Motivating and Impeding Factors Affecting Faculty Contribution to Institutional Repositories

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ABSTRACT

Institutional Repositories (IRs) are predicated on contributions by members of a university community, particularly faculty members. In fact, faculty contribution is considered one of the success factors for an IR even though several studies have found a low rate of faculty submission. In order to learn how we might be able to address this problem, the present study investigated factors that motivate or impede faculty contribution. A conceptual model of the factors was proposed based on the Socio-Technical Network Model and Social Exchange Theory. A survey was conducted based on a sample of 67 professors whose materials were deposited in the DSpace IR of a major research university. 31 out of 67 (46.3%) responded the survey. Findings indicate that faculty members who had planned to contribute to the IR in the future agreed more strongly with accessibility and publicity of open access materials and possess a greater altruistic intention to make their work publicly accessible. The faculty members who perceived an influence of a grant-awarding body on their decision to self-archive were much less likely than others to contribute to the IR. Since the survey was performed as a pilot study, a larger survey and follow-up interviews will be conducted to investigate these factors in greater detail.

Categories and Subject Descriptors

H.3.7 [**Information Storage and Retrieval**]: Digital Libraries – *collection, dissemination, user issues.*

General Terms

Documentation

Keywords

Institutional repository, faculty contribution

1. INTRODUCTION

This paper discusses the problems surrounding faculty contribution to Institutional Repositories (IRs) and proposes a theoretical model for studying the diverse factors surrounding this issue. A growing body of literature regarding IRs has emerged since 2002 when major research universities in the U.S. such as MIT and the University of California launched their own IR systems. Over the past 4 years, an increasing number of research universities have implemented or have plans to implement an IR. Lynch and Lippincott [16] found that out of 97 universities categorized as Carnegie "doctoral universities", 40% already operated IRs. Among non-implementers, 88% were found to be in the planning stage of IR implementation. This finding indicates that IRs are becoming a component of the technical infrastructure in doctoral research institutions. Whether they become a part of the intellectual infrastructure depends crucially on the extent of faculty contribution.

While the rise in IR deployment looks promising, Shearer [21] suggests that the success of IRs will be determined eventually by "their uptake and use by researchers" (p.106). She points to the critical mass of content that led to the significant usage of disciplinary e-print repositories. Translating this to IRs, she argues that the success of an IR should be determined by its use, and one of the measures for the usefulness of IRs is contribution of content. Although potential contributors include faculty, students and staff in universities, faculty members are considered the crucial contributors of scholarly content. However, several studies note that it has been difficult to get faculty members to contribute [5, 8, 19, 25].

Foster and Gibbons [8] interviewed 25 professors at the University of Rochester in order to investigate the factors affecting contribution. They suggest that the primary impetus for faculty contribution is to enable other scholars to find, use and cite the work they submitted to the repository. Foster and Gibbons also identified reasons why faculty did not submit their content, such as copyright infringement worries, and disciplinary work practices (e.g., co-authoring or versioning). Faculty members developed their own routines to create and organize documents. Finally faculty members perceived that IR contribution involved additional work, such as metadata creation for contributed objects.

Other more quantitative studies using survey methodology exist [20, 22]. These studies, however, deal with a broad range of Open

Access (OA) practices including OA journals, disciplinary e-print repositories and IRs. Yet, these existing empirical studies also fail to outline a theoretical basis to analyze benefits and barriers that faculty when confronting IRs.

My dissertation research, therefore, investigates factors that affect the faculty contribution to IRs with a theoretical framework centered on Socio-Technical Networks and Social Exchange Theory. Research questions are presented as follows:

- What are existing ways that faculty members make research/teaching materials publicly accessible on the Internet?
- Why do they want to make their research/teaching materials publicly accessible on the Internet? Why don't they do so?
- Why do faculty contributors submit their research/teaching materials to IRs?
- What makes faculty members reluctant to contribute to IRs?

2. CONCEPTUAL FRAMEWORK

2.1 Conceptualization of IRs

IRs can be conceptualized as the following three entities: (1) electronic Scholarly Communication Forums (e-SCF); (2) digital libraries; (3) knowledge management systems. Several studies explained that an IR would be a new strategy for facilitating changes in electronic scholarly communication [5, 7, 15, 21, 24], and therefore, it can be embraced into a broad family of e-SCFs termed by Kling et al. [13].

In addition, IRs are considered in the context of digital libraries, which are not just information retrieval systems or digital resources collected on behalf of user communities, but also a component embedded in information-related activities of those communities and several information institutions, such as libraries and archives [2]. In this sense, IRs can be regarded as a type of digital library constructed by a university community through contributions of scholars and other members of the community. IRs also serve a wide range of user communities with the collaboration of multiple information institutions.

