs of reSearcher development.

The technical competencies of client libraries sub-theme focuses on the fact that none of the consortium libraries participate in code development, and a wide range of technical competencies exists within the consortium library community. On the sub-theme of institutional challenges, one administrator remarks that a future goal is to make the reSearcher and PKP development processes more streamlined. In addition, another administrator discusses how the “transformation” of the library to take a more active support role in the support of scholarly publishing activities has yet to happen.

F) Collaboration/Community (61)

The major concept from this theme is growing the developer and user base for the software projects (see Table 8). Growing these communities is a key component in sustaining open source projects over the long-term. The development of these communities varies, as the PKP and reSearcher products have different applications and user bases. The concepts emerging from this theme mirror many of the sub-themes in the challenges theme, including the aforementioned challenge of growing the user and development communities. New forms of collaboration are highlighted, as well as the importance of the *Synergies* project for the PKP software and the upcoming PKP conference.

Table 8: Collaboration/Community (Administrators)

Sub-theme	Key Quotes/Ideas
<ul style="list-style-type: none"> • Growing the user and developer communities (61) 	<ul style="list-style-type: none"> - Importance of Synergies project in developing collaboration - “Third way” of collaboration, in contrast to homegrown solutions and vendor products - PKP conference’s importance in developing community - PKP not part of Sourceforge.net – is it really open source?

In terms of new forms of collaboration, one SFU Library administrator mentions the concept of a “third way” of collaboration, as he feels that open source offers a new way of library technology development, in contrast to older homegrown and commercial solutions. With regard to PKP, one CCSP administrator discusses how the software is not a part of larger open source communities such as *Sourceforge.net*. Based upon this fact, he questions the open source nature of the PKP software.

G) Innovation (60)

The innovation theme captures some of the new and potentially groundbreaking directions reSearcher and PKP development are taking. The sub-themes are: 1) New roles for libraries in publishing services and 2) Innovation and pioneering aspects of reSearcher (see Table 9). In relation to new roles for libraries in publishing services, the PKP director’s involvement in African publishing initiatives is highlighted. Within the latter sub-theme, the economics of reSearcher development is discussed, as it is a less expensive project than other foundation-supported library-based open source projects in the United States. In addition, reSearcher is praised for being a project with a wide scope of products and sustained and continuous development.

Table 9: Innovation (Administrators)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • New roles for libraries in publishing services (17) 	<ul style="list-style-type: none"> - PKP director's involvement in publishing initiatives in Africa - SFU Library's involvement in first-tier publications
<ul style="list-style-type: none"> • Innovation and pioneering aspects of reSearcher (23) 	<ul style="list-style-type: none"> - Scope of project innovative - Pioneering piece of software - Not a lot of open source projects as sustained as this one, and the fact that it is entirely funded by a consortium makes it distinct

H) Leadership (60)

The leadership of the SFU Library and PKP directors stands out as one sub-theme, as both of these individuals' advocacy has been important for their organizations. The sub-themes are: 1) Leadership of SFU Library and PKP directors and 2) Co-extensive leadership (see Table 10). The SFU Library director has invested in the systems expertise of the library, while the PKP director has been a tireless advocate in the promotion of OJS on an international level. In addition, the other sub-theme focuses on the key leadership roles of the developers in promoting open source software, as well as the leadership roles of other administrators, and of SFU Library as a whole. In the case of both the reSearcher and PKP projects, developers led the effort to convince administrators to move to an open source model.

Table 10: Leadership (Administrators)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Leadership of SFU Library and PKP directors (19) 	<ul style="list-style-type: none"> - Confluence between their ideas about the changing roles of libraries - Importance of SFU Library director, as software development would not have been possible without him - Importance of PKP director's advocacy in growth of OJS software
<ul style="list-style-type: none"> • Co-extensive leadership (39) 	<ul style="list-style-type: none"> - First PKP developer had a “total grasp of the open source movement and online development” - reSearcher's open source nature “really falls” on one developer who convinced the SFU Library director to make the software open source - SFU Library administrator organizing the PKP conference - SFU Library's institutional leadership

5.2 Developers

The six developers represent the major technical contributors to the reSearcher and PKP projects. Four of the developers are based primarily at SFU Library – three reSearcher developers and the lead PKP developer. The other two developers interviewed are affiliated with outside organizations, but work part-time on PKP software development. The themes that emerge from the analysis of the interviews with the developers are: a) Personal Motivation; b) Project Management and Organizational structure; c) Collaboration/Community Development; d) Opportunities/Successes; e) Challenges; f) Innovation and Value; and g) Leadership. The following sub-sections discuss each theme and its sub-themes in more detail, and provide a summary of the themes and sub-themes in a table format.

A) Personal Motivation (34)

While it appears that motivations for working on the project are varied, all the developers appear to believe in the open source nature of the product (and open access with regard to the PKP developers) to some degree. The main sub-theme is thus “open source and open access philosophical orientation” (see Table 11). This finding resonates with the work of Weber (2004), who states that members of a successful open source project have a positive normative and/or ethical valence towards the goals of the project. For example, one developer thinks that the open source process ultimately makes better software. He states that he “likes the idea that I can create something that someone else can use for free....and possibly could contribute back to.”

Table 11: Personal Motivation (Developers)

Sub-theme	Key Quotes/Ideas
<ul style="list-style-type: none">• Open source and open access philosophical orientation (32)	<ul style="list-style-type: none">- Ethical orientation of PKP project main motivation for one developer- PKP is “philosophically respectable” in comparison to other commercial projects- Less stressful environment than commercial software company- OS process makes better software

Another developer shows a high commitment to open source software development, as he believes that there are many library-based open source products that are comparable or better than proprietary products. This developer also believes in the open source nature of the software – in response to a follow-up question about how the software became open source, he replied that because they already were using so many open source tools, they were all “very keen” on making the software open source.

However, this particular developer also shows an interest in working at SFU Library because of a “less stressful” environment as compared to a commercial software company. For the main PKP developer, the ethical orientation of the project is important to him, as he believes it is a “philosophically respectable” project.

B) Project Management and Organizational Structure (87)

The open source software development process does not occur in a vacuum – an organizational structure surrounds and supports the process. The sub-themes include: 1) Satisfaction with the project, and 2) Software development process (see Table 12).

Table 12: Project Management and Organizational Structure (Developers)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Satisfaction with the project (30) 	<ul style="list-style-type: none"> - Technical support of reSearcher has improved; hiring a consortial support person has made the project “much better” - PKP developer: project “working surprisingly well” - Multi-talented team with PKP; a “positive experience”
<ul style="list-style-type: none"> • Software development process (49) 	<ul style="list-style-type: none"> - Prototyping of commercial-equivalent products - Predicting the development costs of the software in advance is a challenge - PKP: importance of support forum and Bugzilla for feedback - reSearcher: need for more feedback and user testing

In a general sense, the project management and organizational structure receive good marks from the developers. When discussing the project management and organizational structure of these projects, however, it will be useful to distinguish between the two projects. For instance, it appears that while reSearcher developers are

in general satisfied with the project management and organizational structure, PKP developers are expressing more effusive praise for the organizational structure.

The sub-theme dealing with the developers' satisfaction with the project focuses on the fact that the technical support for the projects has improved with the hiring of a person dedicated to coordinating technical support activities. In the case of PKP, all the developers associated with this project are happy with the organizational structure, and in the words of one developer, feel the project is "working surprisingly well."

The software development process sub-theme sheds light on the prototyping process of reSearcher development. New products are prototyped according to existing commercial products. Some developers discuss that not a lot of feedback and user testing is incorporated into reSearcher development, and SFU Library at times is playing "catch-up" to the functionalities of similar commercial products. One developer points out the fact that predicting the development costs of the software in advance is a challenge. This developer also discusses the need to make administration and install documentation better for reSearcher. In terms of PKP, it appears that the support forum and "Bugzilla" bug reporting mechanism incorporate feedback into the development process.

C) Collaboration/Community Development (43)

The question of developing a critical mass of users and the relationship between the core programming group and a voluntary community of programmers is another key component of analyzing successful open source development projects (Weber, 2004). From the findings, it appears that while most of the developers agree that creating a developer community outside of their institution is a worthy goal, most outside

collaboration remains just that - a goal and not a reality. The PKP software has a wider user base and development community, with a few outside developers; the reSearcher software development is limited to SFU Library. The sub-themes are: 1) Questioning the open source nature of reSearcher, 2) Involvement in other library open source projects, and 3) PKP community building (see Table 13).

Table 13: Collaboration/Community Development (Developers)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Questioning the open source nature of reSearcher (12) 	<ul style="list-style-type: none"> - “..project is not really open source yet...because not a lot of people are downloading, contributing, making changes..” - some reSearcher components only recently packaged as open source
<ul style="list-style-type: none"> • Involvement in other library open source projects (12) 	<ul style="list-style-type: none"> - Limited participation of most developers in OSS4Lib and Code4Lib - Future collaboration opportunities with plug-ins a goal
<ul style="list-style-type: none"> • PKP community building (12) 	<ul style="list-style-type: none"> - Working on plug-in system for more collaborative opportunities - Potential for Synergies to grow development community - Critical mass of users, but a challenge exists in growing the development community at the same rate

With regard to the sub-theme of questioning the open source nature of reSearcher, a couple of developers discuss the fact that not a lot of people outside SFU Library are downloading the software, contributing code, or making changes. Most of the reSearcher developers are aware of other library open source projects, but have limited participation in venues such as Code4Lib or Oss4Lib, mainly due to a lack of time and, in a couple of cases, a lack of interest. One of the reSearcher developers also mentions that outside collaboration may not be necessary for reSearcher, and is skeptical of its benefits. This

developer also questions if open source can be successful in libraries, as he thinks it is a niche market with a limited amount of technical people.

In terms of community building for the PKP project sub-theme, one developer mentions the hope of plug-ins as a form of future collaboration opportunities. In addition, one PKP developer mentions that a critical mass of users exists, but a challenge exists in growing the development community at the same rate. One of the PKP developers mentions that a small number of users contribute bug reports and fixes on a regular basis, but contributions of large pieces of code are few.

D) Opportunities/Successes (31)

The sub-themes associated with this theme are: 1) Regional success of reSearcher and 2) Customization, control, and updates of the software (see Table 14). Developers in general feel reSearcher is a valuable contribution, and one developer discusses the fact that it is an economic success. Another developer mentions that it is impressive that reSearcher runs a number of sites in Western Canada from a single installation at SFU Library.

Table 14: Opportunities/Successes (Developers)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Regional success of reSearcher (13) 	<ul style="list-style-type: none"> - reSearcher is a “valuable contribution” and an “economic success” - Successful deployment in university libraries across Western Canada - Impressive to run a number of sites from a single installation at SFU Library
<ul style="list-style-type: none"> • Customization, control, and updates (12) 	<ul style="list-style-type: none"> - Customization of templates - Pride in the new 2.1.1 release of OJS

In terms of the customization, control, and updates sub-theme, reSearcher developers discuss the fact that templates offer more customization for end-users than in previous times. One of the PKP developers mentions the pride he feels in the development cycle of OJS, and especially in the new 2.1.1 release of OJS.

E) Challenges (87)

Despite the successes of the software projects, various challenges, either faced in the past, currently, or projected into the future were mentioned. The sub-themes are: 1) Packaging of the software and support and 2) Open source development realities and library technical competencies (see Table 15).

Table 15: Challenges (Developers)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Packaging of the software and support (16) 	<ul style="list-style-type: none"> - Some reSearcher components only becoming cleanly packaged as open source in spring 2006 - Challenge to package code so it can be easily modified and used by other libraries; more work to make code open source - Tension between competing tasks of 1) source code development and bug fixing; and 2) documentation, installers, and back-end operations - Work needed for maintaining CUFTS knowledgebase - PKP support forum “time consuming”
<ul style="list-style-type: none"> • Open source development realities and library technical competencies (54) 	<ul style="list-style-type: none"> - Not a large community of technical people in the library world - Open source requiring more management and maintenance than commercial products; are libraries willing to invest that extra time and effort? - Misconception that open source should work “out of the box” without major glitches

With regard to the packaging and support sub-theme, the reSearcher developers mention that some software components only became packaged as open source in the spring of 2006. One of the reSearcher developers discusses a key tension between the competing tasks of source code development and bug fixing/documentation. Another reSearcher developer discusses how a lot of human intervention and work is needed in the maintenance of the CUFTS knowledgebase. The lead PKP developer also discusses how managing the PKP support forum is time consuming.

The open source development realities and library technical competencies sub-theme focuses on one of the developer's statements about the small community of technical people in the library community. Another developer also mentions that open source requires more management and maintenance than commercial products, and questions whether libraries are willing to invest that extra time and effort. Other developers also mention the misconception from client libraries that open source should work "out of the box" without major glitches.

F) Innovation and Value (25)

All of the developers report some degree of innovation. Most of the innovation, however, does not appear to be related to the technical aspects of the software. Rather, much of the innovation is related to the organizational structure and management of the software projects, including the large investment in systems staff and developers. The sub-themes are: 1) Sustained development and 2) PKP innovation (see Table 16). The innovation for reSearcher centers around the time it was first developed, since no comparable commercial link resolving tool existed at the time of its development. In

addition, the proposed development of a new electronic resources management tool is discussed by some of the developers as a new and innovative tool. For PKP, developers discuss innovation through the work of the PKP developer, as he is promoting a model that gives users with limited financial means a foothold in scholarly publishing.

