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Self-archiving Motivations across Academic Disciplines on an Academic Social Networking Service

학술 소셜 네트워킹 서비스에서의 학문 분야별 연구자의 셀프 아카이빙 동기 분석

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ABSTRACT : The purpose of this study is to compare motivations for self-archiving across disciplines on an academic social networking site. We carried out an online survey with ResearchGate(RG) users, testing 18 motivational factors that we developed from a previous study (enjoyment, personal/professional gain, reputation, learning, self-efficacy, altruism, reciprocity, trust, community interest, social engagement, publicity, accessibility, self-archiving culture, influence of external actors, credibility, system stability, copyright concerns, additional time, and effort). We adapted Biglan's classification system of academic disciplines and compared motivations across different categories of discipline. First, we compared motivations across the four combined categories by the two dimensions - hard-pure, hard-applied, soft-pure, and soft-applied. We also performed a motivation comparison across each dimension between soft and hard disciplines and between pure and applied disciplines. We examined investigated statistical differences in motivations by demographic characteristics and RG usage of participants across categories as well. Findings showed that there were differences of motivations, such as enjoyment, accessibility, influence of external actors and additional time and effort, and personal/professional gains, for self-archiving across disciplines. For example, RG users in the hard-applied were more highly motivated by enjoyment than others; RG users in the soft-pure were more highly motivated by personal/professional gains than others. It is expected that findings could be used to develop strategies encouraging researchers in various disciplines contributing to share their data and publications in ASNSs.

KEYWORDS : Self-archiving, Academic Social Networking Site, Motivation, Academic Discipline

요 약 : 본 연구에서는 학술 소셜 네트워킹 서비스에서의 연구자 셀프 아카이빙 동기를 학문 분야별로 비교하였다. 대표적인 학술 소셜 네트워킹 서비스인 ResearchGate 이용자를 대상으로 선행연구에서는 온라인 설문조사 결과를 실시하여 연구자의 18가지 셀프 아카이빙 동기 요인(흥미, 개인적/직업적 이익, 평판, 학습, 자기효능감, 이타심, 호혜성, 신용, 공동체 이익, 사회참여, 홍보, 접근성, 문화, 외부적 요인, 신뢰, 시스템 안정성, 저작권 문제, 부가적인 시간 및 노력)을 도출하였다. 후속 연구인 본 연구에서는 Biglan의 학문 분류 기준을 적용하여 연구자의 학문 분야를 구분하고, 이들 분야별 셀프 아카이빙 동기를 비교하였다. 먼저 연구자들의 학문 분야를 경성-순수, 경성-응용, 연성-순수, 연성-응용으로 구분하여 동기를 분석하였으며, 그 다음 단계에서는 경성-연성과 순수-응용으로 구분하여 비교하였다. 나아가 연구자의 인구통계학적 특성과 ResearchGate 이용 현황에 따른 동기의 차이도 살펴보았다. 연구 결과, 학문 분야에 따라 흥미, 접근성, 외부적 요인, 부가적인 시간 및 노력에 대한 동기에 차이가 있는 것으로 밝혀졌다. 예를 들어 경성-순수 분야의 이용자들은 다른 분야의 이용자들에 비해 흥미에 대한 높은 동기를 가지고 있었으며, 연성-순수 분야의 이용자들은 다른 분야 이용자들과 비교하여 개인적/직업적 이익에 대해 높은 동기를 가지고 있었다. 이러한 다양한 학문분야의 연구자들의 동기에 대해 살펴본 연구 결과는 학술 소셜 네트워킹 서비스에서의 연구 데이터와 결과물 공유 활성화를 위한 전략 개발에 도움이 될 것으로 기대한다.

주제어 : 셀프 아카이빙, 학술 소셜 네트워킹 서비스, 동기, 학문 분야

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Ⅰ. Introduction

Self-archiving is referred to as an act of uploading copies of an electronic document in open access repositories (Swan and Brown 2005). Researchers can self-archive their copies of publications in institutional or disciplinary repositories. Academic social networking sites (ASNSs) have emerged as another venue for self-archiving, a key source for accessing research publications in that journal articles are available at ASNSs more than institutional repositories (Borrego 2017). The role of ASNSs has been enhanced not only for allowing researchers to be connected and socially engaged but also readily available for archiving and disseminating data and publications and making them easily sharable online. This could be one of the important motivations of researchers for actively self-archiving in ASNS. Little has been known, however, about their motivations.

Recently, Lee et al. (2019) proposed a model of motivations for self-archiving in ASNSs, which is composed of 18 motivational factors (enjoyment, personal/professional gain, reputation, learning, self-efficacy, altruism, reciprocity, trust, community interest, social engagement, publicity, accessibility, self-archiving culture, influence of external actors, credibility, system stability, copyright concerns, and additional time and effort). They tested the motivational framework with researchers who have done self-archiving by posting their research data or publications in ResearchGate (RG). Findings showed that self-archiving motivations could fluctuate in combination with factors in the personal, social, professional, and external contexts.

Considering various disciplines exist in academia, we believe motivations for self-archiving in ASNSs could also vary depending on the disciplines on which researchers are working. We adapted Biglan's (1973a) classification system of disciplines, especially a two-dimensional system (soft/hard, and pure/applied) when identifying disciplines in ASNSs. We compared the motivations of RG users for self-archiving across disciplines in Biglan's system. Two research questions were proposed and tested as follows.