A third entity by which IRs are characterized is a knowledge management system [3, 4]. Knowledge management systems are defined as "IT- based systems developed to support and enhance the organizational processes of knowledge creation, storage/retrieval, transfer and application" [1]. Branin argues that more and more faculty and students in a university utilize information technology not only to access information but also to create new intellectual output in digital form. He suggests that the approach to knowledge management is relevant to the implementation of IRs that manage a wide range of digital information created in a university. Moreover, knowledge management requires investigating knowledge workers themselves, as well as social and cultural issues regarding knowledge creation and sharing.

The first and second conceptualizations of IRs are particularly related to the socio-technical network model, which provides a framework to investigate the interactions of social and technical elements in e-SCFs [13]. The socio-technical network combines participants with different roles, rights, responsibilities, resource flows, legitimacies and taboo behaviors. In this network, social and technical elements were neither separable nor reducible to one another, but mutually constituted through the interactions between participants, technologies and artifacts. The socio-technical network model provides a general framework that helps understand the interactions between social and technical elements in IRs, although it does not mention specific variables to be examined, especially for the incentive structure. The incentive issues pertain to factors that motivate and impede the faculty contribution to IRs – on which the present study focuses. In this respect, another theory is necessary to frame those factors in a concrete manner. This socio-technical approach was also used by Van House [23] who studies digital libraries as socio-technical networks - networks of technology, information, people, and practices. Since the concept of socio-technical network was applied to both e-SCFs and digital libraries, which implied the nature of IRs, the model is appropriate to examine IRs.

IRs can also be seen as knowledge management systems. Several studies investigated factors that contributed to knowledge repositories or intranets in corporate environments based on social exchange theory [10, 11]. Social exchange theory posits that there are many social interactions outside the economic marketplace involving exchange of different resources, such as favors between neighbors [17] or information. Unlike most economic exchanges which are one-time events, social exchanges of information might take place recurrently based on the history of relations and the mutual contingency of behavior. This recurring exchange results in patterns of interactions and interdependence between people over a period of time, thus strengthening the system.

2.2 A Model of Factors on IR Contribution

Applying Social Exchange Theory to IRs, faculty members may consider costs and benefits implicitly in terms of IR contribution. Based on this assumption, the present study suggests extrinsic and intrinsic benefits relating to IR contribution. Extrinsic benefits include accessibility, publicity and trustworthiness of documents in IRs [12], professional recognition [22], institutional recognition [11], and academic reward [14]. Intrinsic benefits concern altruistic intention of and self-interest in the IR contribution [6]. Cost factors relate to copyright concerns [9] and additional time and effort required to make the IR contribution [8].

In addition to cost and benefit factors, Nahapiet and Ghoshal [18] suggested that relational social capital – trust, identification, and pro-sharing norms - influence the motivation to exchange knowledge. Kankanhalli et al. [11] used those as contextual factors affecting the contribution to knowledge repositories. In the IR context, trust and identification are considered important factors. Trust indicates belief in good intent and competence of other actors, such as a university and users. Identification indicates faculty members' concerns with collective outcomes, membership and loyalty toward universities. Instead of pro-sharing norms, the IR literature mentions pre-print culture, in which researchers distribute drafts of research articles before they have been peer reviewed to colleagues around the world, as a factor. Figure 1 presents a model that depicts the relationship between various factors and the contribution to an IR.

Furthermore, individual traits might affect IR contribution. Kling et al. [13] suggests that one of the central socio-technical features of e-SCFs is that the use of one or more existing communication

channels may either encourage or discourage the use of a newly introduced e-SCF. Centered on this argument, the present study examines the relationship between faculty members' self-archiving experience and their contribution to IRs. Self-archiving refers to depositing scholarly content in publicly accessible web sites. If faculty members already have self-archived their research/teaching materials in web spaces, such as a personal home page, research group web sites or disciplinary repositories, they are more likely to contribute to IRs. However, since they already utilize one or more Open Access venues, they might not have the impetus to contribute their content to IRs. The present study, therefore, investigates whether or how much faculty members' exposure to self-archiving practices (exclusive of IRs) affects their contribution to IRs. Other individual characteristics that might relate to IR contribution include faculty rank, journal-related editorial service, and administrative roles. These positional variations imply individuals' control over resources in their universities or disciplines. Perceptions and experiences of self-archiving might differ across people in these positions.

