An Empirical Research of The Influencing Mechanisms of Research Performance on Scientific Research Social Network

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Abstract: The advent of scientific research social network creates a better environment for scientific communication. It may facilitate researchers to share their scientific knowledge, and then to improve their research performance, so we explore the influencing mechanisms between the degree of user activity on scientific research social network, knowledge sharing and research performance. Using questionnaire survey and Likert scale are the traditional methods, while we get 1133 valid user data from "ScholarMate" website with pursuit of more objectivity and authenticity. After conducting correlation analysis, regression analysis and Mediation effect testing, we get the following results: the degree of user activity on scientific research social network has significant positive effects on the quantity and quality of published papers; knowledge contribution and knowledge search also have significant positive effects on the quantity and quality of published papers; the effect of the degree of user activity on the quantity and quality of published papers are mediated by knowledge contribution .

Introduction

In Web 2.0 era, researchers pay more attention to user interaction as users are both visitors and creators on the web. As virtual community has become an important platform for knowledge sharing, more and more scholars focus on social network. Scientific research social network has attracted more interests for researchers, providing a better environment for knowledge sharing. Nevertheless, there are few research on whether the degree of user activity on scientific research social network has positive effects on users' research performance, how the degree of user activity on scientific research social network exerts influence on users' research performance, what the relationship between the degree of user activity on scientific research social network, knowledge sharing and research performance is. The goal of this paper is to explore their influencing mechanisms.

Literature review

For social network, the degree of user activity refers to the frequency of all users' behaviors in a social network including posting status, uploading photos, forwarding, clicking a "like"-button and commenting. Cao (2012) used four indicators including the number of times being listened, the number of listeners, the number of broadcasting and broadcasting frequency to represent the degree of user activity [1]. Zhou(2011) utilized the formula "(Login frequency + Dwell time) / Login period" to measure the degree of user activity on a social network [2]. Deng (2013) argued that the number of posting status, the number of logs and the number of friends can be used to indicate the degree of user activity [3]. Liu (2012) measured the degree of user activity by the frequency of
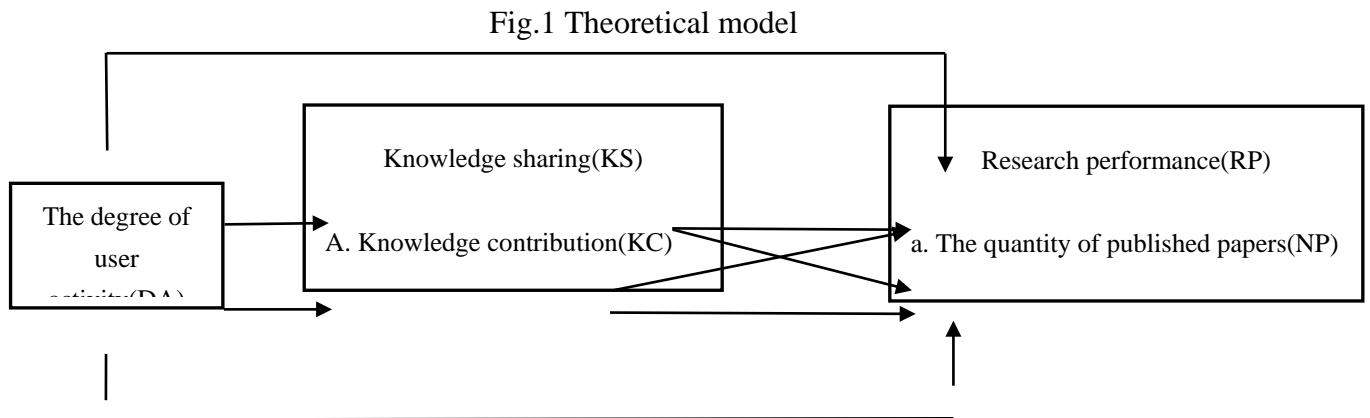
microblogging of users in Sina Weibo [4]. Tang (2012) evaluated the degree of user activity by calculating the time an individual user spending on social network [5]. In this paper we conduct research based on the "ScholarMate" website, which is a professional scientific research social network. And the degree of user activity is defined as the frequency of a variety of user's behaviors and measured by the following formula "The sum of all user's acts / The number of months from registration to the current".

Knowledge sharing was defined as a key process in knowledge management, which includes knowledge creation / generation, knowledge codification / storage, knowledge sharing and knowledge application by Alavi(2001) [6]. Ren (2011) proposed that knowledge sharing includes knowledge demand and knowledge supply, namely knowledge contribution and knowledge search [7]. Lei (2012) showed that knowledge sharing in virtual community is accompanied by the interaction of community members who are not only knowledge providers, but also knowledge seekers including posting / replying or questioning / answering which can be measured by the quality of knowledge sharing and the quantity of knowledge sharing [8]. Since the objects of this research are users on scientific research social network, we choose knowledge contribution and knowledge search as two indicators to measure knowledge sharing.