Table 16: Innovation and Value (Developers)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Sustained development (14) 	<ul style="list-style-type: none"> - Developing software at a time when some of these products did not exist - Development of new ERM tool that currently does not exist in the market right now - Large investment in systems staff
<ul style="list-style-type: none"> • PKP innovation (8) 	<ul style="list-style-type: none"> - Ideology and goals of OJS - Leadership of PKP developer in promoting OJS for users with limited economic means - No competing OSS products like OJS

G) Leadership (27)

The leadership theme revolves around the following sub-themes: 1) Administration commitment to software development and 2) the PKP director and management team (see Table 17). Several developers mention that it is unusual for a library the size of SFU Library to have the number of programmers it has. Developers also discuss the fact that management at SFU Library views systems expertise as a priority, and has had a long-term interest in software development. The sub-theme of administration commitment to software development also refers to the fact that SFU Library does not have core software functionalities in open source. One reSearcher developer, for instance, feels that some prototypes for products are developed “on a whim” and “when there’s not really a need for them.” This developer also believes that

SFU Library is only comfortable having open source for “toy products.” This statement sheds light on the broader organizational commitment to open source at SFU Library. The PKP director and management sub-theme addresses the strong ideological and visionary presence of the PKP director, especially with regard to his efforts to spread OJS around the world.

Table 17: Leadership (Developers)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Administration commitment to software development (10) 	<ul style="list-style-type: none"> - Library management only trusts “toy products” for open source - Unusual for a library the size of SFU to have so many programmers - Management viewing systems expertise as a priority
<ul style="list-style-type: none"> • PKP director and management team (14) 	<ul style="list-style-type: none"> - PKP director an “extremely good manager” and a major “visionary leader” - Strong ideological presence of the PKP director

5.3 Clients

The seven clients represent libraries in the two regional consortia – BC ELN and COPPUL. All of these libraries, with the exception of one, are using the reSearcher software. The themes that have emerged in this analysis are: a) Benefits; b) Challenges; c) Project Management and Evaluation; d) Agency and Inclusion; e) Organizational Motivation; f) Personal Motivation; g) Software Evaluation and Support; h) Collaboration/Community; i) Leadership and Innovation; and j) Suggestions for Improvement. The following sub-sections discuss each theme and its sub-themes in more detail, and provide a summary of the themes and sub-themes in a table format.

A) Benefits (29)

The benefits that the clients describe are divided into the following sub-themes: 1) Responsiveness and 2) Increased control and lower cost (see Table 18). Responsiveness is related to the technical support of SFU Library. One client describes that the responsiveness of SFU Library is a “key factor,” and “knowing the people at SFU Library” made a difference for this person in comparison to his experiences with commercial software technical support. In terms of the increased control and lower cost sub-theme, one client states how open source “requires taking a leap,” but once this has been done, the “benefits are obvious.” Another client talks about how open source builds expertise in local library staff, while other clients discuss how open source is in line with the underlying philosophy of librarianship and how the reSearcher development process is open to user input.

Table 18: Benefits (Clients)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none">• Responsiveness (7)	<ul style="list-style-type: none">- “Working with people we know”- Knowing the people at SFU Library is a difference in comparison to commercial software
<ul style="list-style-type: none">• Increased control and lower cost (20)	<ul style="list-style-type: none">- Open source requires “taking a leap,” but “there are so many benefits to open source that are obvious”- Building expertise in local staff- In line with underlying philosophy of librarianship- Open to user input

B) Challenges (52)

The sub-themes that comprise this theme are: 1) Lack of technical expertise and 2) Sustainability of reSearcher (see Table 19). For the lack of technical expertise sub-

theme, a major factor appears to be a shortage of funds for the small libraries in the consortium to hire systems and programming staff. Thus, technical challenges are associated mainly with the generally low level of technical skills in client library staff. In addition, a couple of clients discuss that while programming skills are not necessary, some technical expertise is required to utilize open source software, as customization of reSearcher is not that easy. One client also states that in the case of reSearcher, the decision to go with an open source model is related to economic concerns. Another client discusses how many libraries will not switch to open source unless there is a “budget crunch.”

Table 19: Challenges (Clients)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Lack of technical expertise (40) 	<ul style="list-style-type: none"> - Lack of financial resources to hire a programmer - Some technical expertise needed to utilize open source software - Motivation to use open source often an economic one
<ul style="list-style-type: none"> • Sustainability of reSearcher (10) 	<ul style="list-style-type: none"> - Concerns about the long-term economic sustainability of reSearcher - Maintaining the CUFTS knowledgebase remains a major issue - dbWiz still in development phase

The other sub-theme of reSearcher’s sustainability is mainly related to the comments of the large library client who chose not to use reSearcher for his library’s link resolving needs in 2003. This decision, this client reports, was based on a perception that the knowledgebase for CUFTS was not well developed for their needs and that many of the interfaces were not user friendly. In essence, this client was concerned about how the knowledgebase would be updated over time, and with the long-term sustainability of the

project. Another client discusses how the federated searching tool, dbWiz, is still in a development phase and is not a satisfactory product at the moment.

C) Project Management and Evaluation (54)

In general, the clients are pleased with the technical support of the project, and emphasize the importance of the consortium model for maintaining the project. The sub-themes are: 1) Technical support and 2) Management structure and importance of the consortium (see Table 20). Several clients discuss the responsiveness of the SFU Library technical support staff, and one client discusses how “loyalty” to the project remains an important factor. One client recommends open source for libraries only if reliable technical support is available.

In terms of the other sub-theme, clients state how the BC ELN consortium has been essential in supporting reSearcher for its member libraries. For instance, one client states she never would have downloaded reSearcher without consortium support. Another client also discusses several factors that have made open source successful in this context, namely: the maturity of the open source product; the level of technical support; and the ethos of the institution. The large library client which chose not to utilize reSearcher several years ago also suggests that framing the open source debate as an “open source versus commercial product” situation may not be accurate. Instead, he suggests that a “corporate versus consortium” framing of open source development is more accurate, since this client states the he is not averse to open source in principle, but had misgivings about the on-going consortium-led management of reSearcher.

Table 20: Project Management and Evaluation (Clients)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Technical support (12) 	<ul style="list-style-type: none"> - More responsiveness than commercial products - Loyalty to project
<ul style="list-style-type: none"> • Management structure and importance of consortium (34) 	<ul style="list-style-type: none"> - Maturity of the open source project; level of technical support; and ethos of the institution important - Smaller libraries benefiting because of BC ELN's support - "Corporate versus consortium" model of open source development

D) Agency and Inclusion (44)

The agency and inclusion theme refers to the degree of control that the clients feel in guiding the development and customization of the software. Throughout the majority of the interview transcripts, clients express a high level of satisfaction with the level of customization they have with the software, as well as with the open lines of communication they have with the software developers. While none of the developers contribute code to the project, they nonetheless feel engaged with the product's development, feeling that their input and feedback has been valued. The two sub-themes are: 1) Communication and control; and 2) Feeling of partnership (see Table 21). One of the clients discusses how a "really open communication system" exists with SFU Library developers, and other clients discuss the increased control and customization they have over reSearcher in comparison to commercial products.

Table 21: Agency and Inclusion (Clients)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Communication and control (19) 	<ul style="list-style-type: none"> - A “really open communication system” exists with SFU developers - Satisfaction with configurability and control
<ul style="list-style-type: none"> • Feeling of partnership (21) 	<ul style="list-style-type: none"> - Sense of being a “usability tester” - “In the loop” about development and support - Importance of knowing people at SFU - SFU Library not having a “marketplace mindset”

The other sub-theme focuses on the feeling of partnership that clients have with SFU Library. None of the clients contribute code to the project, but one client feels like a “usability tester” for the software. Other clients talk about being “in the loop” about development and support, and the importance of knowing the development team at SFU Library well, in comparison to commercial software developers.

E) Organizational Motivation (21)

The organizational motivation theme details some of the factors that have led the clients’ institutions to use the reSearcher software. The sub-themes are: 1) Economic motivation and 2) Open source ethos (see Table 22). While most of the clients express an enthusiasm for open source software, the motivation for having it at their institutions has an economic basis. This fact is particularly evident with the smaller libraries in BC ELN who could not afford the commercial equivalents of the reSearcher software. However, one client does explicitly link reSearcher to an institution-wide open source ethic at his university. This client is a library director who sees the wider benefits of the open source

movement. Another client discusses how the reSearcher software provides a better service to students.

Table 22: Organizational Motivation (Clients)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Economic motivation (12) 	<ul style="list-style-type: none"> - Cost savings through use of reSearcher
<ul style="list-style-type: none"> • Open source ethos (7) 	<ul style="list-style-type: none"> - One client seeing use of reSearcher as part of a campus-wide open source movement - Belief in open source nature of the project

F) Personal Motivation (37)

The personal motivation theme consists of two major sub-themes: 1) Open source philosophical orientation and 2) Personal knowledge about open source software (see Table 23).

Table 23: Personal Motivation (Clients)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Open source philosophical orientation (25) 	<ul style="list-style-type: none"> - “Resonance between the values of the profession and the open source movement” - Open source paralleling sharing activities in libraries - Interest in open source integrated library system
<ul style="list-style-type: none"> • Personal knowledge of open source (12) 	<ul style="list-style-type: none"> - Interest in the promotion and advocacy of open source - Open source movement in libraries “important”

For most of the clients, personal motivation is related to a belief in the benefits of open source software for libraries. This belief in open source software is expressed in different ways, but most of the clients feel that open source values and library values are a good fit. One client, for instance, discusses how the open source process parallels

resource sharing activities in libraries. In terms of personal knowledge about open source software, one client shows an active and long interest in open source issues, while other clients have been exposed to open source mainly through the reSearcher experience. Clients also discuss how the open source movement in libraries is important, as people who actually serve library patrons are developing the software.

G) Software Evaluation and Support (101)

This theme describes the level of satisfaction the clients are expressing with regard to use of the software, as well as with the level of technical support. The sub-themes are: 1) Satisfaction, 2) Critique, and 3) Technical support and responsiveness (see Table 24). Most of the clients are happy with the software, as well as with the technical support. Clients discuss how reSearcher is meeting their basic expectations, and others express satisfaction with the modularity and integration of the software.

Table 24: Software Evaluation and Support (Clients)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Satisfaction (28) 	<ul style="list-style-type: none"> - Meeting expectations - Continuous development cycle - Modularity, integration of software
<ul style="list-style-type: none"> • Critique (29) 	<ul style="list-style-type: none"> - Dissatisfaction with federated searching tool, dbWiz - Interfaces in earlier versions not user friendly - Questioning continuous development of reSearcher
<ul style="list-style-type: none"> • Technical support and responsiveness (34) 	<ul style="list-style-type: none"> - More personalized service - Improvement in support with the hiring of consortial support librarian

In terms of critique, however, a couple of clients express their dissatisfaction with the federated searching tool, dbWiz. While a reflection on this particular product, this judgment may also be based on a larger skepticism about federated searching in the

library community. Other clients discuss how user interfaces in earlier versions of reSearcher were not too user-friendly; however, with newer versions of the software, this concern appears to have abated. The one large COPPUL library that did not utilize the reSearcher software critiques and questions the viability of reSearcher's continuous development.

In terms of technical support and responsiveness, this sub-theme intersects with the project management and evaluation and agency and inclusion themes, discussed earlier. One client comments on a more "personalized" service with reSearcher. In addition, other clients mention that technical support has improved since SFU Library hired a librarian who works on consortium support issues.

H) Collaboration/Community (32)

The collaboration/community theme encompasses the clients' beliefs about their continued involvement in open source projects. Most of the clients have a positive orientation towards open source software, as discussed in earlier themes. In addition, some clients think that further open source collaboration and community building can occur in academic libraries. The sub-themes are: 1) Growth of the library open source community and 2) Loyalty to project (see Table 25). The first sub-theme relates largely to the comments of one of the clients who is consciously linking his library's involvement with wider open source movements in higher education. He believes that small institutions can "definitely" play a role in open source development. This library director is sending his staff to the Access conference and is interested in university-wide open source projects such as Sakai. Other clients express an interest in growing the

library open source community, but one client thinks that the open source community in libraries is not big enough to outpace commercial vendors.

The latter sub-theme focuses on the commitment that BC ELN libraries have for the reSearcher project. While loyalty and a need to support the project motivate some of the clients, one client mentions that loyalty would be less of an issue if the product were not meeting her library’s needs.

Table 25: Collaboration/Community (Clients)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Growth of library open source community (25) 	<ul style="list-style-type: none"> - Access Conference; Sakai - Small libraries can “definitely” play a role in open source development - Open source community in libraries not big enough to outpace commercial vendors
<ul style="list-style-type: none"> • Loyalty to project (4) 	<ul style="list-style-type: none"> - Importance of building community - Strong sense of loyalty from BC ELN libraries

1) Leadership and Innovation (25)

In terms of leadership and innovation, leadership appears to play a key role in the project, while innovation seems less important. The sub-themes are: 1) Open source innovation and 2) Co-extensive leadership (see Table 26). Clients discuss the innovation of reSearcher, but do not point to specific components of the software as being highly innovative. Rather, some clients discuss the importance of the open source movement in general for libraries, and see innovation in SFU Library’s search for cost effective, regional software solutions. One client points out that more innovation may be happening in larger non-library related open source projects. In terms of leadership, several clients mention the importance of the SFU Library director, and one client

discusses how a library implementing an open source solution needs a director who is a “risk-taker.” Another client discusses how leadership in open source projects is often initiated at the developer level.

Table 26: Leadership and Innovation (Clients)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Open source innovation (9) 	<ul style="list-style-type: none"> - reSearcher an “important” piece of software - “creating a new model of how we as libraries work” - Cost-effective solutions - Potentially more innovation in larger open source projects
<ul style="list-style-type: none"> • Co-extensive leadership (15) 	<ul style="list-style-type: none"> - Presence of a leader “who is a risktaker” - SFU Library director’s leadership role and technical experience - Open source projects often initiated at the developer level

J) Suggestions for Improvement (26)

Suggestions for improvement are not extensive, but cover some detailed critique of technical elements, as well as opportunities to expand the open source movement in libraries. The sub-themes are: 1) Technical critique and 2) Open source expansion (see Table 27). In relation to the first sub-theme, one client expresses a desire for more servers and increased bandwidth from SFU Library. Another client discusses the need for a new electronic resources management (ERM) tool that SFU Library is currently planning to develop. Other clients critique the federated searching tool, dbWiz. One client expresses a need for more training on how to use the software.

In terms of open source expansion, one client expresses a desire to have more open source development in core functionalities, such as an integrated library system.