Based on these theories, I have developed the following conceptual framework to model incentives for faculty contribution to IRs.
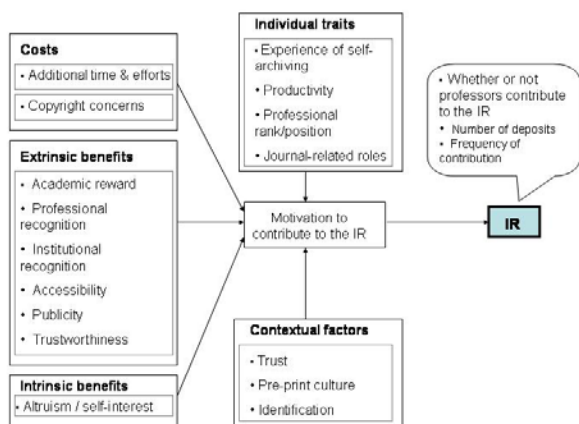

Figure 1. A model of factors that influence faculty contribution to IRs

This model considers the relationships between costs, perceived intrinsic and extrinsic benefits, individual characteristics, and contextual factors. The goal is to isolate the factors influencing faculty contribution in order to better structure incentives and social mechanisms to foster contribution. This model will be tested in a survey and follow-up interviews will be performed. My study population includes assistant, associate and full professors in 18 Carnegie research universities that have live DSpace IR web sites. The total population size is approximately 30,165. There are two sample groups: faculty contributors whose materials are deposited in the IRs and non-contributors. In this paper, however, I will present findings of a pilot survey conducted recently, and discuss tentative answers to the aforementioned research questions.

3. METHODOLOGY
The pilot survey focused on a sample of faculty members in ABC University, one of the 18 universities including members from each of the three strata of my study population. The university deployed a DSpace IR in 2004 and is currently in pilot testing phase. The sample included 67 assistant, associate and full professors whose materials are deposited in the IR.

The survey instrument consisted of four sections: (1) current IR contribution, including 1 yes/no question regarding awareness of IRs, 4 multi-choice questions, 30 Likert-scale questions and 1 open-ended question; (2) future IR contribution, containing 1 yes/no question about likelihood of future IR contribution, 8 Likert-scale questions about motivators, and 1 open-ended question; (3) self-archiving, consisting of 1 yes/no question about self-archiving experience other than IRs, 4 multiple-choice questions, 16 Likert-scale questions and 1 open-ended question; (4) demographic section including 9 questions. If surveyed faculty members indicate that they have awareness of the IR, plan to contribute to the IR in the future, and do other self-archiving practices, they are administered every section of the questionnaire. Otherwise, they will skip one or more sections depending on their awareness and experience of self-archiving. The questionnaire was developed in a web survey format.

Concerning the survey distribution, paper invitation letters were distributed first to 67 faculty members on April 5, 2006. The letter provided the URL of the web survey and an ID for each person. The invitation letter also indicated that a follow-up e-mail with a link to the survey would be sent immediately. The follow-up e-mail was sent twice after distributing the letters. As a result, 31 out of 67 (46.3%) professors responded. Out of 31 respondents, only 9 (29%) were aware of the IR. 13 out of 31 (41.9%) plan to contribute to the IR in the future. Also, 22 (71%) have made their research/teaching materials publicly accessible through venues other than the IR. The 30 Likert-scale questions for IRs, therefore, were answered by those 9 professors who were aware of the IR. However, the 16 Likert-scale questions for self-archiving practices were answered by all 31 respondents.

4. PRELIMINARY FINDINGS
4.1 Surveyed vs. Response Sample
The surveyed sample included 67 professors in ABC University, while 31 out of the 67 responded. Table 1 presents the frequencies and percentages of both survey and response samples. It indicates that the response sample is proportional to the survey sample by disciplines, professional rank, and gender.

Table 1. Survey vs. response sample by discipline, professional rank and gender

Discipline	Survey sample		Response sample	
	Frequenc	Percent	Frequenc	Percent
Science	4	6.0	3	9.7
Engineering	56	83.6	24	77.4
Social Science	5	7.5	3	9.7
Medicine	2	3.0	1	3.2
Total	67	100.0	31	100.0
Professional Rank	**Survey sample**		**Response sample**	
	Frequenc	Percent	Frequenc	Percent
Assistant	2	3.0	1	3.2
Associate	6	9.0	4	12.9
Full	43	64.2	20	64.5

| Distinguished | 16 | 23.9 | 6 | 19.4 |
| *Total* | 67 | 100.0 | 31 | 100.0 |

Gender	Survey sample		Response sample	
	Frequenc	Percent	Frequenc	Percent
Male	64	95.5	30	96.8
Female	3	4.5	1	3.2
Total	67	100.0	31	100.0