RQ 1. How are motivations for self-archiving different across disciplines?

RQ 2. How are motivations for self-archiving different by demographic characteristics and usage patterns across disciplines?

Ⅱ. Related Studies

Discipline is one of the most important contextual factors that affect information behaviors in academia. In ASNSs, discipline is key information to be provided by users that defines the community structure of ASNSs (Jordan 2014). On RG, users in arts and humanities are underrepresented, while biologists are overrepresented (Ortega 2015; Thelwall and Kousha 2014). On Academia.com, most users are in humanities (law, history, philosophy, psychology, etc.) (Ortega 2015; Thelwall and Kousha 2014), while on Google Scholar, computer and information scientists are mostly represented (Ortega and Aguillo 2012).

The disciplinary difference has been observed from users' information behaviors on ASNSs. Jordan (2014) mentioned there could be a disciplinary difference of users' following behaviors in ASNSs, which may lead to building various levels of discretion or dispersion across a disciplinary network on ASNSs. Almousa (2011) analyzed the data crawled from Academia.edu and found no evident difference among disciplines, in most user activities, except users' following and question answering behaviors. Chemistry researchers followed papers, questions, and updates more actively in the ASNS. Researchers in anthropology and philosophy were more active in question answering activities than researchers in computer science and chemistry. Orgeta (2015) discovered that humanities and social scientists are the most engaged group in social connection and profile viewing in Academia.com. Other studies have found that there are differences across disciplines of tagging (Ortega and Aguillo 2012) and question answering behaviors in ASNSs (Jeng et al. 2017).

There has been a disciplinary difference in users' online knowledge sharing behaviors in ASNSs. Jeng et al. (2017) found that RG users in history of art asked more resource-oriented questions. RG users in library and information science are likely to provide practical answers to questions, whereas RG users in astrophysics respond mostly with theories, concepts, and facts. It is also found that researchers in linguistics and sociology frequently update their information, compared to those in physics (Megwalu 2015).

Findings from previous studies show that there are disciplinary differences in user behaviors in ASNSs. Little is known, however, about their motivations for such behaviors in ASNSs and how they are different across disciplines. There is a study of motivation between linguistics and sociologists in ASNSs; users in linguistics are motivated to disseminate their research in a highly diverse research environment. Sociologists are inspired to reach out to individuals to establish

the importance of their work in ASNSs (Megwalu 2015). This study attempted to investigate motivations but limited disciplines to linguistics and sociology only.

Ⅲ. Motivation and Disciplinary Frameworks

1. Motivation Framework

We applied the motivation framework for self-archiving by Lee et al. (2019). The 18 motivations in the framework were originally developed from a comprehensive literature review about self-archiving motivations in academia and motivation for sharing information social media (i.e., Kim 2010; Oh and Syn 2015). We introduced this motivational framework for self-archiving on ASNS and reported findings of motivations without considering the disciplinary differences of the RG users (Lee et al. 2019). In this article, we mainly report the findings about motivations across the disciplines from a follow-up study. The definitions of the 18 motivations for self-archiving in the original framework are shown below (Lee et al. 2019, 567).

- Enjoyment: Users self-archive their research on ResearchGate (RG) for pleasure.
- Personal or professional gain: Users self-archive their research on RG to advance their personal/professional interests, such as promoting work or gaining academic tenure/promotion.
- Reputation: Users self-archive their research on RG to increase their personal, social, and professional recognition in their communities.
- Learning: Users self-archive their research on RG because they want to gain new information and enhance their current stage of knowledge and skills in research.
- Self-efficacy: Users self-archive their research on RG because they have confidence in the quality of their work and feel it merits being shared with others.
- Altruism: Users self-archive their research on RG because it helps others and is the right thing to do.
- Reciprocity: Users self-archive their research on RG because they believe everyone benefits through the open exchange
- Trust: Users self-archive their research on RG because they believe in other users' good intentions.

- Community interest: Users self-archive their research on RG to support the goals and values of their communities.
- Social engagement: Users self-archive their research on RG as a way to connect to and communicate with other users. They perceive self-archiving as a way to feel a sense of belonging in their communities.
- Publicity: Users self-archive their research on RG because they want to see increases in the usage and citation counts of their research.
- Accessibility: Users self-archive their research on RG because they believe it will make their work more widely and more easily available.
- Self-archiving culture: Users self-archive their research on RG because it is common and expected practice in their communities.
- Influence of external actors: Users self-archive their research on RG because they are influenced to do so by others including coauthors, funding agencies, and academic institutions.
- Credibility: Users self-archive their research on RG because they believe that the overall quality of materials stored there is high.
- System stability: Users self-archive their research on RG because they trust the security and stability of RG.
- Copyright concerns: Users do not self-archive their research on RG because they believe doing so would violate the copyrights of the work.
- Additional time and effort: Users do not self-archive their research on RG because of the time and effort required.