The client from the library that does not use reSearcher expresses the desire to have open source for new functionalities, rather than for functionalities that commercial developers already provide.

Table 27: Suggestions for Improvement (Clients)

Sub-themes	Key Quotes/Ideas
<ul style="list-style-type: none"> • Technical critique (16) 	<ul style="list-style-type: none"> - Desire for more servers and increasing bandwidth - Need for new ERM tool
<ul style="list-style-type: none"> • Open source expansion (8) 	<ul style="list-style-type: none"> - More open source development in core functionalities - Open source potentially is more attractive if it offers new services, rather than existing ones

Chapter 6: The Case Study Part II: Discussion & Analysis

6.0 Key Findings

This chapter begins a more focused examination of the case study, as it presents an analysis of the case on two levels. The first part of the chapter focuses on an analysis of the in-depth case study in relation to Weber's (2004) and Raymond's (2001) frameworks, and formulates areas for future best practices research in library open source projects. The second part of the chapter analyzes the case study in the context of the critical theory of library technology framework. The levels of the framework, and their orientations and dimensions of analysis will be applied to an examination of the in-depth case study.

These two analyses emphasize distinct, yet intersecting aspects of the case study. For instance, the open source analysis focuses on the perceived value of the software products, the development of user and developer communities, orientations towards the open source process, and the value of leadership. The critical theory of library technology analysis, however, focuses on the aspects of democratic transformation found in the case study. These analyses are based on the major findings of the case, presented here in a bulleted list, according to some general themes:

Project Successes

- Visionary leadership appears to be key to both projects' successes. Importance of developers in promoting open source, leadership of administration.
- Technological innovation of SFU Library is seen as important by most interviewees.

- Perception of reSearcher as a regional success; success of sustained development, upgrades of software; CUFTS/GODOT most widespread reSearcher component.
- Perception of OJS as a worldwide success. SFU Library's emergence as the institutional "home" for the PKP software appears to be giving the library a prestige boost and is having a synergistic effect on reSearcher development.
- Greater customization and control for member libraries using reSearcher, high user satisfaction with responsiveness and open communication system.
- Consensus among most interviewees about the importance of the consortium funding model for reSearcher.
- Cost benefits, particularly for member libraries using reSearcher.
- Smaller libraries with less technical and financial resources are benefiting from reSearcher.

Project Challenges

- Is the software "truly" open source? If we define an open source project in terms of its user and co-developer community, reSearcher would not be defined in this way, and PKP only marginally.
- Misconceptions about open source from client libraries – maintenance, long-term cost, and technical knowledge.
- For the larger libraries in the consortia, a perception appears to exist that reSearcher may not be appropriate for their needs.
- Low technical skills of consortium libraries a barrier to full utilization of open source software.

- Challenge of providing technical support and documentation; challenge of balancing code development with support activities.
- Challenge of growing developer community at same rate as user community.

Ideology and Areas for Further Reflection

- An ideological orientation towards the open source movement is seen in all interviewee categories, but primarily for clients and developers. However, ideology is driving the open source development less than other concerns, such as a drive for cost benefits and a belief in investing in the technological expertise of SFU Library systems staff. Ideological orientation towards open source and open access appears to be more of a motivating factor with the PKP software.
- Agreement from most key participants that OSS values and library values intersect.
- Is the organizational structure of the reSearcher software deployment (consortium) more responsible for the success of the project or is it the open source nature of the product?
- How will the user and voluntary development communities grow outside of SFU Library?

6.1 Maintaining Library-Based Open Source Projects: Toward Best Practices?

The frameworks of Weber (2004) and Raymond (2001) offer insights into factors that sustain successful open source projects in general, regardless of institutional context. This section explores how these ideas can be applied to the library open source context, as they can help us understand the factors that have sustained the projects. I focus here

on a few of their main ideas, and how they intersect with the case study analysis. The key points I will focus on in Weber's (2004) framework include:

- The product is perceived as important and valuable to a critical mass of users.
- A voluntary community of iterated interaction can develop around the process of building the product.
- The agents are driven by motives beyond simple economic gain and have a “shadow of the future” for rewards (symbolic and otherwise) that is not extremely short.
- Agents hold a positive normative or ethical valence toward the process.

Raymond (2001), in addition, sees the open source movement as a gift culture, and argues that a large beta-tester and co-developer base is needed for an open source project to succeed. Furthermore, he discusses how visionary leadership in an open source project is necessary, but again emphasizes the importance of a large user and developer community.

6.1.1 Importance and value of the product

The value and importance of the software projects are expressed in a variety of ways, across all interview categories. One topic discussed in relation to the PKP software is the expansion of the library's role in publishing and the changing role of libraries. Three administrators, for instance, all discuss how the OJS software allows libraries to take a more active role in supporting “first-tier” publications. In terms of reSearcher, many interviewees state how the product offered innovative functionalities at the time it

first emerged, and one consortium director discusses how reSearcher helps meet his consortium's goals of information equity.

A key point that emerges is noted by one administrator when he states that a "mid-sized library is playing a significant role in software development." Another administrator thinks that reSearcher provides a higher level of service than commercial products, and adds that reSearcher has economic benefits and is more sustainable than proprietary software. One administrator also discusses how reSearcher has reached a level of maturity in its development, and feels that a synergistic relationship exists between PKP and reSearcher. He also cites the continued development and upgrades to reSearcher as a major success. In addition, there is a consensus by both administrators and developers that reSearcher is a regional success in Western Canada. Others also point out that reSearcher's continuous development, updates, and customizability are integral to its success.

However, the importance and value of the product is hindered by the question of whether or not reSearcher is "truly open source." This feeling of doubt about the open source nature of reSearcher is especially expressed by the developers. A developer, for instance, talks about how reSearcher only recently became neatly packaged as open source for non-consortium libraries to use. In relation to the OJS software, one administrator laments that the software is not part of wider open source communities, such as Sourceforge.net. Thus, the importance of reSearcher as an open source product (and to a lesser extent PKP) is debatable.

The importance and value of the product, though, must ultimately be seen through the eyes of the software clients. Overall, it appears that the clients are happy with the reSearcher software. Major points of satisfaction regarding reSearcher from the clients' point of view include: responsiveness, increased control, lower cost, and an open communication system. The idea of responsiveness occurs often, with most clients happy with the technical support of SFU Library, and the fact that programmers associated with a library are meeting their needs. Other clients also discuss the importance of the two regional consortia in managing the reSearcher project. The large library client which chose not to use reSearcher, however, provides a counterpoint to the general consensus about the importance and effectiveness of the reSearcher software. The decision of this library not to use reSearcher in 2003 is largely based on a perception that the product was not "mature" at that time, as well as skepticism about the continued maintenance of the software. This library serves as an important example of how the needs of some of the larger libraries in the consortia may not be met with the reSearcher software.

Despite some misgivings about the open source nature of the software, both projects are perceived as important and valuable to users. Weber's point about importance and value, however, refers to a "critical mass" of users; exactly what constitutes a "critical mass" can be questioned, and will be discussed more in the section dealing with best practices. In summary, the major points regarding the importance and value of the software products are:

- Success of OJS
 - expansion of the library's role in publishing; a changing role for libraries

- Pride in OJS as the leading open source journal publishing software, and its worldwide uptake and use
- Early innovation of reSearcher
 - meeting consortia goals of equity
 - wide range and scope of software products
 - mid-sized library playing a significant role in software development
- Successes of reSearcher
 - regional success
 - customization and updates
 - high quality services
 - economic benefits
 - participation of libraries in the development process
 - continuous development
 - synergy between reSearcher and PKP projects
- Is reSearcher truly open source?
 - packaging of the software for non-consortium users
 - lack of outside developers
- Clients' satisfaction with reSearcher
 - responsiveness, increased control, lower cost
 - open communication system
 - importance of consortium model
 - meeting the needs of larger libraries in consortium?

6.1.2 *Development of community*

Community, in this case, refers to both the user and development communities. The scopes of reSearcher and PKP are different, and this fact is reflected in the issue of community building. PKP has a large user community, as evidenced by the hundreds of journals using the OJS software around the world. As one developer discusses, many users of the software contribute to discussions on the support forum, which this particular developer manages on a daily basis. In addition to the support forum, the “Bugzilla” bug reporting mechanism serves as a tool for managing the contributions of the OJS user community. A developer remarks, however, that outside code contribution is rather slow, but other partners have been added to the team, and a strong OJS partner community exists in Brazil. The *Synergies* project is also discussed by some administrators as a potential way to grow the user and development communities, as well as the upcoming PKP Scholarly Publishing Conference in July 2007. Most of the reSearcher software products, in contrast, have only recently set up support forums, and activity on them remains limited.

The issue of community also has a direct relationship to how the technical support of the projects is maintained. An administrator, for instance, discusses how it has been an issue of “dumb luck” that the growth in the OJS and reSearcher user communities has kept pace with the number of programmers and support staff SFU Library has. A rapid increase in the number of users and the subsequent need for increased support can upset this delicate balance. This situation highlights the importance of Raymond’s (2001) discussion of developing a large beta-tester and co-developer base. Technical support

and code contribution could thus ultimately take place in institutions other than SFU Library. However, as many of the interviewees point out, growing the co-developer community for both projects remains a goal and not a reality.

A potential solution to the growth of the co-developer community mentioned in some of the administrators' and developers' transcripts is the idea of "technology transfer." This idea is linked to the concept of building "regional hubs of expertise" for reSearcher development – current test cases for reSearcher regional hubs of expertise are an academic library in Denmark and a research institute in the Netherlands. These two institutions have only recently taken on the reSearcher software with the help of SFU Library technical support people – it remains to be seen how these institutions might develop into regional centers of expertise for technical support and co-development.

The need for outside collaboration in reSearcher has been questioned, however – as mentioned in Chapter 5, one reSearcher developer in particular is skeptical about the need for collaboration in the project. This skepticism is fueled largely by his perception that an insufficient amount of technical expertise exists in the library community to support open source projects. In addition, he questions the limited, "niche" appeal of library-specific open source projects for non-library open source programmers. The concern with technical competencies in library systems staff occurs in other transcripts as well, especially in many of the clients' transcripts. While this particular developer remains the most pessimistic about the growth of a wider co-development community, other developers express a concern with library-based technical skills, but also find hope in the development of plug-ins to make outside code contribution easier. Another issue

that some administrators and developers point out, however, is the misconception among some clients about the realities of open source software. This misconception is related to the perception that open source software should work easily “out of the box.” In fact, some developers and administrators discuss how open source is often a collaborative process with client libraries, and the rewards of open source accrue over the long-term. One client, for instance, discusses how an investment in open source is an investment in the technical expertise of library staff.

Another issue affecting community development, mentioned in the previous discussion about the importance and value of the software, is the actual open source nature of reSearcher. A couple of developers, for instance, want code contribution to eventually come from outside SFU Library, in order for the process to become more widely open source. However, when developers were asked about their interest and participation in other library-based open source projects, no one actively takes part in them and most do not have the time to work on other projects. Thus, another issue in the growth of the library open source community concerns the amount of time and level of interest that library-based developers have in other library open source projects.

The majority of clients discuss their lack of technical skills and expertise. While many of the clients who deal directly with reSearcher implementation have some basic technical skills, none of them actively contribute code to the project. Most clients express satisfaction with the level of communication and feedback they have in the project, and one client, for instance, describes himself as a “usability tester” for the

software. This client also sums up the sense of community within the consortium's software clients, when he talks about a sense of "loyalty" to the SFU Library project.

A sense of a larger co-developer community is more of a reality in the PKP project, however. Despite the rapid growth of the user community for OJS, though, developers and administrators in the project express a desire to expand the growth of the community. A lead PKP developer also discusses that a major barrier in growing the OJS community is finding co-developers with a strong belief in open source and the project's goals. In both the reSearcher and PKP projects, community-building remains a work in progress. The following is a summary of some of the major points regarding the development of community:

- Collaboration and larger community development remains a goal and not a substantial reality for both projects
- Issue of balancing growth of user and development communities with technical support needs remains a concern
- PKP community development is more active than reSearcher
 - support forum & Bugzilla
 - hope for Synergies project in growing community
- reSearcher community development
 - technology transfer, regional hubs of expertise (e.g., Denmark and Netherlands)
 - low technical competencies of client libraries

- misconceptions from clients about the time and technical investments in OSS
- questioning open source nature of reSearcher
- limited involvement of developers in other library OSS projects
- project loyalty from client libraries

6.1.3 Positive orientation towards the process

A number of interviewees express positive feelings towards the open source movement and process. In general, developers show the strongest positive orientation towards the open source process, but certain key administrators and most clients have a favorable view of open source as well. In terms of administrators, most see a philosophical compatibility between library goals and open source as well as with open access (in the case of OJS). However, none of the administrators takes an official advocacy stance for either open source or open access, regardless of their personal feelings about these topics. One administrator, for instance, believes in the effectiveness of the reSearcher project, but sees no need to “proselytize” for open source, especially for some of the larger libraries in the BC ELN consortium that do not use the software for various reasons. Another administrator is also “not religious” about open source, but sees the benefits of the current open source model as a less expensive way to meet the needs of libraries in the two consortia. He adds that reSearcher does not necessarily have to be fixed to an open source model of development, and might consider other commercial models of development in the future.

With both the reSearcher and PKP projects, developers played a key role in convincing the SFU Library and PKP directors, respectively, to make the software open source. The SFU Library director, in fact, was considering selling the software before a developer convinced him to make the software open source. The SFU Library director's main interest in the software development process comes from an affinity for library-based technology development, as he was influenced by the thinking of his previous library director at another university. This focus on libraries developing their own technology has shaped how the SFU Library director has thought about technology development in libraries. Another administrator expresses the strongest advocacy for open source, as he feels that it is more sustainable than commercial products.