4.2 IR Awareness and Contribution

Out of 31 respondents, only 9 professors were aware of the IR. This result indicates that although all of the respondents have materials in the IR, only a small number have awareness of the repository. This low awareness results from the current strategy used by libraries to populate IRs. Most IRs in the U.S. are composed of materials collected and deposited by librarians on behalf of faculty members. The deposited items are generally pre-existing research papers in labs or departments, such as working paper series. Therefore, faculty members may not realize that their materials are placed in IRs. The other reason is that the IR of ABC University is still in a pilot testing phase and therefore, it has not been widely publicized yet.

Those 9 respondents learned about the IR in various ways. Four respondents came to know of the IR through publicity in a university/library web site, whereas each of the remaining five learned about it differently: contact from an IR staff member, presentation by an IR staff member at a faculty meeting, publicity through campus newspapers, results of a web search engine, and participation in an initial meeting of the IR.

Concerning the frequency of contribution to the IR, one respondent reported the frequency of contribution to the web site of his department saying, "I have been contributing through my department's web site even before the name 'IR' was coined." He had contributed to that web site more than five times, although not to the IR. Other than this case, no respondents had contributed to the IR. This finding, again, suggests that there is a discrepancy between faculty whose materials are deposited in IRs and faculty who consider themselves as contributors. In addition, no respondents had searched the IR.

In spite of the low awareness of the IR, 13 (41.9%) out of 31 respondents planned to contribute to the IR in the future. Interestingly, 7 out of the 13 who were motivated to contribute to the IR had no awareness of the IR, but wanted to make IR contributions in the future. However, 3 respondents aware of the IR were uncertain about contributing to it in the future. Thus, those 13 respondents who had intention to contribute to the IR consisted of 6 who had awareness of the IR and 7 who did not. The rest was composed of 5 (16.1%) respondents who had no plan to contribute in the future and 13 who were unsure about future IR contribution.

4.3 Self-archiving Experience

The present study is also concerned with respondents' self-archiving experience other than the IR. Twenty-two (71%) respondents had deposited their research/teaching materials on publicly accessible web sites other than the IR. Out of the 22 respondents, 6 were aware of the IR and 9 planned to contribute to it. Therefore, most respondents having IR awareness, and a majority of those who planned to contribute, already had some

experience with self-archiving. In addition, 3 respondents had awareness of the IR, planned to contribute in the future, and had self-archiving experience in venues other than the IR. Yet, five respondents who were not aware of the IR, had no plans or were uncertain about contributing to the IR in the future also had no experience with self-archiving. Figure 2 represents the number of respondents that fall into three groups based on their awareness of the IR, IR contribution in the future, and self-archiving experiences. It also shows the number of respondents in overlapping areas among these three groups.
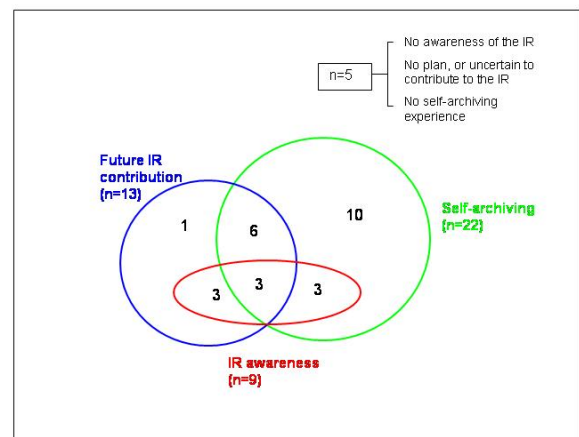

Figure 2. Categorization of 31 respondents based on their awareness of the IR, likelihood of future IR contribution, and self-archiving experience

In the introduction, the present study proposes four research questions and two of them relate to the self-archiving experience of university professors. In the following sections, therefore, I will focus on provisional answers to those two questions based on the pilot survey data.

4.3.1 Research Question 1: What are existing ways that faculty members make research/teaching materials publicly accessible on the Internet?

Out of the 22 respondents who had self-archiving experience, 9 (40.9%) had self-archived their work for more than 5 years and an additional 4 (18%) had done so for 4-5 years. Therefore, a majority had deposited their work in publicly accessible web sites for at least 4 years.