Garfield (1979) believed that index and citation frequency can reflect the quality of academic articles [9].Lack of considering the quality of papers, Long RG (1998) evaluated the research performance of doctoral students by the quantity of their published papers in specified journals [10]. Hirsch (2005) proposed a method using H index to measure the research performance of an individual which considered not only the quality but also the quantity of papers [11].Bian (2008) defined the research performance as achievements in scientific research which have been created by a research-team or an individual over a given period, and proposed to use quality and quantity of papers to measure the research performance of doctoral students directly [12]. Qiu (2008) used the number of papers, total citation frequency and average citation of each paper to evaluate the research performance of researchers in the field of Chinese education technology [13]. In conclusion, the direct outputs are papers of researchers, so we select the quantity and quality of published papers as indicators to evaluate research performance.

Research model and hypotheses

Today, virtual community has become an important platform for knowledge sharing, and knowledge sharing in virtual community has become a hot issue. Lei (2012) proposed that the interaction and knowledge sharing between members of virtual community are correlative [8]. In the field of education, Ahn (2010) suggested that under the useful guidance, social network can help students enhance their comprehensive ability so that they would more easily participate in team activities [14]. After reviewing previous literatures, we found that researches on scientific research social network are mostly concentrated in the recommendation system and the analysis of user behavior, while rarely concentrated in the combination of the degree of user activity, knowledge sharing and research performance. For the research purpose in this paper, based on previous researches, we build the theoretical model as shown in Fig.1 and propose the hypotheses in Table 1.

Fig.1 Theoretical model

The degree of user activity(DA)	Knowledge sharing(KS) A. Knowledge contribution(KC)	Research performance(RP) a. The quantity of published papers(NP)

Table 1.Research hypotheses.

H1: The degree of user activity has significant positive effects on the quantity of published papers.

H2: The degree of user activity has significant positive effects on the quality of published papers.

H3: The degree of user activity has significant positive effects onknowledge contribution.

H4: The degree of user activity has significant positive effects onknowledge search.

H5:Knowledge contribution has significant positive effects on the quantity of published papers.

H6:Knowledge contribution has significant positive effects on the quality of published papers.

H7:Knowledge searchhas significant positive effects on the quantity of published papers.

H8:Knowledge searchhas significant positive effects on the quality of published papers.

H9: Knowledge contribution plays an intermediary role between degree of user activity and the quantity of published papers.

H10: Knowledge contribution plays an intermediary role between degree of user activity and the quality of published papers.

H11: Knowledge search plays an intermediary role between degree of user activity and the quantity of published papers.

H12: Knowledge search plays an intermediary role between degree of user activity and the quality of published papers.

Empirical research

The research objects are the users of the "ScholarMate" Website in this paper, and all the data used are provided by "ScholarMate". The Website adopts random sampling method to extract 1200 user data. After rejecting incomplete information user data, the number of valid data is 1133 and the effective rate is 94.42%.

Select the degree of user activity(DA) as the independent variable, knowledge sharing(KS) as the intermediary variable, and the quantity of published papers（NP）, the quality of published papers(QP) as the dependent variables. Among them, the intermediary variable has two dimensions named knowledge contribution (KC) and knowledge search (KH). And there are 8 control variables, including gender(g), age(a), job title(j), province(p), city(c), workplace(w), educational background(e), major(m).

(1) EFA and correlation analysis

We conduct EFA for 5 indicators of the intervening variable (KS). The detailed procedure of EFA are as follows: KMO value equals to 0.644 and Bartlett sphericity test is significant. Then we synthesize two common factors whose factor loading are greater than 0.5 and eigenvalue greater than 1. Their cumulative variance proportion is 69.310% and we name them knowledge contribution (KC) and knowledge search (KH) respectively. The results of correlation analysis for each variable including Pearson correlation coefficient and p value of two-tailed correlation coefficient test are presented in Table 2. The results show that there exists significant positive correlation between DA and KC, DA and KH,DA and NP, DA and QP; and there is also significant

positive correlation between KC and NP, KC and QP; there exists significant positive correlation between KH and NP, KH and QP.

	DA	KC	KH	NP	QP
DA	1				
KC	.995**	1			
KH	.401**	.379**	1		
NP	.978**	.981**	.253**	1	
QP	.438**	.442**	.092**	.462**	1

Table2. Correlation analysis.