The open source orientation was noted by all of the developers, with one developer discussing how all the developers were "very keen" on making the software open source, since many of the software tools they were already using were open source. A client discusses, from his personal experience, that open source projects tend to succeed when programmers have the "open source religion." With respect to PKP, a developer discusses the "philosophical respectability" of the project as one of his main motivating factors for working on the project. The clients overall also are supportive of open source. Some clients discuss the philosophical compatibility between open source and libraries and the need for libraries to develop their own technological expertise through open source. Some clients would also like to see more open source development in core functionalities (such as integrated library systems), while one client wonders whether open source in libraries would be more effective if it focused on new services

and resources. The following is a summary of some of the major points regarding a positive orientation towards the open source process:

- Administrators' orientation towards open source
 - seeing philosophical compatibility for open source, but not officially advocating for it
 - no need to “proselytize” for open source, especially for larger COPPUL libraries
 - developers' influence in promoting open source for both PKP and researcher
 - SFU Library's positive orientation towards technology
- Developers' orientation towards open source
 - “very keen” on making software open source
 - PKP developers and “philosophical respectability” of project
 - For OJS, interest in open source and open access ideology is important
- Clients' orientation towards open source
 - benefits to open source “obvious”
 - open source in line with underlying philosophy of librarianship
 - investing in open source is investing in staff
 - open source might be better if it offered new services and resources
 - “we libraries have to develop expertise ourselves”
 - resonance between the values of the profession and the open source movement

- need for more open source in core functionalities

6.1.4 Leadership

Leadership is discussed by all interviewees and emerges as a key finding, with the PKP director and SFU Library director receiving much attention, as well as the software developers. A couple of administrators, for instance, discuss the instrumental roles of developers in promoting open source. In terms of PKP, the director is largely responsible for guiding the software's development and promoting the software around the world, both through his advocacy efforts and grant money. The PKP director is also a strong open access advocate, but admits that he has softened his stance on open access, allowing for non-open access subscription options for the OJS software. The vision and energy of the PKP director has been a key element in spreading the OJS software far and wide.

The SFU Library director has made it a priority to invest in the development of the systems staff of the library, developing a high level of technological competence, unparalleled for a library its size. This systems expertise has resulted in a staff that is able to manage the reSearcher project, and now PKP as well. The SFU Library director has a strong belief in the ability and need for libraries to develop their own technology, and this thinking has influenced his actions, as SFU Library has a large pool of programmers. The SFU Library director's leadership in technological development is unquestioned; however, as one developer mentions, the institution-wide commitment to open source can be challenged, as no "critical" applications (such as an integrated library system) are open source at the library. In terms of leadership in the PKP project, a

developer discusses how the administration of SFU Library has “gone out of the way” to provide good infrastructure for the PKP project.

One client discusses how open source projects are often initiated at the developer level. He also points out that his leadership in promoting open source at his library has been instrumental in his institution’s utilization of reSearcher. In addition, he adds that the leadership of library directors is needed to promote open source software on a wider scale. The directors of the two consortia also have shown leadership in promoting reSearcher, albeit in a support role. The following is a summary of some key points regarding leadership:

- Leadership of developers
 - instrumental roles of developers in promoting open source for both reSearcher and PKP
 - open source projects often initiated at the developer level
- Leadership of PKP director
 - software goals, vision, and development largely driven by PKP director
 - energy and vision of PKP director
- Leadership of SFU Library director
 - interest in making SFU Library a good working environment
 - systems experience and belief in having libraries develop their own technological solutions
 - leadership at SFU Library has “gone out of the way to provide good infrastructure” for PKP

- putting resources into systems staff and hiring programmers – unparalleled for a mid-sized library such as SFU Library
- One developer questioning administration’s commitment to open source on an institution-wide level
- Client leadership
 - One client’s leadership role in promoting OSS
 - leadership of library directors as important in facilitating open source development
 - support role of consortia directors

6.1.5 - Toward best practices?

A discussion of preliminary best practices regarding the successful development of library open source projects will have to address a myriad of fundamental issues. Some of these issues, as discussed in Chapter 4, include: 1) funding and management structure, 2) leadership, 3) code development, 4) community building, and 5) technical and financial sustainability. In association with Weber’s (2004) and Raymond’s (2001) discussion of open source best practices, we can begin outlining library open source best practices.

The funding and management structure of the project has a direct effect on a project’s success. For instance, will a consortium manage the project or a foundation? How will technical support be maintained? How will the fees needed for project maintenance be collected? In terms of leadership, I have discussed at length Raymond’s (2001) and Weber’s (2004) points about the importance of visionary leadership. While

leadership is important, a set of library open source best practices must address ways to cultivate library open source leadership and create an environment conducive to technological risk-taking. Community building and code development refers to efforts to make library open source projects viable and sustainable on a wider scale. Technical and financial sustainability refers to models for assuring the technical support of projects. For instance, will a separate spin-off company develop that charges fees for set-up and technical support? These preliminary areas for best practices study and research are discussed in the following bullet points:

- Funding and management structure
 - Project's organizational structure
 - consortium, foundation, library, etc.
 - Start-up funds
 - Funds for sustaining project
 - hosting fees, support fees, etc.
- Technical and financial sustainability
 - Spin-off company for support
 - e.g., Liblime
 - Technical support mailing lists
 - Koha, DSpace, Oss4Lib, Code4Lib, etc.
 - Boundaries between free support and paid support
 - Scope of applications
 - Smaller, niche projects

- Projects dealing with core functionalities such as integrated library systems
 - New functionalities that are not yet covered by commercial products
- Technical competencies of libraries
 - Investments in technical skills of staff
- Leadership
 - Importance of visionary leadership
 - Leadership in library-based open source projects
 - Environment of technological risk-taking
- Community building and code development
 - Wider development community
 - “Critical mass” of users in the library open source context
 - Community generation and sustainability
 - Participation of small, medium, and large libraries
 - Presence of technically skilled programmers in the library open source community
 - Interest in library open source projects from non-library programmers

6.2 Examining the Case: A Critical Theory of Library Technology?

While the case can be examined for its best practices, these criteria do not account for the case's aspects of democratization. Thus, for this endeavor, I turn to the task of examining the findings from the case study in light of the critical theory of library technology framework (see Table 2, Chapter 3). This in-depth case study serves as a test case in the application of the framework, and provides useful insights into the case. Rather than finding "fault" with the case, the framework emphasizes areas of achievement and areas for growth towards the idealized dimensions of the framework. Some questions that arise in the analysis include: 1) How can the framework be applied to this in-depth case study? 2) How is the case manifested in the framework? and 3) What implications does this analysis have for the study of open source software development in libraries?

The exploration of the case study with the framework operates on three levels: 1) policy and advocacy; 2) individual and community; and 3) systems and institution. The analysis will look at each level of the case study, in light of the orientations and dimensions of analysis for each level. Each level has an associated orientation, as the policy and advocacy level is associated with progressive and democratic actions, the individual and community level is focused on participatory and community-oriented actions, and the systems and institutional level is associated with open and collaborative actions.

6.2.1 Policy and Advocacy Level

At the policy and advocacy level, this section examines in the broadest sense how the case exhibits *progressive and democratic* actions. This exploration begins the process of analyzing how the case matches up with the framework. In other words, how progressive and democratic can we characterize the open source movement within libraries, and within the case study in particular? Before analyzing how progressive and democratic the case is in light of the framework, it is helpful to revisit the dimensions of analysis. These dimensions are:

- Challenges technocracy, techno-capitalism, technological determinism, corporate hegemony of ICTs and Internet, etc.
- Addresses issues of power in the development of library technology
- Political challenge
- Ideological challenge

In addressing the first dimension, can we describe the open source movement in libraries, through the lens of this case study, as a challenge to technocracy and determinist arguments about technology in libraries? This dimension operates on the policy and advocacy level and can be described in one sense as an ideological challenge to the dominant focus on proprietary models of library technology development. Many developers, clients, and certain administrators have a positive orientation towards the open source process, and where relevant, open access publishing. A strong ideological argument about the new roles of libraries in supporting electronic publishing, the power

open source gives libraries to guide their own technology development, and the importance of increased technical competencies in libraries arises. The technological expertise of SFU Library undercuts a determinist viewpoint about library technology.

The advocacy of key actors has been important in promoting the open source nature of both the reSearcher and PKP software suites. In the case of reSearcher, the SFU Library director, developers, and key clients have been instrumental in promoting open source development. Some of the clients and one of the consortium directors discuss how open source software marks a shift in thinking about library technology development – how investments in open source software are investments in library staff. Other clients discuss the need for a wider range of library software applications to have open source equivalents. All of the clients, with the exception of one, come from small colleges and for the most part are satisfied with the reSearcher software.

From a policy-related viewpoint, the role of the two regional consortia cannot be underestimated. While the reSearcher software was initially developed for the COPPUL consortium, reSearcher currently now technically “belongs” to the programmers at SFU Library. However, the initial support of COPPUL in supporting and promoting the software amongst COPPUL library directors was a key to the project’s early success. In particular, one library director of another COPPUL library was a key ally of the SFU Library director in advocating for the benefits of the reSearcher software. This library director is also one of the clients interviewed in this study, and is a leading open source software advocate in the Canadian academic library environment.

The advocacy role of the PKP director in promoting the OJS software around the world has been crucial in the software's continuing development. Many interviewees discuss his tireless efforts in traveling around the world and speaking about the benefits of the software and open access publishing in general. Through grants he has received from various agencies, he has been able to make OJS arguably the leading open source journal publishing software in the world. The PKP director's advocacy is related to how the OJS software is integrated into the larger PKP organization's goals of increasing access to knowledge. The research agenda of the organization is helping to promote the software in the developing world, particularly with the current *Strengthening African Research Culture and Capacities Project*. This project involves African publishers, editors, researchers, and libraries in exploring the feasibility of moving journals to online management and full-text publishing as a way to strengthen local research culture and knowledge building (Public Knowledge Project, n.d.-c). Projects such as this one and others in the developing world help in the growth and visibility of the PKP software.

Another important role for the PKP director is in his ideas about the changing roles of libraries with regard to electronic publishing. He sees this changing role of libraries not in the sense that librarians will become publishers, but will extend their talents and skills in ways that support the distribution and take-up of knowledge produced within academic settings. In this scenario, he sees the library becoming known to faculty for providing advice on how to improve the reach of their work as authors, editors, and conference directors. In addition, he also sees potential in the presence of a library-specific webpage on the PKP website, which would demonstrate how libraries are using

the PKP software to integrate their services and provide contacts for other libraries for potential best practices. In addition to the PKP director, other administrators at SFU Library also agree in principle with this idea about the changing roles of libraries with regard to electronic publishing. This relates to the idea that academic libraries can integrate their electronic publishing services with institutional repositories, and participate in “first-tier” publishing, according to one of the administrators.

However, focusing primarily on an ideological answer belies many of the practical realities behind the adoption of open source software in the case study. In addition, while many of the administrators are sympathetic with the goals and philosophy of open source software, no organization has an official advocacy stance for open source software. The PKP director stands as a strong advocate for open access publishing, but his stance has become slightly tempered as a result of his interactions with other project participants, notably the CCSP director. In terms of open source advocacy, it does not appear that the case of SFU Library (especially for reSearcher) is linked strongly to a larger consciousness of the wider open source movement in libraries. Open source development at SFU Library thus does not have the “radical,” political character characteristic of other more ideological, progressive, and grassroots open source movements. The more pragmatic strand of the open source movement seems to be driving the software development at SFU Library. In addition, it needs to be emphasized that smaller, non-core applications (link resolving, federated searching) are open source at SFU Library, but not major applications such as an integrated library system. This

point reflects back to the statements of one developer, who questions the administration's long-term commitment to open source.

The SFU Library director, as stated in earlier discussions, is not “religious” about open source software. The reSearcher project, rather, seems to be influenced more by the SFU Library director's belief that libraries should develop their own technological solutions. The open source model for reSearcher is working at the moment and meeting the needs of client institutions and SFU Library. However, as the SFU Library director points out, this arrangement might be reassessed in the future, with proprietary models potentially explored as well. The findings show that inherently practical concerns are largely driving the reSearcher project, such as cost benefits. With PKP, the director of that project has advocated strongly for open access issues, and the software developed out of his concern for issues surrounding public access to research. In this sense, PKP development presents a political and ideological challenge to the current commercial publisher-dominated scholarly publishing environment. The sense of a larger ideological and political angle comes from PKP and OJS in particular. The political economy of academic knowledge production can be dramatically shifted if open access initiatives facilitated by tools such as OJS take hold. In fact, the “access to knowledge” orientation of the PKP project is part of a decidedly political agenda to increase access for the wider public to scholarly information. The open source nature of the product also coincides with the ideological agenda of the PKP director. The large and growing user community for PKP and an active community associated with the support forum most likely ensure the continued open source nature of the product.

Does the case study address the issue of power in the development of library technology? The case appears to resonate most strongly with this particular dimension of analysis. A point of pride for interviewees who work at SFU Library is the robust systems department of the institution, and the large number of programmers the library has. Thus, the project is innovative in the amount of resources put into technical concerns, especially for a mid-sized library. This emphasis on the systems strength of SFU Library is due in large part to the actions of the SFU Library director, as many of the interviewees discuss. This advocacy on the part of the SFU Library Director cannot be underestimated, and appears to be the major factor in the technological strength of SFU Library.

Thus, returning to the overarching theme about the progressive and democratic elements of this case, these elements manifest in several ways. In terms of the first dimension of analysis regarding a challenge to technocracy, the open source movement in libraries appears to offer a viable alternative to dominant commercial models of library technology development, but on a small scale. The technological strength of SFU Library also counteracts determinist orientations. The ideological underpinnings for open source in the case of reSearcher are not clearly defined. However, PKP is having an effect on an international scale in terms of new models of electronic scholarly publication. But in terms of the second dimension that deals with “issues of power in the development of library technology,” then it does appear that this case study demonstrates a greater degree of technological expertise and power being appropriated by the library. SFU Library emerges as a model of a library placing importance on developing

technological expertise. Technological power and expertise are the domain of SFU Library, particularly in the case of the PKP partnership, demonstrating a shift in thinking about the traditional roles of libraries in technology development.