The survey also collected data regarding what kinds of publicly accessible web sites the respondents used for self-archiving and what version of research articles they deposited there as well. Figure 3 presents the frequency of deposit of refereed, published articles in the past 3 years in the following three types of web spaces: personal web pages, disciplinary repositories, and research group/lab/center web sites. Personal web pages were used most frequently by respondents (14), followed by research group/lab/center web sites (11), and disciplinary repositories (6). Interestingly, 4 respondents had never deposited their published articles in any of those web spaces. This result indicates that there may be other types of web sites that respondents employ for self-archiving, or they may not deposit published articles, but only other types of research work.
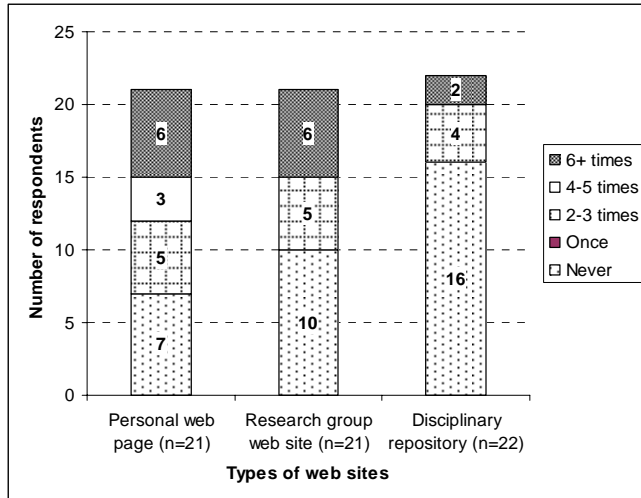
Figure 3. Types of web sites and frequency of self-archiving refereed, published articles

In addition, Figure 4 presents the frequency of deposit of pre-refereed articles in those three types of web spaces. Similar to the self-archiving published articles, personal web pages were the most frequently used (10 respondents), followed by research group web sites (8), and disciplinary repositories (6). However, respondents were less likely to self-archive pre-refereed articles than they were to self-archive refereed, published articles.
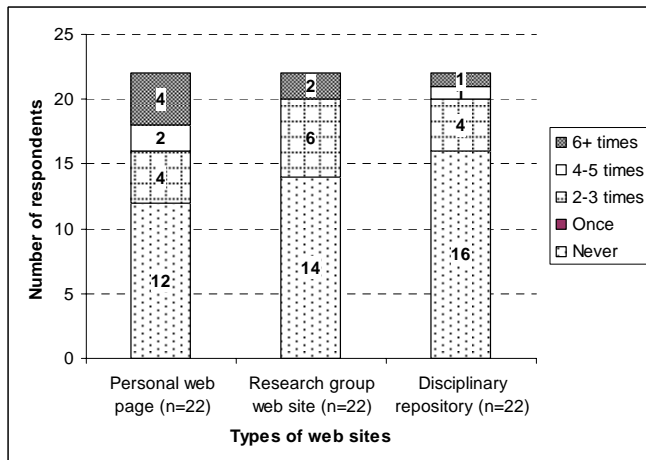

Figure 4. Types of web sites and frequency of self-archiving pre-refereed articles

This finding is also supported by another result regarding percentages of various research materials that respondents had self-archived in the past 5 years. These research materials included pre-refereed articles, refereed and published articles, unrefereed articles (technical reports or working papers), book chapters and data sets. Figure 5 shows that published articles and unrefereed papers had been self-archived by the most respondents (15). 9 respondents had self-archived more than 50% of their published articles, whereas 5 respondents had self-archived more than 50% of their unrefereed papers. In addition, only 10 respondents had deposited pre-refereed articles on publicly accessible web sites, and 4 of those had self-archived more than

50% of their pre-refereed articles. Also, only two respondents had self-archived data sets, and one of them had made 51-75% of his data sets publicly accessible on the Internet.
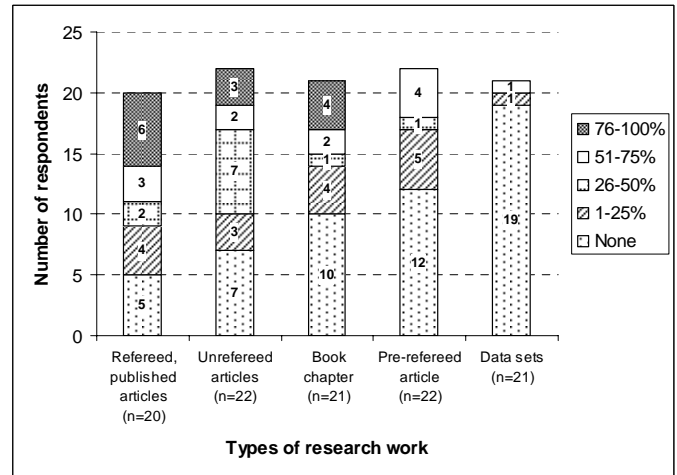