2. Disciplinary Framework

We used Biglan's (1973a) classification system of disciplines for the sample selection of disciplines. Biglan's (1973a) system has been known as one of the most reliable systems for classifying disciplinary areas in academia (Stoecker 1993). Previous studies tested the system, comparing differences across disciplines by academic norms, structure, and activities (Smart and Elton 1982; Stoecker 1993). Originally, Biglan's system classified academic disciplines by the subjects and cognitive styles of disciplines in three dimensions (hard-soft, pure-applied, life-nonlife). A two-dimensional system (hard-soft, pure-applied), however, is most widely used in the fields of research (Laird et al. 2008).

The two-dimensional system is composed of the hard-soft and pure-applied dimensions. The *hard/soft* dimension specifies the methodological approach to collect and analyze data in research. The hard discipline mainly refers to producing data obtained from experiments and performing predictions based on the analysis of quantifiable data. In contrast, the soft discipline deals with the interpretation and applications of finding with data collected from qualitative methods. The *pure/applied* dimension is related to academic concerns with theoretical development and application to practical problems. The pure discipline focuses on building theories to develop the foundation of research, while the applied discipline mainly discusses using findings to solve problems or make decisions in practicum.

We used Biglan's classification system when analyzing the topic categories of disciplines in ASNSs. We found that the two-dimensional system is appropriate for describing the distribution of disciplines in ASNSs. The two-dimensional system classifies disciplines into four categories, for example, astronomy, botany, chemistry, mathematics, and physics in the hard-pure group; computer science, mechanical engineering, electrical engineering, and nuclear engineering in the hard-applied group; psychology, sociology, history, and philosophy in the soft-pure group; economics, finance, communication, and special education in "the soft-applied group." Table 1 shows the disciplines we selected to classify and applied in the current studies. The list of disciplines in *hard/soft* and *pure/applied* dimensions are suggested by Laird et al. (2008).

〈Table 1〉 Selected disciplines across the four categories

Type	Hard	Soft
Pure	Mathematics, Chemistry	Psychology, Sociology
Applied	Electrical Engineering, Mechanical Engineering	Economics, Communication, Education

Ⅳ. Methods

We used a survey method to collect data from RG users. On RG, we selected the top eight universities in the ranking of RG scores, which refers to the level of active participation. We send a link of an online survey questionnaire to RG users affiliated with the top eight universities who self-archived their research items at least once in RG across various disciplines. We recruited RG users from the departments from the top eight universities (University of Michigan, University

of Washington-Seattle, Stanford University, University of California-Los Angeles, University of California-San Diego, University of Pennsylvania, University of Wisconsin-Madison, University of Florida) based on their RG score shown in Table 1 until we reach the number of 50 for the statistical analysis across the disciplines. A total of 2,655 invitations to the online survey was sent RG users via their email accounts; 226 RG users completed the online survey.

In the survey questionnaire, we first asked to complete informed consent first. We asked participants to specify their demographic information and their use of RG (i.e., how long they have been a member of RG, how frequently they use RG). We then asked them to note the level of agreements to the statements about motivations with a Likert scale, rating from one to five (one - strongly disagree, five - strongly agree). Three or four statements were provided to test each factor of motivation. Most of the Cronbach's alpha coefficient for 18 categories were rated acceptable, close to .70 or higher (Nunnally 1978).

For the data analysis, we used two approaches to observe motivations across disciplines. First, we compared motivations across the four combined categories by the two dimensions - hard-pure (N=51), hard-applied (N=53), soft-pure (N=63), and soft-applied (N=59). Second, we performed motivation comparison across four individual categories; we compared motivations ibetween the soft (N=122) and hard (N=104) disciplines. We then compared motivations between the pure (N=114) and applied (N=112) disciplines. Specifically, we employed nonparametric tests (Kruskal-Wallis H, Mann-Whitney U, and Kendall's Tau-b correlation) as the survey data are not normally distributed. In addition, we investigated statistical differences in motivations across categories by demographic characteristics and checked if there exist linear relationships between RG usage of participants and their motivations.

Ⅴ. Findings

1. Motivations comparison across the four combined categories

Table 2 shows participants' demographic backgrounds in the four combined categories of hard-pure, hard- applied, soft-pure, and soft-applied disciplines. About 70% of hard-pure and hard-applied users were male, while about 70% of soft-pure users were female. In the soft-applied group, almost the same number of males and females participated in the survey. Most participants

were equal to or younger than 39 years old, while the age distribution of participants in the soft-applied category was almost equal across age groups, 10 to 20 %. About 70% of participants in the hard-pure and soft-applied groups had doctorate degrees. About 50% of participants in the hard-applied and soft-pure groups had doctorate degrees. About 55% of participants in the hard-pure group were researchers, while about 50% of participants in the soft-pure group were students. About 50% of participants in the soft-applied group were faculty members.