6.2.2 *Individual and Community Level*

On the individual and community level, we can focus on the *participatory and community-oriented* characteristics of the case. Assessing the participatory and community-oriented nature of the case study depends on how we define both what “participatory” and “community” mean in this case. To review, the dimensions of analysis are:

- Community input and participation in the development, production, management, and maintenance of library technology
- Utilizes participatory aspects of technologies
- Local control
- Social and cultural challenge

The first half of this chapter dealing with open source best practices in relation to the case also brought up the issue of community, and it is true that collaboration and larger community development remain a goal and not a major reality for both projects. In addition, with reSearcher, meaningful technical contributions from client libraries are limited due to the generally low technical competencies of the client libraries. However, despite these realities, community input and participation do play a significant role in both projects.

For instance, a basic finding that remains important is that the reSearcher client base, made up largely of small college libraries, are the major beneficiaries of the project. Many of the clients express satisfaction with the software and praise the responsiveness of the technical support and the customizability of the software. While none of the clients contribute code, a few express the idea that they are “beta testers” for the software, and many of them feel included in the feedback and development process for reSearcher components. A number of clients discuss how they would never have been able to afford commercial link resolving software, if it were not for reSearcher’s CUFTS and GODOT software. reSearcher is thus addressing a previously unmet need for link resolving and electronic resource management software at a reduced rate. One client mentions, for instance, that he will “happily wait” for the next version of CUFTS and GODOT to be developed, rather than search for a comparable commercial product. Part of this attitude comes from the economic realities of most client libraries, since they cannot afford many commercial products; however, this attitude also reflects a loyalty to SFU Library and its open source software products.

The consortia help define the community in this project, and are also important mediators in providing the software to consortium libraries. As discussed earlier, COPPUL helped in the initial development of the software, but does not currently have a stake in the management of the software. BC ELN, on the other hand, remains active in providing technical support for reSearcher for member libraries in British Columbia. Both consortia remain committed to community-based solutions for the electronic information needs of their member libraries. Beyond the consortium model, the

participation of client libraries in the development of the software may also get a boost from a development model in which SFU Library approaches individual libraries for new software project development. The amount each library pays is based on its size and ability to pay, and this development model has already been implemented in the case of dbWiz. The current project to enhance the electronic resource management functions of CUFTS is taking this approach as well.

Thus, despite the presence of the significant user and developer communities that both Weber (2004) and Raymond (2001) discuss as crucial to the success of open source projects, a deep sense of community pervades the reSearcher project. As discussed earlier, according to the criteria of open source scholars, this case dubiously qualifies as a “true” open source project, as the scope of the project and the developer community remains limited, with the source code only recently packaged as open source. However, the level of interest from the libraries in the consortia, and the real benefits that local libraries (especially in the province of British Columbia) gain from reSearcher point to a regional, community-based open source success story. Community in this case is defined by the smaller client libraries in the two consortia, and their participation appears to be more meaningful and significant than with commercial vendors. While commercial vendors are not completely maligned, a majority of the clients are happy with a process in which librarians are managing the technical support and guiding the development of their software. Drawing upon Feenberg (1999; 2002), library values are imbuing the development of the software, and technological expertise has been democratized, with libraries directing more of their technological development.

In terms of the future growth of the reSearcher user and development communities, the recent uptake of reSearcher by a library in Denmark and a research center in the Netherlands holds out promise for more such “beta testers” for the software, and potential code contributors. These two international partners have been able to pay for their technical support, and more partners like these can potentially push the software forward to create a “critical mass” of users. Thus, despite whether or not the project can truly be called open source at this point, this fact does not detract from the community and participatory nature of the project.

In the case of reSearcher, this case study provides a model of how a library with a high level of technological expertise acts as the hub of a software development “cooperative.” Libraries with technical expertise can contribute code, but are not required to do so, but all libraries of the “cooperative” pay a fee either to the library or the consortium to manage and sustain the project. It appears that the open source nature of the software is an ancillary part of the process, and its potential as of now is underutilized.

The PKP community, due to the nature of the software application, is naturally wider than the reSearcher community. The international scope of the project is impressive, with users from around the world active on the PKP support forum and Bugzilla. With respect to the criteria for judging successful open source projects, it appears that PKP is further along than reSearcher. However, assessing community input and participation in the development of the project is more difficult for the basic reason that no interviews with PKP users were conducted. However, given the wide and

distributed nature of PKP software users as evidenced by their activity on the support forum, it appears that these users have a “voice” in guiding the development of the software. The PKP conference in July 2007 will most likely influence how much user community input and participation will guide the future development of the software.

The framework helps us identify many positive dimensions, but at this point it is useful to focus on some areas for growth. For instance, when it comes to community input and participation in the development, production, management, and maintenance of library technology, both projects are not community-oriented in the deepest understanding of this term. For reSearcher, librarians in the two consortia have an open communication system with SFU Library technical staff, and give feedback on features, but are not formally involved in the development process. As some administrators and developers admit, not much feedback comes from member libraries in terms of usability testing – all of the usability testing, if done at all, is based at SFU Library.

What makes the case of SFU Library noteworthy, however, is that the realm of technological expertise has shifted to the library. Several clients remark that since library employees manage the software development and technical support, they feel that their library-specific needs are being met. This reality is contrasted with the traditional situation in which commercial vendors who may not have as much of a “library perspective” manage technical support. It appears to be the case that the technical “experts” at SFU Library are effectively meeting the needs of their clients.

The question of participation and participatory technologies also has to be addressed, and strikes at the heart of what a truly “participatory” process means with

regard to open source. All of the clients interviewed do not contribute code to the project, since they do not have the technical or programming skills to do so. If a relatively high level of programming and technological skills are needed for open source software, how truly participatory a process can open source be? This idea needs to be explored more in future studies.

Also, the question of community and participation needs to be extended beyond just the client libraries. In the case study, it does not appear that significant feedback or participation in the development process is solicited from users of the software, namely students. While some interviewees discuss how the software is meeting the needs of end users, little evidence from the field exists to support this claim. A re-envisioning of the participatory and community-oriented angle of this case thus might entail greater participation of users and more direct involvement of client librarians in the development of the software.

6.2.3 Systems and Institution Level

On the systems and institution level, we can begin exploring the *open and collaborative* aspects of the case study. These aspects manifest themselves in various ways. The dimensions of analysis for this level are:

- Values institutional collaboration
- Builds on existing library strengths of resource sharing and cooperation
- Challenges hierarchical models of technology development
- Economic challenge

On a basic level, the fact that both projects are open source gives credence to the “open” nature of the projects. As mentioned, however, one of the key findings has been the dubious open source nature of the products themselves, particularly reSearcher. The open source nature of the product is in question because the development communities are limited to small groups of developers – in the case of reSearcher the developers are limited to SFU Library, while with PKP, a few outside developers exist in other institutions in Canada. However, with PKP, an active community of collaborators exists in Brazil and the growth of the project’s developer community can receive a boost through the *Synergies* grant and the PKP Scholarly Publishing Conference in July 2007.

With regard to the first dimension of analysis dealing with the value of institutional collaboration, this case provides a number of examples. The partnership to develop the PKP software is one such example, in which an academic library, a university research project, and a university-based center focused on publishing studies have come together for a common goal. This collaboration appears to be quite unique, and as many of the administrators discuss, came together in a surprisingly effective and generally effortless way. In addition, all of the administrators are happy with the partnership and how well it is going. The *Synergies* grant of \$5.8 million will help in solidifying this partnership, as well as the PKP conference. This partnership presents a “new model” of institutional collaboration, a fact emphasized by some SFU Library administrators who feel that libraries should find non-traditional partners in various library technology and service initiatives.

Several interviewees also mention the high quality of the research team, with a “natural division of expertise” occurring. The SFU Library administrators, for instance, discuss the “library perspective” they bring to the PKP project, with a focus on tools for increasing access and providing the technical infrastructure and institutional home for the project. In addition, as discussed earlier, this partnership is part of an idea about the changing roles of libraries in creating support services for electronic publishing.

The institutional collaboration dimension of analysis is also reflected in the role of the two consortia, and SFU Library’s ability to work with client libraries in the on-going development of the reSearcher software. The reSearcher model presents an example of inter-institutional collaboration, with the smaller client libraries providing feedback and usability testing, while SFU Library remains the hub of technological development. The involvement of SFU Library programmers in events such as the Access Conference in Canada highlight the importance placed on collaboration and knowledge sharing with other institutions, and the recent expansion of reSearcher to Denmark and the Netherlands points to international collaboration efforts.

However, limited outside collaboration exists to support software development on a wider scale. The need for large-scale collaboration with other individuals and institutions may not be needed for reSearcher; however, with PKP’s continued international growth, developing more outside and inter-institutional collaboration appears to be an important goal. While outside collaboration remains limited, however, the role of the two consortia in supporting reSearcher development points to library strengths of resource sharing and cooperation. Through the consortium model, client

libraries with limited financial and technical resources have been able to utilize the reSearcher software. Many of the libraries, without the help of the consortium and SFU Library's software, would not be able to afford similar commercial software products and would not have the technical support team of SFU Library at their disposal. An adjusted fee (set according to library size), paid through the consortium, allows consortium libraries to have access to the software and technical support.

Existing library strengths of resource sharing and cooperation also affect the development of the PKP software. Many interviewees, including the PKP director, discuss how the SFU Library is providing an institutional home and legitimacy for the project. Rather than being the project of a single academic group, the PKP software is now managed by the library, aiding in its long-term sustainability and management. The resource sharing and cooperation of the library community is influencing the development of the PKP software, with administrators at the library largely behind the organization of the inaugural PKP Scholarly Publishing Conference in July 2007. In addition, the *Synergies* project puts SFU Library in a position to work with other libraries throughout Canada in the development and support of OJS.

On the topic of challenging hierarchical models of technology development, both reSearcher and PKP development exhibit these qualities. The investment in the technical and programming skills of the systems department at SFU Library rests largely on the shoulders of the SFU Library director. With this technical expertise at an institutional level, SFU Library is able to manage both software projects for their user communities. The remarks of many clients about the responsiveness and inclusiveness they feel in the

technical support process, in comparison to their experiences with commercial software products, speaks to technological hierarchies being broken down. Having a library design and develop software in conjunction with and for other libraries offers an important example of a positive outcome in this case.

Thus, it appears that both open source projects in this case resonate with the open and collaborative orientation. However, to focus on areas for growth and improvement, this case study also highlights the importance of increasing the technological competencies of library staff. While this case demonstrates institutional resource sharing and collaboration in action, the lack of technical and programming skills in many libraries serves as a major barrier to the wider uptake of open source software in the library world. In addition, while open source might challenge certain hierarchical models of technology development in principle, this idea cannot become reality if technological competencies in the library community remain low. In fact, new hierarchies might develop, with more technologically knowledgeable institutions pushing development according to their own needs. While a technological imbalance will always exist between larger, financially robust libraries and smaller libraries with limited financial resources, this gap should not be allowed to become even more pronounced in the future.

6.3 Synthesis

The two approaches in this chapter – an analysis of the case with regard to open source best practices and an analysis in relation to the critical theory of library technology framework – have offered insights into the case from two varying, yet overlapping perspectives. The open source analysis has emphasized the perceived value of the

software projects, factors relating to the development of community, orientations towards the open source process, and the value of leadership. Based on this analysis, preliminary areas for best practices research have been suggested.

The critical theory of library technology analysis, while having some overlap with the open source analysis, has focused on the levels of democratic transformation exhibited in the case. The open source analysis, on the other hand, focuses to some degree on the shortcomings of the case with regard to what constitutes an authentically open source project. However, the critical theory of library technology analysis highlights the progressive and democratic, participatory and community-oriented, and open and collaborative orientations of the case.

The case study provides an example of a regional community-based technological solution built on institutional collaboration. The technological expertise of SFU Library is a defining characteristic of the case, and offers a model of a mid-sized library taking greater control over its technology development. The PKP project also provides a model of emerging roles for libraries in the support of electronic publishing. Thus, while we may question the open source nature of the software products, this fact is less important in the critical theory analysis. What remains more important is how the case pushes forward in the direction of a democratic reconstruction of library technology, and highlights the areas for growth towards the idealized dimensions of the framework.

Chapter 7: Conclusion and Areas for Future Research

7.0 Summary

The last six chapters have focused on several concepts and themes, including: the need for critical frameworks for re-envisioning library technology, the development of the critical theory of library technology framework, a discussion of prominent library open source projects, and the findings and analysis from the test case. I return now in this chapter to the main research questions of the dissertation, and answer each of them consecutively. The second part of the chapter discusses future areas for research and inquiry. These future areas of research include applications of the critical theory of library technology framework in analyses of other areas of library technology development and practices. In addition, future research should include a continuous re-assessment of the framework in the light of other critical theoretical orientations. This framework provides an opportunity for informed reflection in the library profession in the area of information technology, but as a form of critical theory, offers tools for re-examining various other library practices and values. Ultimately, the framework offers a challenge to critically examine the stated values of service and democratic ideals of the library profession, within the context of the dominant information society.

The first question from the study was:

- What are the dimensions of a critical theory of library technology that can advance library public service goals and develop an alternative vision of an information society?

The second and related set of questions were:

- How can a critical theory of technology be applicable for libraries in defining and developing an information society? Can this framework advance a public service ethic of libraries in an environment of increasing privatization and commoditization of public services?

To answer these questions, we have to look back at the arguments developed at the beginning of the dissertation. Through the introduction and literature review, the case was made for developing critical frameworks to interrogate library technology development in an information society, increasingly dominated by information commodification and technological determinism. The information society is linked largely to access to ICTs, and the library profession in general is embracing the dominant discourse of the information society.