Figure 5. Percentages of self-archived research materials

Respondents also made other types of research/teaching materials publicly accessible. As can be seen in Figure 6, 15 (71.4%) and 14 (66.7%) had self-archived lecture notes and course syllabi, respectively. Conference presentations were found to be the 3rd most frequently self-archived materials. Yet, two respondents had self-archived none of the material types listed in the survey.
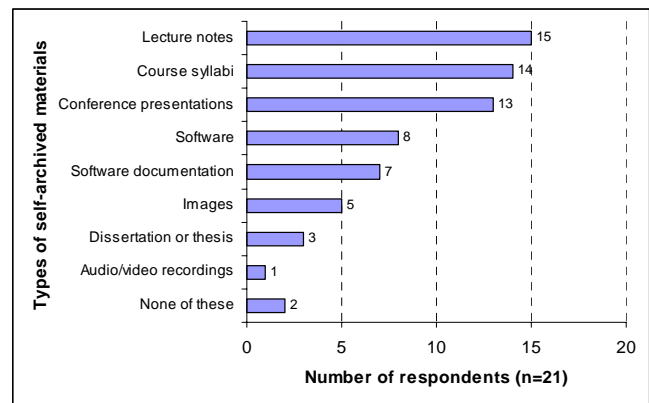

Figure 6. Types of self-archived research/teaching materials

In sum, the 22 respondents who had self-archiving experience used personal web pages more frequently than research group/lab/center web sites or disciplinary repositories. However, it is possible that some respondents might use other types of web sites that the survey did not cover for self-archiving. Refereed, published articles were self-archived by more respondents than pre-refereed articles. Respondents also tended to self-archive a greater percentage of refereed articles than other types. In addition to research articles, the majority of the respondents had self-archived lecture notes, course syllabi, and conference presentations.

4.3.2 Research Question 2: Why do they want to make their research/teaching materials publicly accessible on the Internet? Why don't they do so?

All 31 respondents responded to 16 Likert-scale items regarding benefit, cost, and contextual factors that influence their decision about whether to self-archive. These items were presented as statements offering a scale of options across five choices: strongly agree, somewhat agree, neutral, somewhat disagree, and strongly disagree. Just in case respondents did not sufficiently know what the items meant, the choice of "I don't know" was provided as well.

In order to answer this research question, I compared the 16 items' rating values between two groups: (1) The 22 respondents experienced in self-archiving; (2) The 9 respondents with no experience in self-archiving. For this comparison, a permutation test was used. Since the size of survey data was small, normality of data was not assumed. The permutation test is one of the non-parametric methods that can render reliable results even for a small set of data. The null hypothesis for this test is that there is no difference in the distribution of item ratings between the two groups and therefore, they have been drawn from the same population.

Out of the 16 items, 7 items were considered benefit factors regarding the increase in (1) accessibility and (2) publicity of their research work, (3) professional recognition, (4) positive impact of self-archiving on tenure and promotion, and (5) altruistic intention. Two items concerned publicity, whereas two other items related to academic reward. As a result of the permutation test, there was no statistically significant difference in those items' rating values between the two groups. However, the comparison of mean values between the two groups indicated that the group of respondents having self-archiving experience agreed with the benefit factors more strongly than did the group with no self-archiving experience. In addition, two open-ended responses indicated that posting research papers on the web would save time compared to sending hardcopies or e-mailing files to those who requested the papers.

Four items were considered cost factors including (1) concerns about preservation of self-archived materials; (2) publishers' policy that prohibited self-archiving; and (3) additional time and effort required to perform self-archiving. Two items were regarded as preservation issues. Similar to the results of benefit factors, the permutation test did not show a statistically significant difference in item ratings of cost factors between the two groups. The groups also showed similar mean values of those items, while there was some difference in mean value of the item regarding publishers' policy. Considering the choice of 'strongly agree' as 5 and 'strongly disagree' as 1, the group having self-archiving experience rated the item 2.97 on average, whereas the other group provided the mean value of 3.67. Therefore, the group with no self-archiving experience might perceive publishers not to allow self-archiving more strongly than the group with self-archiving experience.