Note: *p <0.05, **p <0.01, ***p <0.001

(2) Regression analysis

Conducting regression analysis for our hypothesis, as shown in Table 3, all models have passed F-test, indicating that the overall model is valid. Results of regression analysis show: DA has significant positive effects on NP in model 1(β = 0.974, P <0.001); DA has significant positive effects on QP in model 2 (β = 0.449, P <0.001); DA has significant positive effects on KC in model 3 (β = 0.991, P <0.001); DA has significant positive effects on KH in model 4 (β = 0.447, P <0.001); KC has significant positive effects on NP in model 5 (β = 0.981, P <0.001); KC has significant positive effects on QP in model 6 (β = 0.455, P <0.001); KH has significant positive effects on NP in model 7 (β = 0.253, P <0.001); KH has significant positive effects on QP in model 8 (β = 0.096, P <0.001). So H1, H2, H3, H4, H5, H6, H7, H8 are all verified.

Table3. Regression analysis

	MODEL1	MODEL2	MODEL3	MODEL4	MODEL5	MODEL6	MODEL7	MODEL8
	NP	QP	KC	KH	NP	QP	NP	QP
Control variable								
Gender	-.004	-.001	.000	.001	-.004	-.001	.042	.021
Age	.002	-.072*	.008**	-.090***	-.005	-.076*	.233***	.034
Job title	.002	-.007	.004	-.034	-.002	-.009	.109***	.043
Province	-.016*	-.017	.001	.017	-.018***	-.017	-.045	-.030
City	.025**	.028	.018***	-.054	.007	.020	.080*	.053
Workplace	.003	.102**	-.004	-.016	.008	.103***	.046	.121***
Educational background	-.009	.020	.001	.021	-.010	.019	.014	.031
Major	-.007	-.027	.003	.098***	-.010	-.028	-.105***	-.071*
Independent variable								
DA	.974***	.449***	.991***	.447***				
Intermediary variable					.981***	.455***		
KC							.253***	.096***
KH								
R²	.958	.213	.990	.184	0.963	.217	.170	.043
F value	2876.401***	33.821**	12312.314***	28.128***	3275.744***	34.589***	26.809***	5.641***

(3) Mediation effect testing

According to the method proposed by Baron and Kenny (1986), we test the existence of KS's mediation effect between DA and research performance (RP) [15]. The detailed results is listed in Table 4.

First, examine the mediation effect of KC. After adding KC in model 9, the regression coefficient (β) of DA decreases from 0.974 to 0.242 significantly, indicating that the effect of DA on NP are partly mediated by KC, then H9 is verified; after adding KC in model 10, the regression coefficient (β) of DA is no longer significant, indicating that the effect of DA on QP are fully mediated by KC, then H10 is also verified.

Second, examine the mediation effect of KH. After adding KH in model 11 and model 12, their regression coefficients (β) of DA remain significant, but increase from 0.974 to 1.049 and 0.449 to 0.494 respectively, so H11, H12 has not been verified.

Table4. Mediation effect testing

	MODEL9	MODEL 10	MODEL11	MODEL12
	NP	QP	NP	QP
Control variable Gender	-.004	-.001	-.004	-.001
Age	-.003	-.077*	-.013**	-.081***
Job title	-.001	-.010	-.004	-.010
Province	-.017***	-.017	-.014**	-.015
City	.011	.016	.016**	.023
Workplace	.006	.104***	.001	.100***
Educational background	-.010	.019	-.006	.022
Major	-.009	-.029	.009**	-.017
Independent variable DA	.242***	-.189	1.049***	.494***
Intermediary variable KC	.739***	.644*		
KH			-.167***	-.102***
R²	.964	.217	.981	.222
F value	2995.773***	31.169***	5815.645***	31.965***

Conclusions and suggestions

Based on the results of empirical research, we can draw the following conclusions:

(1) The degree of user activity in scientific research social network has both significant positive influence on the quantity and quality of published papers, Which suggests using scientific research

social network may have a certain help to improve research performance; Meanwhile, it also has both significant positive influence on knowledge contribution and knowledge search, which suggests that the network creates a better environment for users to share knowledge. The higher the degree of user activity is, the more willing people are to share knowledge.

(2) The effect of the degree of user activity on the quantity of published papers are partly mediated by knowledge contribution but on the quality of published papers are fully mediated by knowledge contribution, which reveals the primary reason why the degree of activity has both significant positive influence on the quantity and quality of published papers is that scientific research social network provides a good platform for knowledge contribution among users.

Some suggestions are as follows:

(1) Scientific research social network on the one hand, should improve its scientific use function to provide its users with a more convenient, authoritative platform for scientific communications; on the other hand it can be appropriate to enhance the cooperation with universities and scientific research institutions to broaden the amount of users.

(2) Universities and scientific research institutions should encourage scientific researchers to use resources on scientific research social network more often and set up relevant groups to discuss scientific issues for the advancement of scientific communication in such a field.

(3) Scientific researchers should make full use of scientific research resources in the network platform, combining online and offline research communication, to improve the efficiency of scientific communication, and then facilitate personal performance in the scientific researches.

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