〈Table 2〉 Demographic background of participants in the four combined categories

Variables	Categories	N=226							
		Hard-Pure (N=51)		Hard-Applied (N=53)		Soft-Pure (N=63)		Soft-Applied (N=59)	
		n	%	n	%	n	%	n	%
Gender	Female	15	29.4	16	30.2	48	76.2	27	45.8
	Male	36	70.6	37	69.8	15	23.8	31	52.5
	Others	0	0	0	0	0	0	1	1.7
	Total	51	100	53	100	63	100	59	100
Age	18-29	21	41.2	22	41.5	27	42.9	9	15.3
	30-39	24	47.1	21	39.6	24	38.1	17	28.8
	40-49	0	0	4	7.5	5	7.9	8	13.6
	50-59	3	5.9	2	3.8	0	0	13	22.0
	Over 60	3	5.9	4	7.5	7	11.1	12	20.3
	Total	51	100	53	100	63	100	59	100
Highest Degree	Bachelor's degree	7	13.7	3	5.7	4	6.3	0	0
	Master's degree	7	13.7	19	35.8	27	42.9	14	23.7
	Doctorate degree	35	68.6	30	56.6	31	49.2	45	76.3
	Professional degree	1	2.0	1	1.9	1	1.6	0	0
	Others	1	2.0	0	0	0	0	0	0
	Total	51	100	53	100	63	100	59	100
Job Position	Students	14	27.5	23	43.4	32	50.8	12	20.3
	Researchers	28	54.9	16	30.2	16	25.4	13	22.0
	Faculty members	6	11.8	10	18.9	11	17.5	28	47.5
	Others	3	5.9	4	7.5	4	6.3	6	10.2
	Total	51	100	53	100	63	100	59	100

Table 3 presents participants' use behaviors of RG. Most participants were a member of RG for about 2 to 4 years. The average year of being a member across the four categories was 2.63 years. The frequency of visiting RG sites varied. About 13 to 20% of participants in each

group visited RG sites more than ten times during the past three months. The average time of vising RG sites during the past three months was 8.4.

〈Table 3〉 RG usage of participants in the four combined categories

Variables	Categories	N=226							
		Hard-Pure (N=51)		Hard-Applied (N=53)		Soft-Pure (N=63)		Soft-Applied (N=59)	
		n	%	n	%	n	%	n	%
RG account history (years to be a member of RG)	Less than a year	1	2.0	0	0	0	0	1	1.7
	1-1.9 years	5	9.8	10	18.9	11	17.5	17	28.8
	2-2.9 years	9	17.6	16	30.2	24	38.1	15	25.4
	3-3.9 years	18	35.3	18	34.0	17	27.0	13	22.0
	4-4.9 years	11	21.6	4	7.5	4	6.3	4	6.8
	More than 5 years	4	7.8	5	9.4	5	7.9	5	8.5
	No answer	3	5.9	0	0	2	3.2	4	6.8
	Total	51	100	53	100	63	100	59	100
RG usage frequency (Times visited RG in the past 3 months)	None	11	21.6	10	18.9	10	15.9	12	20.3
	1-2 times	8	15.7	9	17.0	16	25.4	10	16.9
	3-4 times	9	17.6	10	18.9	11	17.5	14	23.7
	5-6 times	7	13.7	10	18.9	9	14.3	9	15.3
	7-10 times	6	11.8	7	13.2	5	7.9	3	5.1
	More than 10 times	10	19.6	7	13.2	12	19.0	9	15.3
	No answer	0	0	0	0	0	0	2	3.4
	Total	51	100	53	100	63	100	59	100

Motivations for self-archiving across the four categories (hard-applied, hard-pure, soft-applied, and soft-pure) were examined using a Kruskal-Wallis test (see Table 4). Enjoyment and influence of external actors are statistically significantly different across categories. Pairwise comparisons were performed using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons. The post hoc analysis suggested that a statistical difference existed in enjoyment between the hard-pure and soft-applied groups. Participants in the hard-pure group were more highly motivated by enjoyment than participants in the soft-applied group. There was a statistically significant difference in influence of external actors between the hard-pure and soft-pure groups as well. Those who are in the hard-pure group were more highly motivated by influence of external actors than those who are in the soft-pure group.

〈Table 4〉 Mean ratings of motivations across the four combined categories (*N*=226)

Motivations	Hard-Pure (N=51)		Hard-Applied (N=53)		Soft-Pure (N=63)		Soft-Applied (N=59)		χ^2	p
	M	SD	M	SD	M	SD	M	SD		
Enjoyment	3.15	0.94	2.96	0.84	2.71	0.81	2.58	0.84	13.45	.004*
Personal/Professional Gain	3.16	0.84	2.97	0.77	3.05	0.72	2.85	0.93	4.09	.252
Publicity	3.73	0.81	3.82	0.65	3.90	0.61	3.82	0.77	1.78	.619
Reputation	3.86	0.83	3.76	0.72	3.96	0.64	3.79	0.89	2.87	.412
Learning	3.69	1.01	3.70	0.85	3.61	0.89	3.63	0.98	.70	.874
Self-efficacy	3.80	0.88	3.85	0.68	3.98	0.57	3.94	0.64	1.32	.725
Community Interest	3.80	0.83	3.81	0.74	3.84	0.71	3.78	0.80	.189	.979
Social engagement	3.81	0.95	3.71	0.78	3.89	0.70	3.72	0.88	1.90	.594
Altruism	4.07	0.81	4.11	0.65	4.16	0.51	4.17	0.63	.422	.936
Reciprocity	3.89	0.86	3.92	0.65	4.05	0.55	4.03	0.63	1.61	.658
Trust	3.95	0.80	3.79	0.79	4.00	0.61	3.94	0.67	1.71	.634
Accessibility	4.05	0.93	4.22	0.71	4.46	0.46	4.33	0.74	6.18	.103
Self-archiving culture	3.46	0.80	3.59	0.77	3.55	0.79	3.70	0.80	2.64	.45
Influence of external actors	3.01	0.96	2.81	0.75	2.49	0.84	2.64	0.85	11.34	.01*
Credibility	3.37	0.94	3.44	0.69	3.42	0.56	3.26	0.70	2.51	.473
System stability	3.37	0.84	3.48	0.79	3.30	0.68	3.41	0.77	2.67	.445
Copyright concerns	3.21	1.09	2.98	0.93	3.02	0.99	3.23	1.15	2.28	.517
Additional time and effort	2.77	0.89	2.73	0.64	2.37	0.75	2.68	0.92	7.68	.053