Five items were regarded as contextual factors, including 1) pre-print culture; 2) trust of readers; 3) influence of other actors – co-authors; 4) grant-awarding body; and 5) university or department actions - upon respondents' decisions to make, or not to make their materials publicly accessible. The permutation test showed that there was a statistically significant difference in pre-print culture between the two groups. Table 2 presents the item regarding pre-print culture and its p-value.

Table 2. P-value of the item regarding pre-print culture from the permutation test

	p-value
In my field, it is common for researchers to post their work on publicly accessible web sites.	0.0318

Although there was no statistically significant difference in perception of trust in readers, two respondents expressed concerns about plagiarism of their research and teaching materials on the Internet. One of them mentioned that some researchers at other universities had taken the entire course outline that the respondent sent to them at their request, and simply replaced the headers with their information. He stated, "I do not believe we should let the bad acting of a few impair the access of the many." Another respondent mentioned, "Plagiarism is so common and widespread, that I would volunteer to put only dated (published) material or obvious material on the web."

Overall, respondents that had self-archived their materials tended to agree with benefit factors more strongly than those who had no self-archiving experience, although there was no statistically significant difference between the two groups. There was also no significant difference in cost factors, although the group with no self-archiving experience was more likely to perceive publishers as prohibiting self-archiving. The existence of pre-print culture was the only factor showing a statistically significant difference between the two groups. The group with no self-archiving experience might not have pre-print culture in their disciplines. This finding suggested that the existence of pre-print culture might be positively related to the decision to self-archive. Concerns about plagiarism might impede self-archiving as well.

4.4 Factors Affecting IR Contribution

The survey data showed that no respondents considered themselves to be contributors to the IR, and therefore, it was not possible to compare perceptions between IR contributors and non-contributors. Regarding future contribution to the IR, however, respondents were categorized into two groups: (1) 13 professors who planned to contribute to the IR in the future and (2) 18 professors who had no plan or were uncertain of their future contribution to the IR. It would be interesting to see the differences in perceptions of self-archiving between these two groups in order to conjecture about factors affecting IR contribution.

4.4.1 Research Question 3: Why do faculty contributors submit their research/teaching materials to IRs?

While the survey data did not directly answer this research question, some data provided helped me to infer factors that would encourage professors to contribute to the IR. The 13 respondents motivated to contribute to the IR in the future rated the importance of reasons for the IR contribution using a 5-point scale. Table 3 presents those reasons based on ratings of respondents.

The most important reason was found to be preservation of respondents' materials, followed by the IR capability to show the frequency of viewing and downloading their materials. Institutional recognition was the 3rd most important reason, although its rating was not as high as the first and the second reasons. Retaining copyright did not provide an incentive for future contribution. Respondents also did not connect functions provided by existing publishing systems with the IR. Thus, the peer review process and academic reward were considered least important motivators.

Table 3. Reasons for future IR contribution

	Mean	S.D.
The IR would preserve my materials.	4.31	1.18
If the IR shows how many times my materials in the IR were viewed and downloaded	3.85	1.07
I would receive recognition from my university.	3.08	1.55
Publishers would not have exclusive rights over my work.	2.77	1.54
If there were a peer review process in the IR	2.31	1.44
I would receive financial reward.	2.00	1.29
My contribution would count toward my tenure and promotion	1.54	0.78

5=very important; 1=very unimportant
N=13

In addition, two respondents suggested that the IR would help researchers and students in the same field to communicate. Furthermore, one respondent mentioned that the IR might help to facilitate the coordination of interdisciplinary teaching and research efforts.

In order to examine motivating factors, ratings of the 7 items representing benefit factors were compared between the group that had intention to contribute to the IR and the group that had either no intention or uncertainty about future IR contribution. Table 4 lists 4 items having statistically significant differences in ratings with their p-values from the permutation test.

Table 4. P-values (one-sided) of benefit factors from the permutation test

	p-value
Posting my research work on publicly accessible web sites will increase the chance to communicate my research findings to peers.	0.0459
Posting my research work on publicly accessible web sites will increase the potential impact of my work.	0.0018
Posting my materials on publicly accessible web sites will enlarge the readership of the materials.	0.0257
Posting my materials on publicly accessible web sites allows other scholars to access those that they could not otherwise use.	0.0202

The null hypotheses involved no differences of item ratings between the two groups. Alternative hypotheses, however, were that the group motivated to contribute would have higher ratings on benefit factors than the other group. In order to test these hypotheses, permutation tests were utilized to generate one-sided p-values.

The first item represented increase in accessibility, and the second and third referred to publicity. The fourth one indicated an altruistic intention to contribute to the IR. This result suggested that professors who planned to contribute to the IR might acknowledge these benefit factors more than professors who either had no intention or were unsure of making an IR contribution in the future.

