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The Literature Review of Technology Acceptance Model: A Study of the Bibliometric Distributions

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THE LITERATURE REVIEW OF TECHNOLOGY ACCEPTANCE MODEL: A STUDY OF THE BIBLIOMETRIC DISTRIBUTIONS

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Abstract

Technology acceptance model plays a signified issue in the information systems field since this theory was introduced by Davis in 1989. This paper investigates the features of technology acceptance model literature based on bibliometric method. By searching the ISI Web of knowledge database under the keyword of "technology acceptance model," 689 articles were retrieved and analyzed though growth of the literatures and citation, document type, publication countries, subject area, keyword analysis are addressed. The distribution of journal paper was also examined using Bradford's law and Lotka's law. As the result, this research found that technology acceptance model literature has a steady growth as well as the citations. Relevant articles were concentrating on computer science, information systems, management, information science, and library science. The author productivity distribution data in technology acceptance literature was consistent with Lotka's law. Furthermore, eight core journals were identified utilizing the Bradford's law.

Keywords: Bibliometric, Technology Acceptance Model, Lotka's Law, Bradford's Law.

1. INTRODUCTION

With the tremendous growth of the technology, people have more opportunities to use the new technology in their daily life as well as work in the practical environment, indeed, researchers explored and released theoretical model to explain user's information technology adoption and use such as theory of reasoned action (Fishbein and Ajzen, 1975), theory of planned behavior (Ajzen, 1991), and technology acceptance model (TAM) (Davis, 1989), and user acceptance of information technology: toward a united view model (Venkatesh et al., 2003).From those theories and models, "the most widely employed model of information technologies adoption and use is the technology acceptance model" (Venkatesh and Bala, 2008). TAM was been announced first at the journal of MIS Quarterly in 1989 (Davis, 1989) and used to explain the user adoption of technology use in different environment setting. The thrust of this paper is employing the bibliometric methodology toward the productivity view to get the better comprehension about research tendency of technology acceptance model such as research authors, subjects, languages, and institutions. Next, this research would progress the Bradford's law (Bradford, 1934) to find out the core journals through separating the entirely range of journals into three parts by number of articles. Indeed, Lotka's law (Lotka, 1926) would be performed to achieve author productivity. In the last section, research implications and future research suggestions would be discussed.

2. LITERATURE REVIEW

2.1. Technology Acceptance Model

Technology acceptance model (TAM) is generally considered as the most influential and common theory in information systems field (Lee et al., 2003), and has received through the affluent empirical supports. TAM is based on the theory of reasoned action (Fishbein and Ajzen, 1975), which discussed how attitude impacted behaviour. TAM involved the two core predictors: perceived usefulness and perceived ease of use and the dependent variable: behavior intention. Since TAM was introduced in 1989, researchers applied this model into several research streams. Some researches focused on identifying the determinants of key predictors, namely, perceived ease of use and perceived usefulness (Karahanna and Straub, 1999; Koufaris, 2003; Wixom and Todd, 2005). Some papers extended the TAM by other theories in increase the predictive power (Dishaw and Strong, 1999; Venkatesh et al., 2003; Gefen, 2004). Others would use the meta-analysis to testing the effects by involving user type and usage type (King and He, 2006), the competing role of behavioral intention, facilitating condition, and behavioral expectation (Venkatesh et al., 2008), environment-based voluntariness (Wu and Lederer, 2009).

2.2. Bradford's Law

Bradford's law had been introduced in 1934 (Bradford, 1934), which is a regular pattern over a huge number of articles from different journals on a particular subject. According to this law, numbers of relevant articles would be concentrated in a small number of journal titles, and the remaining articles would be distributed over the vast account of journal titles. Indeed, the journals could be separated into three groups by number of articles according to the formulation and the proportion of the number of journals in each group would be 1: n: n^2. Through the process, some core journals in that article field can be identified. The Bradford's law has been widely employed to study journal literature distribution (Gillaspy and Huber, 1996; von Ungern-Sternberg, 2000), author productivity (Chung, 1994), empirical hyperbolic distribution (Fairthorne, 2005).

2.3. Lotka's Law

Lotka's law (Lotka, 1926) of scientific productivity is also an example of empirical laws to explore the pattern of productivity of literatures; sometimes it has been called "the inverse square law of scientific productivity" (Lotka, 1926, p. 320). This law mainly discussed about the higher level of

productivity of articles. Lotka's law (Lotka, 1926) was used to measure the productivity of authors. The general form of Lotka's law can be expressed as $y=c/x^n$, where y=percentage of authors, x=number of articles published by an author, c=constant and -n=slope of the log-log plot.