*. Significant at the 0.05 level (two-tailed)

There were statistically significant differences on several motivations when compared motivations by demographic background and RG usages in the four groups. In the hard-applied group, female participants were more highly motivated by personal/professional gain than male participants (female: M=3.48, SD=0.54, male: M=2.75, SD=0.75, Mann-Whitney U test: U=140.50, p<.05). Younger participants were more highly motivated by social engagement than older participants (Kendall's tau-b correlation: τ_b=.230, p<.05). Also, those who had master's degrees were more highly motivated by social engagement (master's degree: M=3.51, SD=0.64, doctorate degree: M=3.88, SD=0.84, Mann-Whitney U test: U=190.00, p<.05) and trust (master's degree: M=3.65, SD=0.64, doctorate degree: M=3.94, SD=0.73, Mann-Whitney U test: U=191.50, p<.05) than those who had doctorate degrees. Simple linear regressions were performed to find out relationships between motivations and RG account history and frequency of use. The longer the participants were the member of RG, the more highly they had concerns on copyright (F(1,51)=6.22, p<.05).

The more frequently they visit RG, the more highly they were motivated by learning (F(1,51)=4.57, p<.05) and community interests (F(1,51)=4.81, p<.05).

There were no statistical differences in motivations by demographic background and RG usage in the hard-pure group except age. Older participants were more highly motivated by influence of external actors (τ_b=.239, p<.05) and additional time and effort (τ_b=.240, p<.05).

In the soft-applied group, there were statistically significant differences on motivations on enjoyment, (τ_b= -.207, p<.05), personal/professional gain (τ_b= -.328, p<.05), learning (τ_b= -.221, p<.05), community interest (τ_b= -.192, p<.05), social engagement (τ_b= -.230, p<.05), altruism (τ_b= -.211, p<.05), copyright concern (τ_b= -.199, p<.05). The younger the participants were, the more highly they were motivated by these motivations. RG account history also mattered to this group. The longer they had the RG account, the more highly motivated by reputation (F(1,53)=9.372, p<.05).

In the soft-pure group, personal/professional gain mattered by various factors. Female participants (M=3.16, SD=0.73) were more highly motivated by personal/professional gain than male participants (M=2.71, SD=0.58) (Mann-Whitney U test: U=220.00, p<.05). The younger participants were, the more highly motivated by personal/professional gain (τ_b= -.188, p<.05). Those who had masters' degrees (M=3.32, SD=0.75) were more highly motivated by personal/professional gain than those who had doctorate degrees (M=2.86, SD=0.65) (U=265.50, p<.05). Additionally, it was found that those who had doctoral degrees (M=2.61, SD=0.73) were more highly concerned by additional time and effort than those who had master's degrees (M=2.11, SD=0.73) (U=265.00, p<.05). The shorter they had the RG account, they were more highly motivated by personal/professional gain F(1,59)=5.89, p<.05), and reputation (F(1,59)=5.33, p<.05) and had more highly concerned on accessibility (F(1,59)=4.260, p<.05).

2. Motivations comparison across the four individual categories

Participants' demographic background and RG usage were recaptured by the individual categories and described in Table 5. Male participants were more related to the hard and applied groups than females, while females were more associated with the soft and pure groups than males. Most participants across dimensions are aged between 18 to 39. About 65% of the participants across dimensions have doctorate degrees as the highest degree.

〈Table 5〉 Demographic background of participants in the four individual categories

Variables	Categories*	N=226				N=226			
		Hard (N=104)		Soft (N=122)		Pure (N=114)		Applied (N=112)	
		n	%	n	%	n	%	n	%
Gender	Female	31	29.8	75	61.5	63	55.3	43	38.4
	Male	73	70.2	46	37.7	51	44.7	68	60.7
	Other	0	0	1	0.8	0	0	1	0.9
	Total	104	100	122	100	114	100	112	100
Age	18-29	43	41.3	36	29.5	48	42.1	31	27.7
	30-39	45	43.3	41	33.6	48	42.1	38	33.9
	40-49	4	3.8	13	10.7	5	4.4	12	10.7
	50-59	5	4.8	13	10.7	3	2.6	15	13.4
	Over 60	7	6.7	19	15.6	10	8.8	16	14.3
	Total	104	100	122	100	114	100	112	100
Highest Degree	Bachelor's degree	10	9.6	4	3.3	11	9.6	3	2.7
	Master's degree	26	25.0	41	33.6	34	29.8	33	29.5
	Doctorate degree	65	62.5	76	62.3	66	57.9	75	67.0
	Others	3	2.9	1	0.8	3	2.7	1	0.9
	Total	104	100	122	100	114	100	112	100
Job Position	Students	37	35.6	44	36.1	46	40.4	35	31.3
	Researchers	44	42.3	29	23.8	44	38.6	29	25.9
	Faculty members	16	15.4	39	32.0	17	14.9	38	33.9
	Others	7	6.7	10	8.2	7	6.1	10	8.9
	Total	104	100	122	100	114	100	112	100

In Table 6, RG account history refers to years that participants were a member of RG and RG usage frequencies referred to the number of visiting the RG sites for the past three months. The distributions of the years and frequencies vary.