This dominant discourse, however, needs to be questioned for alternative visions to emerge. Critiques of the information society and its relationship to the library profession have been discussed by some authors in the field (Apostle & Raymond, 1997; Harris *et al.*, 1998). These authors have critiqued the “information paradigm” and noted the threat of increasing “entrepreneurism” on the traditional public service ethics of the library profession. These changes in the library community are often associated with technological transformations occurring in the field. Both determinist and techno-capitalist strands of thought plague the field, especially in its relationship to information technology. As I have argued, the LIS field does not adequately theorize technology in a way that promotes the stated democratic and progressive goals of the library profession. For instance, “techno-enthusiasts” in the library community often take a deterministic

viewpoint in line with dominant information society visions of ICTs, while “technophobic” elements in the library community regard most technological innovation as a threat to the “traditional” library. Thus, a need for critical frameworks and models for library technology development exists (Buschman, 1993b), and this dissertation has addressed this knowledge gap and concern.

In response to this need, a critical theory of library technology framework has been developed. Critical theory has been utilized in the LIS field before, but rarely discussed in relation to libraries and technology. Critical theory and critical theory of technology are useful in this endeavor, since they offer insightful critiques of technological determinism, technological instrumentalism, and techno-capitalism. Critical theory of technology proposes a dialectic of technology that avoids one-sided approaches in theorizing and evaluating the development of new technologies and their often contradictory effects (Kellner, 1999). Given the benefits of critical theory in offering democratic possibilities for technology development, I explored how a critical theory of library technology framework can be applied to the library context.

This critical theory of library technology framework developed in the dissertation draws from the work of scholars such as McLuhan and Feenberg for its foundations. This framework is multi-disciplinary in its approach, and addresses the power dynamics of library technology practices. It moves in its analysis from the larger context of the information society to the particulars of library practices and services, building connections between these areas, and linking theory to practice. The development of this framework proceeded through the use of critical theory as a method. From the debates

surrounding technological determinism and techno-capitalism and how they affect library technology discourses, technophilic and technophobic poles in the library community were identified and discussed. The dialectical tension between these two poles creates the opening for critical frameworks to view and understand library technological discourses. The critical theory of library technology framework thus emerges as a way to navigate through these opposing library technology viewpoints.

The foundations are drawn from and grounded on a close reading in the areas of technology and media studies, social informatics, community informatics, and critical theory of technology. The foundations form the conceptual basis of the framework, and are as follows: 1) technology as fundamental basis of library development; 2) social and community informatics; and 3) critical theory of technology. Out of this conceptual basis, the framework can also be used as a mode of analysis. The framework is thus both a conceptual tool for helping the field think more critically and democratically about technology and to re-envision the library as a prominent technological voice in society, as well as an analytical tool for exploring library technology activities and movements. This critical theoretical project is thus concerned about both democratic outcomes of library technology development and the democratization of library technological decision-making.

Using these foundations and the concept of democratization from a critical theory of technology, the framework is envisioned as operating on the levels of: a) policy and advocacy; b) individual and community; and c) systems and institution. Each level has an associated orientation, with the policy and advocacy level emphasizing progressive

and democratic actions; the individual and community level focusing on participatory and community-oriented actions; and the systems and institution level emphasizing open and collaborative actions. Each level also has associated dimensions of analysis, which describe the orientations of each level in more detail, and provide guidelines for analyzing cases of library technology development. Thus, the framework spans technological advocacy, politics, and decision making, while addressing concerns at community, individual, and systems/institutional levels.

The third question was:

- Are open source and open access software initiatives a route for libraries to reclaim and shape ICTs for enhancing public service missions?

Chapter 4 has addressed this question in a general sense, while Chapters 5 and 6 answer it at an institutional level. The open source movement in libraries provides an example of libraries utilizing the power of Internet technologies to advocate for their interests and values. In addition, the open source movement is sometimes linked to grassroots democratic, global, and alternative visions of an information society. Library and open source values of collaboration and resource sharing appear to intersect and reinforce each other (Clarke, 2000). Given these apparent synergies and intersections between the library and open source worlds, the open source movement in libraries served as a useful example for applying the critical theory of library technology framework as a mode of analysis. The open source model offers a potentially more democratic form of technology development for libraries. Chapter 4 provided insights about how open source software is being utilized in different ways by various libraries,

and highlighted prominent library open source projects. The in-depth case study offered an example (an institutional level view) of a library open source project.

The findings indicate that the open source movement and open access publishing are routes for libraries to enhance public service missions. However, the generalizability of the in-depth case study remains limited, and more comparative and wide-scale studies are needed. In addition, open source ideology appears to be less of a motivating factor in the case study than previously thought, and the open source natures of the projects remain underdeveloped. The examples discussed in Chapter 4 and the in-depth case study show a level of interest in open source software to meet public service needs with the added benefits of reduced cost and increased customization and control.

In the in-depth case study, small client libraries without large budgets or systems staff report satisfaction with the software both in terms of cost and technical support. From the viewpoint of many clients, the public service missions of their libraries have been enhanced by the reSearcher software. SFU Library is also performing a public service for the two consortia through the development of reSearcher, developing software at a reduced rate for consortium libraries. Thus, SFU Library is seeing an expansion of its public service mission, as it has the mandate of being a software producer for consortium libraries and is a global facilitator of the PKP software.

With regard to the second part of the question, open access publishing is an option that can enhance library public service missions through reduced subscription costs for electronic journals and new models of publishing support services. In the case study, the OJS software is not specifically an open access tool, even though the PKP director is a

supporter of open access initiatives. Journal editors who use the software have the option to make their journals have subscription features. However, the model that OJS and the PKP software in general is presenting, of an academic library hosting open source software for electronic publishing, is unique. SFU Library is providing a public service to the international user base of OJS by hosting and maintaining the software. The growth of OJS through *Synergies* and the PKP conference can only enhance the scope of this public service agenda.

The fourth question was:

- What are some of the institutional and economic constraints that can hinder library-based development of open-source applications?

This question was addressed in relation to the open source best practices analysis. In Chapter 4, the terrain of open source projects in the library community was discussed. Best practices were identified in these major areas: 1) funding and management structure; 2) leadership; 3) code development; 4) community building; and 5) technical and financial sustainability. Raymond's (2001) and Weber's (2004) frameworks were used in the analysis of prominent library open source projects. The in-depth case study of SFU Library offers an opportunity to apply both the open source best practices frameworks of these authors and the critical theory of library technology framework as modes of analysis.

Some of the institutional and economic constraints affecting library-based development of open source software include a lack of technical and programming skills by library staff and a lack of funds for investment in open source maintenance and

training. In addition, collaboration and community building of a wider co-developer base in other libraries is a constraint, as well as the limited interest and scope of library-specific applications for non-library programmers. Another economic constraint centers around how the technical support for these types of projects will be funded and managed. The leadership of key library administrators is a major factor in determining the success of a project.

7.1 Findings and Analysis: Some Reflections

The last three sets of questions deal with the in-depth case study in particular (see Chapters 5 and 6 for a fuller discussion). The first question was:

- What lessons does a case study of a library developing open source and open access initiatives in Canada show us about the potential to re-shape technology for democratic ends?

The potential to re-shape technology for democratic ends is most clearly demonstrated in many of the reSearcher clients' satisfaction with the software. This satisfaction with the project is related to the fact that a library is developing the software for other libraries – library values and concerns appear to be influencing the development of the software. In this sense, SFU Library is facilitating a democratization of technological expertise. The fact that many of the smaller libraries in the consortia benefit from having the software at a reduced rate, compared to commercial products, is another aspect of technological democratization. The consortium model also facilitates a democratic resource sharing model, allowing these smaller libraries to have the software and technical support at a reduced rate. However, how democratic the development

process of reSearcher is, given the limited technical skills of client libraries, is a topic addressed in the last question.

With the PKP software, the potential for re-shaping technology for democratic ends is evident in the large uptake of OJS software in developing countries. In addition, the PKP director's major initiative currently underway is focusing on the role of electronic journal publishing as a way to strengthen local research culture and knowledge building. The use of the OJS software in a range of developing countries speaks to a democratization of scholarly publishing activities, as many of the journal editors in these countries would most likely not have been able to publish their journals without this software. Thus, the library, in hosting and providing technical support for the software, is participating in a democratization of scholarly publishing. More studies specifically focused on the role of OJS in developing countries would be needed, but on the surface, it appears that the library is helping to facilitate a wider participation in scholarly knowledge production. In addition, SFU Library is providing a model of new roles for academic libraries in the support of electronic publishing. While a model that is still evolving, SFU Library's hosting of open source journal publishing software has the potential to make the library a clearinghouse of information and support for campus-based units that want to publish electronically and/or in an open access format.

The next set of questions were:

- Are there particular factors about a Canadian library culture (institutional or professional) that are promoting open source software development? Do these factors affect how libraries can utilize a critical theory of technology?

These questions can be inferred from some of the findings and analysis. The case study provided a window of analysis into the library community of Western Canada, but it is difficult to generalize the findings from this case to the entire Canadian library context. However, the cooperation of two library consortia in deploying an open source project appears to be unique to the Canadian context.

Canada, a country with approximately one-tenth the population of the United States, has consequently a smaller library community and a limited number of regional consortia. Cooperation in the library community and resource sharing appear to be both a value and necessity in this environment. In addition, the fact that SFU Library, as a mid-sized library (in comparison to large ARL libraries), has been able to manage this project speaks to the priority placed on systems and technological development at this library. This project is also a homegrown solution, reflecting a wider focus on cost-effective library technology solutions. But focusing on the case as emblematic of the larger Canadian academic library context would not be appropriate, as SFU Library appears to be unique amongst Canadian libraries in this regard. Further studies of the Canadian library open source community would be needed.

However, the strongest case for a Canadian model of nationwide cooperation and collaboration is found in the *Synergies* grant. A model for promoting digital scholarship for social science and humanities journals in Canada, the project received a \$5.8 million grant from the Canadian government through the Canada Foundation for Innovation. This action shows a national level of support for open access and electronic publishing efforts. SFU Library, CCSP, PKP, and the University of Victoria represent just one

“node” of a nationwide program with an ambitious mandate to transform scholarly publishing in Canada’s social sciences and humanities. *Synergies* is the type of program that seems most uniquely Canadian, in contrast to the U.S. context. Specifically, *Synergies* displays a commitment from the national government to support an endeavor deemed to be in the best interest of the country, and which depends on large-scale nationwide, cross-institutional cooperation. With limited foundation support in the Canadian higher education context (in contrast to the U.S.), the national government is the major source of higher education project and research funding in Canada.

Finally, I now address the last set of questions:

- What lessons can be learned from this Canadian case to help build and refine a critical theory of library technology? What does the test case tell us about the applicability of the theoretical framework as a mode of analysis?

The in-depth case study of SFU Library’s open source initiatives has served as a test case in the application of the critical theory of library technology framework and provides a closer examination of the open source phenomenon in libraries at an institutional level. However, as the first test case of the framework, it has a limited ability to build and refine the framework. Future studies using the framework will have to address this issue. Despite this fact, this test case provides several lessons about the applicability of the framework as a mode of analysis.

These lessons are important when contrasted with Raymond’s (2001) and Weber’s (2004) frameworks for understanding the open source process. The application of their frameworks to the case study interrogates the factors that have sustained the

project. These frameworks emphasize the leadership of key administrators and developers, and a positive orientation towards the open source process displayed by certain interviewees. However, by the criteria of these frameworks, both software projects cannot be considered fully open source, as their co-developer communities are still limited in size. OJS has a much larger user community, but this fact has much to do with the nature of the application. Many interviewees discuss the need to grow the user and developer communities, but in the case of reSearcher, a lack of technical competencies in the library world seems to be a barrier; with OJS, interviewees discuss the need to bring in people with an appropriate philosophical orientation for the project. Managing the growth of these developer communities and their dynamics will be important future challenges.

Do these general conclusions affect how we can judge the “success” of the two projects? Judging the projects as “successful” or “unsuccessful” with regard to open source development is not a fruitful area for analysis. Rather, the areas for best practices research discussed in Chapter 4 and further refined in Chapter 6 provide examples for moving library open source projects toward an idealized level of “success.”

The critical theory of library technology framework, on the other hand, is not focused on success per se, but on the democratic actions and potentialities of the case. From this orientation, many positive outcomes and areas for growth and transformation are identified. On the policy and advocacy level, the case exhibits progressive and democratic tendencies in the example it is setting for technological and systems staff investment for libraries. The leadership of developers and key administrators in

promoting an open source software regional solution for the electronic resource management needs of libraries is notable. On the PKP side, the advocacy of its director has positioned the software as the leading open source software of its kind in the world, and the association of the PKP software with the library is having a synergistic effect on the library's software development program. The increased scope and visibility of the PKP project adds to the library's reputation for systems and technical expertise. In addition, having the PKP software based at the library can create a new model for academic libraries in the support and development of electronic publishing services.

However, a major finding is that ideological factors in the development of open source software play a lesser role than initially thought. Certain key developers have pushed for open source development and a general positive orientation towards open source exists amongst clients, but a strong ideological commitment to open source is not found at the administrative level. This applies particularly to reSearcher, as practical concerns about cost and the need to develop an in-house technical solution were more important priorities than having the software be open source, and a door is open for the software development model to change in the future. In the case of the PKP software, a developer paved the path for open source, and the worldwide growth of the software has most likely set it on a path of continued open source development.

The individual and community level of analysis highlights the participatory and community-oriented aspects of the case. While in the case of reSearcher, libraries are not developing code directly to the project, a sense of community has evolved around the project, with clients expressing satisfaction about the level of responsiveness and control

they have over the software. However, a further question to be explored, given the technological competencies needed for open source software, is how participatory of a process it is. With PKP, the development team has grown outside of British Columbia, with other partners in Canada and a wide user base around the world. The *Synergies* grant and the PKP conference can potentially contribute to the community development of the PKP software.

On the systems and institution level, the development of the PKP software provides an example of a unique partnership that appears to be working well. This example of institutional collaboration brings together non-traditional partners, and is potentially creating a new model for academic libraries in the support of electronic publishing. With reSearcher, the two consortia have collaborated with SFU Library in the deployment of the software, and the BC ELN consortium is active in providing technical support for member libraries. A key barrier to increased collaboration with other libraries in the development of reSearcher, however, is the low level of technical competencies of many client libraries. A broader democratization of technological expertise in libraries appears to be needed.