According to the extent papers, numerous authors attempted to apply the Lotka's Law to different fields. Murphy (1973) used the humanities of data set to test the law and the result indicated that the distribution followed the Lotka's law. Chung and Raymond (1990) tried to find the patterns of productivity in the finance literatures and found those literatures would conform greatly well to the Lotka's law if the data set from a large collection of journals. Long et al. (2009) attempted to build up the distribution of publications of information systems field following the Lotka's law, as the result, the distribution could not followed the Lotka's law.

3. METHODOLOGY

This research would accumulate from the Citation database of Social Sciences Citation Index (SSCI) and Science Citation Index (SCI) on Web of Science created by ISI Web of Knowledge (vision 4.7). This database can be much easier to collect the TAM literatures in academic papers. By using the keyword of "technology acceptance model", we searched the relevant article such as reviews, proceeding papers, corrections, editorial materials, meeting abstracts form 1956 to 2009. Then we calculated the record count of the numbers of literatures, keywords, countries, subject areas through each literature derived from database. As the results, this research summarized the 689 papers which topic is related of "technology acceptance model" from 1991 to 2009.

4. ANALYSIS RESULTS

After summarizing the data collected from the database, the growth of publication shows in figure 1. Apparently, the tendency of literature growth of literatures increased steadily in each year.

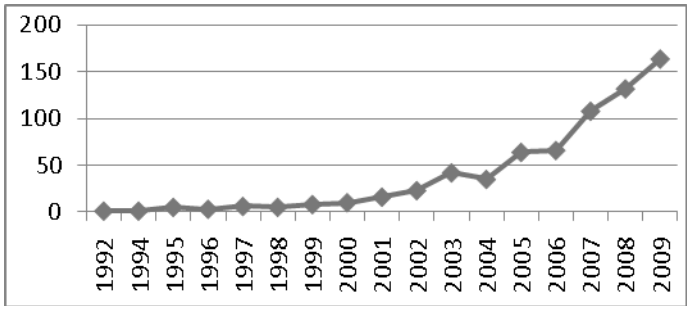

Figure 1. The tendency of literature growth of technology acceptance model

The authors who published TAM literature was came from 41 countries. The U.S.A. (37.32%) is the primary country. The second one is the Taiwan (13.67%), which contributes 111 literatures, followed by South Korea (54 record counts, 6.65%), China (52 record counts, 6.40%) and Canada (45 record count, 5.54%). The involvement of researchers in many countries indicates that TAM has been able to draw the attention in the academic field.

4.1. Subject Area and Keywords Analysis

The mainly concerned area of TAM are "Computer Science, Information Systems", "Management", "Information Science & Library Science", "Business" and "Computer Science, Cybernetics". The result indicates that TAM has been considered as a major issue in computer science as well as management and business, that is, TAM already becomes an interdisciplinary theory.

Besides the subject area, this study also conducted the keyword analysis. Numbers of keyword from literatures not only reflect the topic of research, but also provide a convenience way to search and retrieval. The top 10 keywords show in table 1. Since the keywords are subjectively provided by authors, the similar terms of keywords show in diversity and overlap. Some similar terms were been

considered as the same group according as they expressed the same meaning such as electronic commerce and e-commerce. Therefore, we classified all the keywords into the groups and showed the top 10 keywords in the table 1. By observing the most commonly used of keywords, the hot research issues from past researches are identified clearly.

Rank	Key word	Count (sum=2965,)	%
1	Technology Acceptance Model (TAM)	263	8.87%
2	Electronic commerce	64	2.16%
3	Internet(Web)	46	1.55%
4	Structural equation modeling(SEM)	44	1.48%
5	Perceived usefulness, Usefulness	42	1.42%
6	Trust	41	1.38%
7	Technology acceptance	39	1.32%
8	Perceived ease of use	39	1.32%
9	Theory of planned behavior (TPB)	32	1.08%
10	E-learning, Online learning,	27	0.91%

Table 1. High frequency keywords in TAM literature

4.2. Bradford Law and Core Journal

As mentioned before, the journal article is the mainly publication form. In total, there are 174 journals had published 584 TAM articles. Through the 174journals, 98 journals only published one article among those journals. Table 2 provides the number of publication in each journal and relevant information ranking by the number of publish paper according to the zoning of Bradford's Law. Table 2 provides the ratio comparisons of three zones (9:27:138), it approximately equal to $1:4.5:4.5^2$. That is, A: B: C = 1: n: n^2. The result matches the explanations of Bradford's Law. It indicates the publication of TAM in these journals account for one-third of the total amount.