In sum, professors might be motivated to contribute to the IR by the prospect of an increase in the accessibility of their materials – both long-term preservation and an enhanced opportunity to make them accessible to peers. In addition, publicity factors – wider readership, increase in potential impact of their work, and knowing the usage statistics, would be positively related with IR contribution. Furthermore, respondents' altruistic intention to make their materials publicly accessible was likely to be a motivator to contribute to the IR.

4.4.2 Research Question 4: What makes faculty members reluctant to contribute to IRs?

In order to investigate this research question, ratings of 4 items regarding cost factors related to self-archiving were compared between the group motivated to contribute to the IR and the other respondent group. The permutation test showed that there were no statistically significant differences in those items between the two groups. Yet, regarding the item about the lack of secure maintenance of self-archived materials, the group that planned to contribute rated it 2.90 on average, while the group with either no plan or uncertainty about future contribution to the IR rated it 3.71. The median rating of the former group was 3, whereas that of the latter group was 4. This result suggests that the latter group might be more concerned about secure maintenance of open access materials than the former group. In order to attract the latter group, IRs might have to emphasize their function of long-term preservation and explain how it would be accomplished.

A permutation test was also conducted in order to compare ratings of 5 items regarding contextual factors between the two groups. One item about the influence of a grant-awarding body on respondents' decision showed a statistically significant difference based on a one-tail test (Table 5).

This result indicated that professors who were motivated to contribute to the IR in the future perceived less influence of grant funders on their decision about whether or not to self-archive their work. Since the former group acknowledged benefit factors more than the latter group, it was suggested that grant funders' influence might be mitigated by respondents' already strong belief in positive outcomes from self-archiving.

Table 5. P-value (one-sided) of the item about grant funders' influence on self-archiving decision

	p-value
My decision to make, (or not to make) my materials publicly accessible on the Internet was influenced by my grant-awarding body.	0.0176

5. DISCUSSION

Faculty members who planned to contribute to the IR in the future agreed with some of the benefit factors resulting from self-archiving more strongly than professors who had no intention or uncertainty to make an IR contribution. Those benefit factors included an increase in (1) the chance to communicate research findings to peers, (2) potential impact of research work, (3) larger readership, and (4) an altruistic intention to make research work accessible to other researchers. In addition, those faculty members motivated to contribute to the IR rated long-term preservation of their work as the most important reason for any future contribution to the IR. The next most important motivating factor would be the IR's capability to provide data on the number of viewing sessions and downloads of their work deposited in the IR. Currently, few DSpace IRs provide such functions, although displaying the usage statistics would apparently encourage faculty contribution. Overall, faculty motivated to contribute to the IR appreciated the positive outcomes of self-archiving, especially growing accessibility and publicity of their research work, and displayed altruistic intentions.

Of the cost factors suggested in the model (Figure 1) – copyright concerns and additional time and effort – there were no significant differences between the two groups. In particular, for the item about publishers' policies of self-archiving, 5 respondents who planned to contribute to the IR, provided "I don't know" answers, whereas 6 who did not plan or were uncertain to contribute, provided "I don't know" responses. This result indicated that respondents in general, had a lack of knowledge about copyright issues related to self-archiving. One respondent stated, "I have to sign copyright forms from most journals before they will publish research work. I don't know how this affects depositing [the] same in the IR."

In regard to contextual factors – trust, pre-print culture, and identification – items regarding only trust and pre-print were examined, since the 16 items of self-archiving did not include items relating to identification. Pre-print culture seemed to exist in the fields of the respondents who had self-archiving experience. However, there was no significant difference between the group that planned to make IR contributions and the other group in spite of the difference in the pre-print cultures of the two groups. Among the contextual factors, a grant-awarding body's influence on self-archiving decision showed a significant difference; however, faculty who planned to contribute to the IR perceived less influence by grant funders on their self-archiving decisions than those without previous self-archiving experience. This indicates that the impact of other external actors might influence the decision-making process of potential IR contributors.

6. CONCLUSION

The present study examined various factors that might influence faculty contribution to IRs, based on a small set of survey data. The permutation test showed that benefit factors were more influential than cost or contextual factors, although this result was not conclusive yet. Follow-up interviews will be performed to complement these survey data, and to improve the survey instrument. Subsequent to these activities, the actual survey and interview data will be collected from a larger sample of university professors. The data will provide results with generalizability, and more insight into faculty motivation and barriers to IR contribution.

7. ACKNOWLEDGMENTS

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