〈Table 6〉 RG usage of participants in the four individual categories

Variables	Categories	N=226				N=226			
		Hard (N=104)		Soft (N=122)		Pure (N=114)		Applied (N=112)	
		n	%	n	%	n	%	n	%
RG account history (years to be a member of RG)	Less than a year	1	1.0	1	0.8	1	0.9	1	0.9
	1-1.9 years	15	14.4	28	23.0	16	14.0	27	24.1
	2-2.9 years	25	24.0	39	32.0	33	28.9	31	27.7
	3-3.9 years	36	34.6	30	24.6	35	30.7	31	27.7
	4-4.9 years	15	14.4	8	6.6	15	13.2	8	7.1
	More than 5 years	9	8.7	10	8.2	9	7.9	10	8.9
	No answer	3	2.9	6	4.9	5	4.4	4	3.6
	Total	104	100	122	100	114	100	112	100

Variables	Categories	N=226				N=226			
		Hard (N=104)		Soft (N=122)		Pure (N=114)		Applied (N=112)	
		n	%	n	%	n	%	n	%
RG usage frequency (Times visited RG in the past 3 months)	None	21	20.2	22	18.0	21	18.4	22	19.6
	1-2 times	17	16.3	26	21.3	24	21.1	19	17.0
	3-4 times	19	18.3	25	20.5	20	17.5	24	21.4
	5-6 times	17	16.3	18	14.8	16	14.0	19	17.0
	7-10 times	13	12.5	8	6.6	11	9.6	10	8.9
	More than 10 times	17	16.3	21	17.2	22	19.3	16	14.3
	No answer	0	0	2	1.6	0	0	2	1.8
	Total	104	100	122	100	114	100	112	100

The grand mean of years being an RG member across dimensions was 2.62. Most participants were a member of RG for 2 to 3 years. Participants accessed about 8 to 9 times for the past three months, but the standard deviations were large, and it referred to a variety of frequencies among the RG users.

〈Table 7〉 Mean comparison of motivations between the hard and soft groups

Motivations	Hard (N=104)		Soft (N=122)		U	p
	M	SD	M	SD		
Enjoyment	3.05	0.89	2.64	0.83	4,660.50	.001*
Personal/Professional Gain	3.06	0.82	2.96	0.83	5,810.00	.272
Publicity	3.78	0.73	3.86	0.69	6,871.50	.276
Reputation	3.81	0.78	3.88	0.77	6,793.50	.352
Learning	3.70	0.93	3.62	0.93	6,028.50	.516
Self-efficacy	3.82	0.78	3.96	0.60	6,893.00	.255
Community Interest	3.80	0.78	3.81	0.75	6,314.00	.95
Social engagement	3.76	0.86	3.81	0.79	6,482.00	.776
Altruism	4.09	0.73	4.16	0.57	6,489.50	.762
Reciprocity	3.91	0.76	4.04	0.59	6,911.00	.239
Trust	3.87	0.80	3.97	0.64	6,479.50	.777
Accessibility	4.14	0.83	4.39	0.61	7,483.50	.018*
Self-archiving culture	3.53	0.79	3.62	0.80	6,649.00	.530
Influence of external actors	2.91	0.86	2.56	0.84	4,844.50	.002*
Credibility	3.41	0.82	3.34	0.63	5,786.00	.248
System stability	3.43	0.81	3.35	0.72	5,815.00	.275
Copyright concerns	3.09	1.01	3.12	1.07	6,382.00	.938
Additional time and effort	2.75	0.77	2.52	0.85	5,336.50	.038*

*. Significant at the 0.05 level (two-tailed)

Table 7 shows the mean ratings of motivations for self-archiving of participants in the hard and soft groups. The rank of the motivations between the two groups was almost the same. The most highly rated motivation was accessibility, and it was followed by altruism, reciprocity, trust, self-efficacy, reputation, publicity, social engagement, community interest, self-archiving culture, learning, system stability, credibility, and so on. Except for the highest motivation, accessibility, most motivations in higher ranks were a mix of personal and professional, and social motivations. The two least highly rated motivations were additional time and effort and influence of external factors.

When compared to the mean ratings between the hard and soft groups using Mann-Whitney U test, there were statistically significant differences on four motivations between the two groups - enjoyment, accessibility, influence of external actors, and additional time and efforts. Participants in the hard group were more highly motivated by enjoyment, influence of external actors, and additional time and efforts than those in the soft group. Participants in the soft group are more highly motivated by accessibility than those in the hard group.

There were statistically significant different motivations in demographic information of participants in each group. Among participants in the hard group (N=104), female participants (M=3.43, SD=0.77) were more highly motivated by personal/professional gains (U=705.00, p=.002) than male participants (M=2.91, SD=0.79). A similar pattern was observed in the soft group (n=122), where female participants (M=3.12, SD=0.80) were also more highly motivated by personal/professional gains (U=1239.50, p=.009) than male participants (M=2.69, SD=0.82).