	No. of articles(a)	No. of journal(b)	Accumulated Journals (c)	Accumulated (a)*(b)	log(c)
(A) Core	59(I&M)	1	1	59	0.00
	38(Comput Hum Behav)	1	2	97	0.30
	28(MISQ)	1	3	125	0.48
	26(JCIS)	1	4	151	0.60
	21(BIT)	1	5	172	0.70
	20(COMPUTERS & EDUCATION)	1	6	192	0.78
	16(IJHCS)	1	7	208	0.85
	15(DSS, JMIS)	2	9	238	0.95
(B) Relevant	14	1	10	252	1.00
	12	4	14	300	1.15
	11	3	17	333	1.23
	10	3	20	363	1.30
	9	3	23	391	1.36
	8	4	27	422	1.43
	7	4	31	450	1.49
	6	5	36	480	1.56
(C) marginal	5	5	41	505	1.61
	4	4	45	521	1.65
	3	8	53	545	1.72
	2	23	76	591	1.88
	1	98	174	689	2.24

Table 2. The distribution of TAM literature

No. of articles	No. of authors	%	Cum. %
1	988	58.39	58.39
2	296	17.49	75.89
3	153	9.04	84.93
4	104	6.15	91.08
5	35	2.07	93.14
6	36	2.13	95.27
7	14	0.83	96.10
8	32	1.89	97.99
9	9	0.53	98.52
11	11	0.65	99.17
14	14	0.83	100.00
Total	1692	100.00	100.00

Table 3. Productivity of authors

4.3. Author Productivity and Lotka's Law

There are total 1692 authors (shown in table 3) contributing to the publications of 689 articles in TAM literatures. According to this data set, 988 authors (58.39%) contributed one article. It is consistent with the Lotka's law that about 60% authors contribute only one paper. The maximum of articles by one author is 14, followed by 11 and 9.

Pao (1985) suggested utilizing Kolmogorov-Smirnov (K-S) test to state the observed author productivity distribution is not significantly different from a theoretical distribution. This method is also recommended and uttered by other researches (Nicholls, 1989; Newby et al., 2003; Ahmed and Rahman, 2009). This test based on the maximum absolute difference to compare expected to actual values for the cumulative frequency distributions. This test is based on the maximum absolute difference between the observed and theoretical cumulative frequency distributions.

This study followed the Pao's recommendation (1985) conducted analysis which calculated the slope n value and the constant c value by using the Kolmogorov-Smirnov examination to confirm whether the TAM literatures consistent with the Lotka's law or not (Tsay, 2004). According to following equation:

$$n = \frac{N\sum XY - \sum X \sum Y}{N\sum X^2 - (\sum X)^2}$$

Where X denotes the log of numbers of paper, Y denotes the log of numbers of author.

The value of n = -2.85422. Then get the constant c value by following equation.

$$c = \frac{1}{\sum_1^{p-1} \frac{1}{x^n} + \frac{1}{(n-1)(p^n-1)} + \frac{1}{xp^n} + \frac{1}{x+2p-1)^{n+1}}}$$

The value of c = 0.81058. Since the value of n and c, $y=c/x^n=0.81058/x^{-2.85422}$.

According to Kolmogorov-Smirnov (K-S) test, if the sampling number is bigger than 35, the threshold value will be 0.0464 ($1.63/1235^{1/2}$ = 0.0464.).The value of Dmax (0.0106) is less than the threshold value. The result matched the generalized Lotka's law, which indicated that the author productivity distribution data in TAM literature consistent with Lotka's law.

5. CONCLUSION

According the analysis, several findings would be discussed as followings: First, technology acceptance model (TAM) is generally regarded as the most momentous theory (Lee et al., 2003) due to the increasing volume of relevant researches in recent years. Researchers have applied this theory into different fields, distinctive circumstances, or essential determinants. Secondly, the main research development countries were U.S., Taiwan, and South Korean as well as authors' institutions in those

countries. And others counties, for example Peoples of China, Canada, England, Spain, Singapore, Netherlands, and Australia, also could be found numbers of relative papers. Third, technology acceptance model has been mainly applied into some subject area such as computer science, management, psychology, operation research, and engineering. Indeed, according to keyword analysis, the result indicated some popular issues that have been discussed which were E-commerce, Internet, and trust. Finally, this research not only identified the core journals with the technology acceptance model researches through the Bradford's law (Bradford, 1934), but tested the Lotka's law (Lotka, 1926) to get the insights of author productivity in this academic area. Future research could use the different analysis such as co-citation to get the deeper comprehension with this model.

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