7.2 Future Areas for Research

This test case of the critical theory of library technology framework serves as the groundwork for future studies of library technology development and practices. More in-depth and comparative studies of other library open source projects are needed, both in terms of a framework-driven analysis and in an effort to understand library open source best practices. Similar studies using this framework can be undertaken to study other

library open source projects in-depth, such as the ones discussed in Chapter 4. While this study relied mainly on qualitative structured interviews and project documents as the main forms of empirical data, other studies would be useful that combine ethnographic field observations, as well as surveys and focus groups, especially to understand client and user perspectives. Comparative research of library open source projects would begin addressing in greater detail factors that both facilitate and limit the development of library technology as a democratic process. Some basic questions that arise in the study need to be explored further, such as:

- Does a sufficient pool of technically competent people working in libraries exist for open source software to succeed on a wide scale?
- Do library open source projects have an appeal for non-library programmers? Should library applications have crossover with similar open source applications?
- What types of applications and management structures lend themselves to effective library open source development?
- How will library open source projects grow beyond their institutional boundaries and develop wider co-developer and user communities?

Moreover, this framework can also be extended to other areas of technology development within libraries (see Figure 1). As this framework is extended beyond just a study of open source in libraries, some questions to consider include:

- In light of future studies in different contexts, what are other critical elements that can be incorporated into the critical theory of library technology framework?

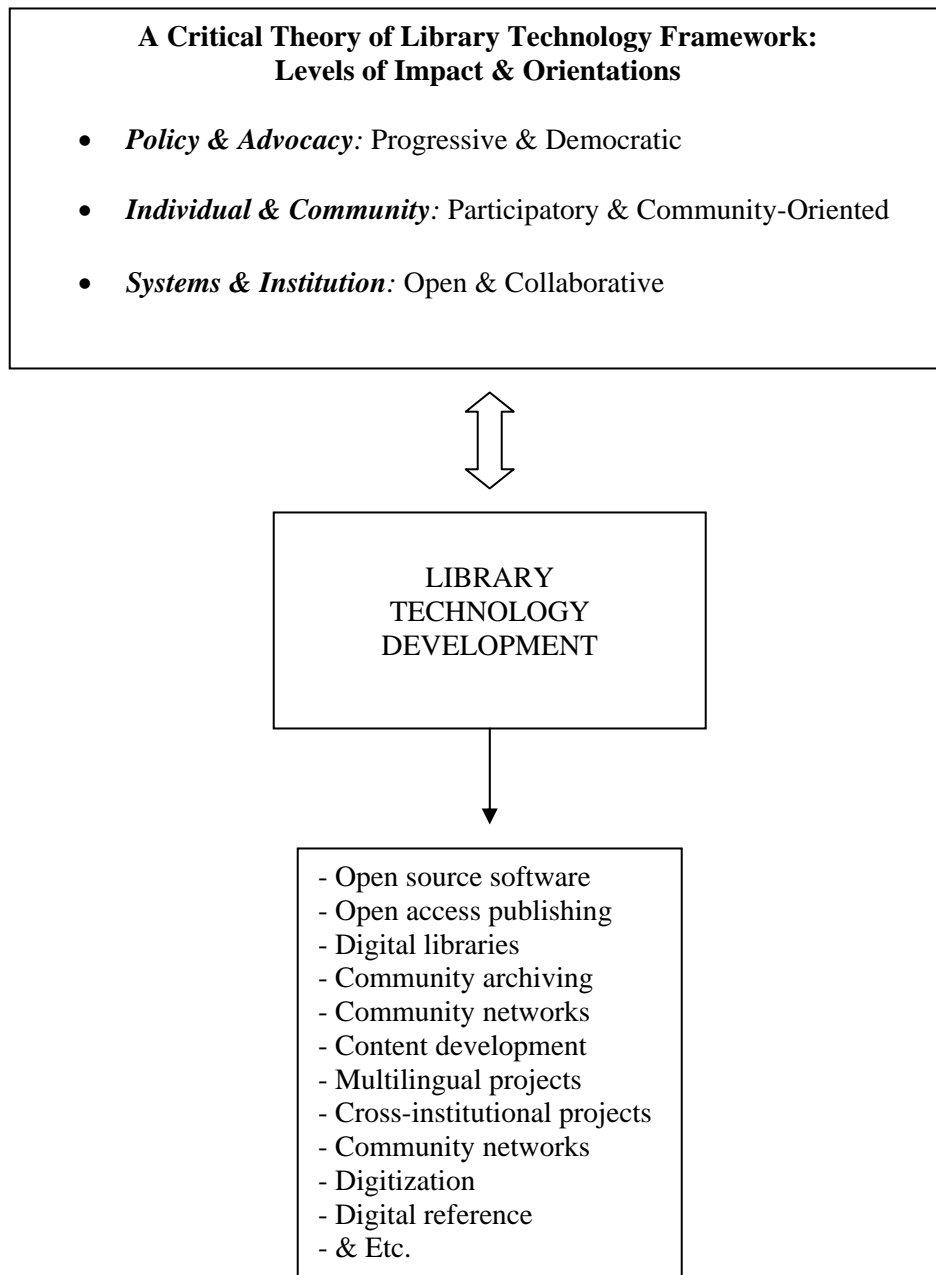
- Can we use this framework to examine or create a model to study other library practices?

Thus, besides the open source movement, the framework can be applied for other library technology projects. I have discussed at certain points in this dissertation the example of open access publishing, and the roles academic libraries are playing in promoting this movement. Libraries, in response to the scholarly publication crisis of escalating academic journal prices, are involved in efforts to find alternatives to this situation. The support of open access electronic publishing is largely a result of this reality, and this type of technological advocacy can be studied at the policy and advocacy, individual and community, and systems and institution levels of the framework to understand its dimensions of democratization.

The case of community archiving of information resources offers another example for application of the framework. In Chapter 3, I discussed the hypothetical case of a library-based information network serving an immigrant Bangladeshi community in Artesia, California. In the case of an immigrant and diasporic immigrant community such as this one, community archiving presents possibilities for extending library-based services for these communities. Diasporic communities offer a unique challenge for providing services, as their needs extend beyond territorial boundaries (Srinivasan & Pyati, in press). The critical theory of library technology framework can be used to study the library's roles and technological decision-making processes that can meet the needs of this hypothetical community.

Critical Theory of Library Technology Framework: Application

Figure 1



Any community archiving project can be analyzed at the three levels of the framework. Studying how this technology-mediated community archiving project aligns with the dimensions of the framework can highlight areas for a more democratic, inclusive, and culturally relevant intervention for this community. This fact is especially pertinent given that studies have shown that the library often does not rank high as an information source in immigrant communities (C. M. Chu, 1999; Metoyer-Duran, 1991). However, despite this reality, libraries can take a more active role in making their services more relevant to immigrant communities, from partnering with local community organizations to including archival material of immigrant communities (Caidi & Allard, 2005). The framework can help envision librarians as active facilitators of local immigrant information resources, and develop a more holistic approach to immigrant information services.

Similarly, a future research agenda using the critical theory of library technology framework will have to address the refinement of the framework in light of other studies in different social, political, economic, and cultural contexts. This framework, in the tradition of critical theory, is flexible and adaptive, and needs to be open to other critical social theories that have a bearing on library technology development. This idea becomes more evident when studying the roles of libraries in technology development and access in developing countries, for instance.

An example of how this framework can be used in developing countries is in the study of telecenters and information kiosks, and how they provide access to technology to

local communities. Telecenters and kiosks are being used in information access initiatives in the developing world, with libraries in some cases also serving as community ICT access hubs. Given this reality, however, little research has focused on comparative research between telecenters and libraries in meeting the ICT-mediated information needs of diverse communities in developing countries. This framework can be used, for example, to envision a more prominent role for libraries in extending their services in meeting the information needs of these communities vis-à-vis telecenters. While this particular research area is still evolving, I present it mainly as an example of the usefulness and applicability of a critical theory of library technology framework.

7.3 Final Thoughts

Ultimately, the significance of this particular study lies in its pioneering efforts at incorporating critical theory into studies of library technology. The critical theory of library technology framework is one of the first major attempts at critically framing technology discourses and actions within libraries. In addition, open source software in libraries has been studied with an effort to outline areas for best practices research, as well as areas and potentials for greater democratization of technology development. The in-depth test case provides a preliminary example of how this framework can be used as a mode of analysis. However, the micro-nature of the test case makes reassessing a broad-based framework such as this one a task of limited generalizability.

More in-depth case studies of open source software in libraries are needed, in order to better understand best practices, and to assess the framework as a mode of analysis. In addition, more studies will have to assess if open source can become an

effective and wide grassroots/democratic technology movement in libraries. How and/or whether this movement can provide alternative information society visions in the library community also remains to be seen. In the case study (reSearcher in particular), for example, open source software development is not strongly linked to a larger political and ideological open source movement. Thus, whether or not the library-based open source movement is sufficiently political enough for progressive transformation and change is an open question. The framework offers idealized dimensions of technological democratization based on its foundational dimensions and the dialectic of library technology – further research and critique will be needed to reassess these foundations and what democratization of library technology means in different contexts.

On a wider scale, however, this dissertation opens up a research agenda focused on re-examining library practices, values, ethics, and actions. The particular focus of this study has been on library technology, and the introduction of a critical theoretical orientation to this area. This endeavor is of increasing concern given the context of the information society and the inadequate responses of the library community to articulate a consciously progressive and transformative vision of information technology. The goal of the research has been to create an opening for more such critical approaches in the field, to facilitate reflection upon the ethics and values of the field.

Many of the stated values of the profession are found in the statements of professional organizations, such as the American Library Association (ALA). The ALA's Library Bill of Rights, for instance, discusses the importance of intellectual freedom and states that "books and other library resources should be provided for the

interest, information, and enlightenment of all people of the community the library serves” (American Library Association, 1980). This concept of service to a community is also being extended and re-envisioned through information technology. In terms of democratic values, “Libraries: The Cornerstone of Democracy,” an initiative of a previous ALA president, Nancy Kranich, is apropos. It states that:

Democracies need libraries. An informed public constitutes the very foundation of a democracy; after all, democracies are about discourse—discourse among the people. If a free society is to survive, it must ensure the preservation of its records and provide free and open access to this information to all its citizens. It must ensure that citizens have the resources to develop the information literacy skills necessary to participate in the democratic process. It must allow unfettered dialogue and guarantee freedom of expression (American Library Association, 2006).

These statements are important in defining the democratic and service values of the profession, but we need informed reflection and action in the field to move towards these ideals. This dissertation has brought a critical character to democratic discourses and actions in the profession, by extending this democratic vision to technology and technological discourses. New democratic models of engagement, which shift the discourse of power in libraries, have been discussed. What I have presented is also a call for a repositioning of libraries in relation to technology, in which informed actions can have broader implications for democratic outcomes in society. This task is especially important, as technology and discourses of technology are an important nexus of

influence and power in society. I have also shown that critical theory is inherently practical, and has important implications for the field, creating openings for transformative action.

The current ALA President, Leslie Burger, has a presidential theme entitled “Libraries Transform Communities” (Burger, n.d.). To build upon this idea of transformation and to give it a more progressive character, however, requires action and reflection. Action-reflection is ultimately a form of praxis, a way to transform the world that goes beyond mere verbalism and activism (Freire, 1970). A critical theory of library technology framework is thus a tool for praxis in the library community. In contesting the dominant information society, libraries have an important role to play in envisioning new models of democratic engagement and activism.

APPENDIX A:
Interview Protocols

Interview Protocol

Tape #

Participant #

Administrators

Introduction

Thank you for agreeing to talk with me for approximately an hour about your work for my doctoral research. Your time and effort are greatly appreciated.

In general, I want to focus on the development of the partnership to manage the OJS software, as well as the vision and goals of this project. In addition, I would like to learn about some of the successes and challenges of this project, and how you envision the future development of the OJS software and the role of your organization in this process.

To ensure confidentiality and integrity of participation, the interviews will be coded so that only I will be able to identify the interviewees, and data will be aggregated and incorporated into the narrative analysis portion of my research. When I draw upon interview data for my analysis, there will be no reference to individuals.

Most of my questions are open-ended, so please feel free to elaborate as you see fit and to ask questions at any time. Do you have any questions before we begin? If not, I will start recording.

Interview Questions

1) Please describe your organization's involvement with the OJS project.

[Allow interviewee to take time and elaborate. Prompt with follow-up questions, such as the following, to make responses more specific]

- A) What role is your organization playing in this partnership? What activities will your organization be coordinating?
- B) How does this involvement fit in with the goals of your organization? In other words, how is your organization benefiting from this partnership?
- C) What are the goals and vision of this project and partnership, both for (a) your organization; (b) the communities you serve; and (c) society at large?

2) What factors, in your opinion, motivated your organization's involvement in this project? [Prompt with following questions, if more elaboration is needed]

- A) Would these be classified as institutional, economic, political, and/or social factors? Why do you think the particular factors you mentioned were more important? Does any one type of factor stand out as more significant?

3) Please characterize the development of this partnership now in retrospect. Did any one organization have more of an influence in the process?

- A) Do you consider this to be an activity/project that could be replicated/implemented in other libraries? Why or why not? [Prompt for elements of success, barriers, challenges]
- B) What do you think are some of the important factors in this particular situation that allowed this partnership to emerge?

- 4) What do you see as the major opportunities and/or challenges of this project?
- A) Who are the major stakeholders involved in the opportunities and challenges of the project? (e.g, organizations participating, academic libraries, publishers, faculty, greater society, etc.)
 - B) Do the opportunities outweigh the challenges or vice versa? Are some opportunities and challenges yet to be realized (i.e., projected into the future)?
- 5) What is your particular interest and motivation with this project? Do you have past experience in these types of endeavors?
- 6) What priority does this project have in relation to your organization's current activities?
- 7) Do you view this project as groundbreaking or innovative?
- A) Why or why not?
 - B) How do you view this project in the context of larger movements in the fields of academic publishing, information access, and libraries today? Do you think it has the potential to be a significant project and make an important contribution to these fields? Why or why not?
 - C) How else would you characterize this project? Do any of these words - cutting-edge, trailblazing, progressive, radical, unique, experimental, practical –

apply to this project? Or perhaps there are other words and descriptions you can think of? Why?