When Kendall's tau-b correlation were used to observe the correlation between motivations and age, there were statistically significant differences in personal/professional gain, additional time and effort, and reputation. In both hard and soft groups, the older the participants were, the less they were motivated by personal/professional gain (the hard group: τ_b= -.162, p<.05; the soft group: τ_b= -.271, p<.05). In the hard group, the older the participants were, the more they were concerned about additional time and effort (τ_b= .214, p<.05). In the soft group, the younger the participants were, the more highly motivated by reputation (τ_b= -.176, p<.05)

A Mann-Whitney U test was used to observe statistically significant differences between motivations and the highest degrees of participants. In the hard group, there was a statistically significant difference in a motivation of additional time and effort between those who had master's

degrees and those who had doctorate degrees. Those who had doctorate degrees had more concerns about additional time and effort (U=600.50, p=.03) than those with master's degrees. In the soft group, there were statistically significant differences in two motivations of personal and professional gain (U=1126.00, p=.013) and self-archiving culture (U=1194.00, p=.036) between those who had master's degrees and doctorate degrees. Those who had masters' degrees were more highly motivated by personal/professional gain and self-archiving culture than those who had doctorate degrees.

A similar pattern to motivations by the highest degrees has been shown when testing motivations by job positions. A Kruskal-Wallis test was used to observe if there were statistically significant differences between motivations and job positions. In the hard group, there was a statistically significant difference in the motivation of additional time and effort between students and researchers. Researchers had more concerns about additional time and effort (χ^2 (2)=11.41, p<.05) than students. In the soft group, there were statistically significant differences in the two motivations of personal/professional gain (χ^2 (2)=6.628, p<.05) and self-archiving culture (χ^2 (2)=7.046, p<.05). Pairwise comparisons showed that students (M=3.23, SD=0.79) had been more highly motivated by personal/professional gain than faculty members (M=2.75, SD=0.83). Faculty members (M=3.91, SD=0.76), however, were more highly motivated by self-archiving culture than students (M=3.45, SD=0.76).

Simple linear regressions were performed to find out if there were statistically significant relationships between motivations and RG account history and between motivations and RG usage. There were no statistically significant differences between motivations and RG account history of participants in both soft and hard groups. There was no statistical relationship between motivations and RG usage in the soft group. There were, however, statistically significant relationships on the two motivations - learning (F(1,102)=4.89, p<.05) and system stability (F(1,102)=4.89, p<.05) - and RG usage of participants in the hard group. Those who visit RG more frequently were more highly motivated by learning and system stabilities.

Table 8 shows the mean ratings of motivations of participants in between the pure and applied groups. The rank of motivations in the two groups was almost the same in between the groups and the rank of motivations in the hard and soft groups. There were no statistically significant differences in motivations between the pure and applied groups.

〈Table 8〉 Mean comparison of motivations between the pure and applied groups

Motivations	Pure (N=114)		Applied (N=112)		U	p
	M	SD	M	SD		
Enjoyment	2.91	0.90	2.76	0.86	6,935.00	.259
Personal/Professional Gain	3.10	0.78	2.91	0.86	7,192.50	.097
Publicity	3.83	0.71	3.82	0.71	6,323.00	.900
Reputation	3.92	0.73	3.78	0.81	7,080.50	.151
Learning	3.64	0.94	3.66	0.92	6,308.00	.876
Self-efficacy	3.90	0.73	3.90	0.66	6,339.50	.927
Community Interest	3.82	0.76	3.79	0.77	6,584.50	.678
Social engagement	3.85	0.82	3.72	0.83	7,041.00	.177
Altruism	4.12	0.66	4.14	0.64	6,197.50	.699
Reciprocity	3.98	0.70	3.98	0.64	6,238.50	.763
Trust	3.98	0.70	3.87	0.73	6,951.50	.238
Accessibility	4.27	0.74	4.28	0.72	6,417.50	.945
Self-archiving culture	3.51	0.80	3.65	0.79	5,666.50	.140
Influence of external actors	2.72	0.93	2.72	0.80	6,301.00	.865
Credibility	3.40	0.75	3.35	0.70	6,697.00	.518
System stability	3.33	0.75	3.44	0.78	5,789.00	.221
Copyright concerns	3.10	1.03	3.11	1.05	6,296.00	.857
Additional time and effort	2.55	0.84	2.71	0.80	5,605.00	.110

We further examined statistical differences across demographic characteristics of participants in each group. In applied group, there was a statistically significant difference in personal/professional gain (U=1003.50, p<.05) between female and male participants. Female participants (M=3.22, SD=0.83) were more highly motivated by personal/professional gains than male participants (M=2.72, SD=0.83).