8) How does your organization envision future participation in this project?

A) What are the long-range goals and vision of this project, both from your organizational perspective, and a partnership perspective?

B) What are the long-term opportunities and challenges you foresee in this project?

9) Now that I have concluded my questions, do you have any comments or questions?

THANK YOU very much for taking the time and effort to participate in my research. In case I have follow-up questions, I will be in touch with you shortly.

Tape #

Participant #

Software Developers

Introduction

Thank you for agreeing to talk with me for approximately an hour about your work for my doctoral research. Your time and effort are greatly appreciated.

In general, I want to focus on the development of the Software@SFU Library open source software that you manage. In particular, I would like to know more about the specifics of the development process, and how the software is being used within SFU Library and in other libraries as well.

To ensure confidentiality and integrity of participation, the interviews will be coded so that only I will be able to identify the interviewees, and data will be aggregated and incorporated into the narrative analysis portion of my research. When I draw upon interview data for my analysis, there will be no reference to individuals.

Most of my questions are open-ended, so please feel free to elaborate as you see fit and to ask questions at any time. Do you have any questions before we begin? If not, I will start recording.

Interview Questions

(** Note - Additional questions only for Mark Jordan, Systems Division Head, at Simon Fraser University Library)

**How did the Software@SFU Library program emerge?

- What were some of the motivations in its development?

- Are there specific economic, institutional, political, and/or social factors that contributed to its development?

**Is the program unique and innovative in the field of library technology? How would you characterize the Software@SFU Library program in the context of other open source projects in libraries?

**What have been some of the successes and challenges/setbacks of this project? What are some factors that have contributed to these successes and challenges?

**How would you characterize the contribution of this program to the greater library community and society at large?

1) Please describe briefly the features and uses of the open source software program you manage. [Prompt with specific questions about the particular software in question, if needed]

2) How is the open source software production process managed at SFU Library? Is the open source development process at SFU Library part of a larger open source community?

- 3) What are the opportunities and challenges you see working in this area of library technology?
- 4) What is your particular interest and motivation with this open source software project? How did you get involved with open source and library projects? Do you have past experience in these types of endeavors?
- 5) Do you know of or keep up to date with other open source projects in libraries?
- 6) Do you see this involvement in library technology initiatives as innovative and a valuable contribution to the field? Why or why not?
- 7) How can these types of open source projects be developed in other libraries?
- A) What are possible factors that can facilitate this type of initiative?
 - B) What are possible barriers to the spread of these types of initiatives?
- 8) Now that I have concluded my questions, do you have any comments or questions?

THANK YOU very much for taking the time and effort to participate in my research. In case I have follow-up questions, I will be in touch with you shortly.

Tape #

Participant#

Clients of SFU Library Software

Introduction

Thank you for agreeing to talk with me for approximately an hour about your work for my doctoral research. Your time and effort are greatly appreciated.

In general, I want to focus on how your library/institution has been utilizing open source software developed by SFU Library. I am interested in the details of how the software has been integrated into your institution, and how this software compares to other products you have used.

To ensure confidentiality and integrity of participation, the interviews will be coded so that only I will be able to identify the interviewees, and data will be aggregated and incorporated into the narrative analysis portion of my research. When I draw upon interview data for my analysis, there will be no reference to individuals.

Most of my questions are open-ended, so please feel free to elaborate as you see fit and to ask questions at any time. Do you have any questions before we begin? If not, I will start recording.

Interview Questions

1) What is your personal knowledge and experience regarding open source software?

What motivated you to use open source software for your institution?

2) How would you rate your experience using the SFU software? [Give time for interviewee to elaborate and prompt with specific questions, such as the ones that follow]

- A) Is this software meeting your institutional and users' needs?
- B) Are there any particular opportunities and challenges you see to using this software?
- C) Are there particular benefits you see to library institutions and the public you serve in utilizing open source software in particular?

3) How does this software compare to other proprietary software products you have used in the past?

A) In comparison to proprietary software, is the SFU open source software a marked improvement, a small improvement, the same, or not an improvement? [Include prompts, such as following question, to help interviewee elaborate]

B) How and in what areas can we make these comparisons [Bring up categories such as usability, end user customization, cost, technical support, system stability, etc.]?

4) In the discussion of open source software, much has been said about the ability for end users to adapt systems to local needs. Has this been the case in your institution?

A) If your institution has been able to adapt the software to local needs, what has this project entailed? Does this necessitate having a staff that includes software programmers?

B) Has technological competence been a barrier to the full utilization of these systems?

5) What suggestions would you have to improve SFU open source software to better meet your needs and the needs of the public you serve?

6) Do you see this open source project as an innovative and important movement in your field? Why or why not? Do you feel that your institution, by utilizing this software, is participating in an innovative movement in the field that can have important consequences? Why or why not?

7) Would you recommend other libraries to utilize open source software products? If so, why?

A) What are particular factors (institutional, economic, cultural, social) in your institution that have facilitated the use of open source software?

B) What factors do other libraries need to consider should they want to adopt open source software? What do you consider are the reasons/barriers/factors other libraries state for not adopting open source software?

C) Overall, would you rate the open source movement in libraries as a positive phenomenon? If so, why? [Prompt interviewee to cite some specific profession-wide benefits]

8) Now that I have concluded my questions, do you have any comments or questions?

THANK YOU very much for taking the time and effort to participate in my research. In case I have follow-up questions, I will be in touch with you shortly.

APPENDIX B:

List of Acronyms

- ALA: American Library Association
- ARL: Association of Research Libraries
- BC ELN: British Columbia Electronic Library Network
- CARL: Canadian Association of Research Libraries
- CCSP: Canadian Centre for Studies in Publishing
- COPPUL: The Council of Prairie and Pacific University Libraries
- ICTs: Information and communication technologies
- IFLA: International Federation of Library Associations and Institutions
- IR: institutional repository
- LIS: Library and information science
- OA: open access
- OAI: Open Archives Initiative
- OJS: Open Journal Systems
- OSS: open source software
- PKP: Public Knowledge Project
- SFU: Simon Fraser University
- UBC: University of British Columbia
- WSIS: World Summit on the Information Society

APPENDIX C:
Glossary of Frequently Used Terms

- British Columbia Electronic Library Network (BC ELN):

The British Columbia Electronic Library Network (BC ELN) is a partnership between the Province of British Columbia and its publicly funded post-secondary libraries. Some services BC ELN provides include the negotiation of electronic resource site licenses for member libraries and the production of union databases. BC ELN is involved in the maintenance of the reSearcher project (see the entry on reSearcher), providing technical support for member libraries.

- Canadian Centre for Studies in Publishing (CCSP):

The Canadian Centre for Studies in Publishing (CCSP) is a university/industry initiative dedicated to the development of publishing in Canada and internationally, based at Simon Fraser University's downtown Vancouver campus. This organization is currently one of the three principal partners in the management and development of the PKP software.

- The Council of Prairie and Pacific University Libraries (COPPUL):

The Council of Prairie and Pacific University Libraries (COPPUL) is a consortium of 20 university libraries located in Manitoba, Saskatchewan, Alberta and British Columbia. COPPUL is active in resource sharing, collective purchasing, document delivery, and other library-based collaborative activities. This consortium played an important role in the initial development of the reSearcher software.

- Critical Theory:

Defined in this context in the tradition of The Frankfurt School of critical theory, which has its origins at the Institute for Social Research, founded in Frankfurt, Germany in 1923. Critical theory is a form of normative social theory that is concerned with progressive social transformation and change, an interrogation of power dynamics in society, the connections between theory and politics, and a focus on the emancipation of those who are oppressed. Critical theory is distinguished from traditional, mainstream social theory through its multidisciplinary perspectives, its attempts to develop a dialectical and materialist social theory, and its goals for socio-political transformation (Kellner, 1989). In this particular study, critical theory is highly relevant to a critique of technocracy, techno-capitalism, and technological instrumentalism and determinism within libraries. Critical theory offers a multidisciplinary approach to society which combines perspectives drawn from political economy, sociology, cultural theory, philosophy, anthropology, and history, and offers an antidote to the often non-critical quantitative approaches within contemporary social science (Bronner & Kellner, 1989).

- Critical theory of technology:

Defined in this study largely in the context of Feenberg's (2002) conception of the term. Critical theory of technology discusses the essential *ambivalence* of technology (Feenberg, 2002), its ability to be shaped by social forces for progressive ends. Specifically, a critical theory of technology orientation maintains that while the Internet and ICTs have developed under capitalist hegemony, these socio-technical

constructions are sites of struggle and contestation. The relevance of Feenberg's critical theory of technology to libraries lies in the ambivalence of technology – while libraries are discussed in WSIS as merely access points to technology, for instance, libraries can also be envisioned as active *shapers* of technology for democratic and progressive ends. This form of technological activism reflects a shift in orientation that envisions libraries as active agents in shaping technology for democratic ends and contesting ideologies of commoditization, privatization, and technological determinism.

- Critical theory of library technology:

A critical theory of library technology, following in the tradition of Frankfurt School critical theory, is multi-disciplinary in its approach, and addresses the power dynamics of library technology practices. As critical theory moves from the universal to the particular in its analysis, this framework also moves from the larger context of the information society to the particulars of library practices and services. The framework builds connections between these contexts, and also provides a lens to understand the techno-capitalist pressures facing many libraries today. In addition, the framework links theory to practice, providing a space to re-shape determinist and instrumentalist discourses. The framework is a conceptual tool for understanding and reflection about democratic approaches to library technology services and practices, as well as an analytical tool for exploring library technology development.

- Democratization:

As defined by Feenberg (1999), democratization is considered “deep” when, “it includes a strategy combining the democratic rationalization of technical codes with electoral controls on technical institutions” (p.147). This form of democratization normalizes popular agency into the standard procedures of technical design. This concept, in a broader context, is also related to enhanced participatory and discourse democracy. Democratization, in the context of critical theory, is a process of reconstruction and transformative social change. This process involves moving beyond the contradictions of techno-capitalist modernity to push dominant discourses of democracy towards “deep” democratic potentialities.

- Open access (OA):

This term refers to the availability of electronic information resources with limited restrictions. OA literature is digital, online, free of charge, and free of most copyright and licensing restrictions – what makes this possible is the Internet and the consent of the author or copyright-holder (Suber, 2004). OA can be applied to the areas of electronic journal publishing, institutional repositories, and online archives, for instance.

- Open source software (OSS):

Refers to software in which the source code of the software is free. In contrast to proprietary software, the source code is available along with the software and is free to modify, use, and distribute – free, in this case, however, does not necessarily mean free of cost. The open source process is often characterized by widespread

collaboration and distributed development. Semi-official rules of protocol and licenses govern open source communities around the world. The Open Source Initiative (<http://www.opensource.org>) and the Free Software Foundation (<http://www.fsf.org>) are two leading open source community organizations.

- Progressive:

The “progressive” movement in critical theory is tied to the linkage of theory, practice, and democratic politics. In this respect, progressive approaches are closely related to issues of praxis, as critical reflection is linked to transformative action in the world. In addition, a progressive approach to politics and social change makes connections between the universal and particular, as larger social, political, and economic power dynamics are brought to bear on specific sites of democratic struggle.

- Public Knowledge Project (PKP):

Refers to a federally-funded research initiative and organization based at the University of British Columbia and Simon Fraser University, as well as the suite of software applications associated with this organization. It seeks to improve the scholarly and public quality of academic research through the development of online environments. The software suite consists of Open Journal Systems (OJS), Open Conference Systems (OCS), and an Open Archives Initiative (OAI) Harvester. All of these applications are currently maintained and supported by Simon Fraser University Library, with the support of PKP and the Canadian Centre for Studies in Publishing (CCSP).

- Simon Fraser University Library open source software products:
 - reSearcher suite: An integrated set of open source software tools for libraries to manage electronic information resources (e.g., electronic journals, journal databases).
 - CUFTS: Serials management software. It consists of a knowledgebase of over 375 full-text resources. Provides electronic resource management (ERM) services, an integrated serials database, link resolving, and MARC records for libraries. Some ERM features can include the centralization of details about electronic holdings, such as licensing terms, renewal dates, contacts, and more.
 - GODOT: A link resolving tool. Link resolving describes a process in which a link embedded in a library's citation database provides a direct link to full-text collections. GODOT works in conjunction with the CUFTS knowledgebase to provide link resolving from databases.
 - Citation Manager: A bibliographic management tool, allowing users to capture citations or references from library resources into personal, online databases. It is similar to RefWorks, a commercial bibliographic management product.

- dbWiz: A federated searching tool. It provides library users with a single interface for searching a wide range of library resources, and returns records in an integrated result listing.
 - PKP suite: A set of open source electronic journal publishing, conference website development, and metadata indexing tools.
 - Open Journal Systems (OJS): An open source journal management and publishing system.
 - Open Conference Systems (OCS): A web-publishing tool that creates a web presence for scholarly conferences.
 - Open Archives Harvester: A metadata indexing system that allows users to create a searchable index of the metadata from Open Archives Initiative (OAI)-compliant archives.

- Techno-capitalism:

A modern, dominant form of capitalism with wide-ranging reach in today's world. Technology plays a key role in this form of advanced capitalism, producing new configurations of economy, politics, society, and culture.

- Technological determinism & instrumentalism:

Technological determinism presents technology as an autonomous force in society, with a logic of its own that is largely independent of society. Thus, social institutions have to adapt to this autonomous logic of technology. Instrumentalism is a dominant conception of technology in society, as it views technologies as neutral tools, devoid of any political influence or social character.

- World Summit on the Information Society (WSIS):

A two-part United Nations-sponsored conference, which took place in December 2003 in Geneva, Switzerland and November 2005 in Tunis, Tunisia. This conference, among other issues, was focused on the role of information and communication technologies (ICTs) in the development of a global information society. More details are available at: <http://www.itu.int/wsis>.

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