In addition, the correlations between motivations and age were checked in the pure and applied group, respectively. In both pure and applied groups, age was negatively associated with personal/professional gain (the pure group: τ_b= -.173; the applied group: τ_b= -.260, p<.05), meaning that older participants were less likely motivated by personal/professional gain. In the pure group, there was a positive association between age and additional time and effort (τ_b= .152, p<.05). Older participants tend to perceive self-archiving as a task expending time and effort. Meanwhile, in the applied group, age was also negatively associated with enjoyment (τ_b= -.174, p<.05), suggesting that older participants were less likely motivated by enjoyment. The participants who have doctorate degrees (M=3.94, SD=0.69) were more highly motivated by self-efficacy (U=935.50, p<.05) than

the participants who have master's degrees (M=3.76, SD=0.58).

Simple linear regressions were performed to find out if there exist relationships between motivations and RG usages in both groups. In the pure group, RG account history could statistically significant predict reputation ($F(1,107)=5.08$, $p<.05$), learning ($F(1,107)=3.96$, $p<.05$), and accessibility ($F(1,107)=5.34$, $p<.05$). The longer the participant had been a RG member, the less they were motivated by reputation, learning and accessibility. In the applied group, RG account history predicted reputation ($F(1,106)=9.12$, $p<.05$), self-efficacy ($F(1,106)=4.21$, $p<.05$), and social engagement ($F(1,106)=4.21$, $p<.05$). In other words, the longer the participants had been a RG member, the more they were motivated by reputation, self-efficacy, and social engagement. Moreover, there were statistically significant relationships between RG usage and learning ($F(1,108)=4.20$, $p<.05$), community interest ($F(1,108)=5.91$, $p<.05$), and social engagement ($F(1,108)=5.39$, $p<.05$). The more frequently they visit RG, the more highly motivated by learning, community interest, and social engagement.

Ⅵ. Discussion and Conclusion

Findings of the distribution of demographics across disciplines have shown a similar pattern from previous studies in that the hard-pure and hard-applied disciplines are male-dominant while the soft-pure disciplines are female-dominant (Ceci and Williams 2007; Leslie et al. 2015). When separating participants into soft vs. hard and pure vs. applied, male RG users mainly belong to hard or applied disciplines while female RG users have been in the soft or pure group. RG may replicate the gender distribution in academia, although it exists online. Ages, however, were relatively young. Most participants were younger than the 40s and have doctorate degrees regardless of their disciplines. RG users who have done self-archiving are young and have the highest degrees in academia.

Findings of motivations show that there are differences in motivations for self-archiving across disciplines. RG users in hard-pure disciplines such as mathematics and chemistry were more highly motivated on enjoyment by self-archiving data and publications on RG for pleasure than those in other disciplines. At the same time, their communities may have a culture of encouraging self-archiving in that they were more highly motivated by influence of external actors such as co-authors, funding agencies and academic institutions than those in other disciplines. RG female

users in soft-pure and hard-applied disciplines had higher motivations for personal/professional gains which have used self-archiving as a strategy to promote work and gain academic promotion than male users. It could be because females are placed in a comparative environment for promotion in these fields. At the same time, personal/professional gain was a motivation that is related to age, degrees, and RG account history. RG users who are younger, had master's degrees, and had less RG history were more highly motivated by personal/professional gain than those who are older, had doctorate degrees and had RG history longer.

When comparing the motivations between the hard and soft groups of RG users, RG users in the hard group were more highly motivated on enjoyment, accessibility, influence of external actors, and additional time and effort than the users in the soft group. RG users in the hard group may believe self-archiving in RG may help their work more widely and readily available online. Additional time and effort was a constraint factor of motivations in that they may be bothered spending their time and effort on self-archiving on RG than RG users in the soft group. In both hard and soft groups, younger users were less motivated by personal/professional gains than older users. In the hard group, the younger users have shown more highly motivated on reputation to increase their personal, social and professional recognition in their fields than older users. There were differences in motivations of personal/professional gains and additional time and effort among those who have the different level of degrees. In the hard group, RG users who have doctoral degrees have deep concerns about additional time and efforts than RG users who have master's degrees. In the soft group, however, RG users who have master's degrees were more highly motivated by personal/professional gains and self-archiving cultures than RG users who have higher degrees. There were no statistically significant differences in motivations of RG usages between the hard and soft groups except the RG frequencies. In the hard group, RG users who are more frequently visiting RGs are more highly motivated by learning and system stability. They would like to visit RG to enhance their knowledge and skills and research and believe RG could be a secure place to share their data or publications in the community.

When comparing the motivations between the pure and applied groups of RG users, the statistical difference was hardly shown on motivations between the two groups. Being in the pure or applied fields may not influence much self-archiving behaviors while being in the soft or hard group matters, as shown above.

Findings from the current study have implications for developing strategies that encourage researchers in various disciplines to share their data and publications in ASNSs. Academic cultures

of disciplines where researchers belong to could positively influence their perceptions and attitudes towards self-archiving in ASNSs. ASNSs were the platform for self-archiving in the current study but findings could be applied to facilitate institutional repositories or open access repositories. We believe findings could be applicable to design open access sites/services for researchers and develop institutional information and technical policies such as providing internal and external incentives to researchers who share their data and resources in the sites/services.

There are limitations to the current study in that RG was these platform for ASNSs, and it may not represent other ASNSs. A comparative analysis across different kinds of ASNSs would be needed as a follow-up study. Biglan's classification system of disciplinary was used for the current study because it is one of the widely used systems in academia. The academic fields have evolved, however. Biglan's system may not properly reflect the nature of multidisciplinary or interdisciplinary fields.

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