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An empirical study of research trends and forecasts: Customer relationship management

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This paper surveys customer relationship management (CRM) technology trends and forecasts using bibliometric analysis from 1989 to 2009 with topic as “customer relationship management” in SSCI database. The bibliometric analytical technique is used to examine the topic in SSCI journals from 1989 to 2009, based on the scope of 1121 literatures of CRM. This paper implemented and classified CRM literatures using eight categories for different distribution status in order to explore how CRM technology trends and applications have developed in this period. Also, the paper will perform K-S test to verify the reliability of Lotka’s Law. The analysis provides a roadmap to guide future research and abstract the trend information so that CRM researchers can save some time since core knowledge will be concentrated in core categories. This implies that the phenomenon “success breeds success” is more common in higher quality publications.

Key words: Customer relationship management, technology trend and forecast, bibliometric methodology.

INTRODUCTION

Customer relationship management (CRM) is the method that companies use to interact with customers. The methods include employee training and special purpose CRM software. There is an emphasis on handling incoming customer phone calls and e-mail, although the information collected by CRM software may also be used for promotion, and surveys such as those polling customer satisfaction.

Customer relationship management (CRM) includes a set of processes and activates systems supporting as a business strategy to build long term, profitable relationships with specific customers (Ling and Yen, 2001). Customer data and information technology (IT) tools organize the groundwork upon which any successful CRM strategy is built. Besides, the rapid growth of the Internet and its related technologies has greatly increased the chances for marketing and has transformed the relationships between companies and their customers are managed (Ngai, 2005).

There is no universally accepted definition of CRM,

although, CRM has become widely recognized as an important business approach (Ling and Yen, 2001; Ngai, 2005). Some reference definitions of CRM are:

1. Defined as an enterprise approach to understanding and influencing customer behavior through meaningful communications in order to improve customer acquisition, customer retention, customer loyalty, and customer profitability (Swift, 2001).
2. Treated as the strategic use of information, processes, technology, and people to manage the customer’s relationship with your company (Marketing, Sales, Services, and Support) across the whole customer life cycle (Kincaid, 2003).
3. Defined as a comprehensive strategy and process of acquiring, retaining, and partnering with selective customers to create superior value for the company and the customer. It involves the integration of marketing, sales, customer service, and the supply chain functions of the organization to achieve greater efficiencies and effectiveness in delivering customer value (Parvatiyar and Sheth, 2001).

These definitions highlight the importance of regarding CRM as a universal process of gaining and retaining

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customers, with the support of business intelligence, to maximize the customer value to the organization.

This paper surveys customer relationship management (CRM) technology trends and forecasts using bibliometric analysis from 1989 to 2009 with topic as "customer relationship management" in SSCI database. The bibliometric analytical technique is used to examine the topic in SSCI journals from 1989 to 2009, based on the scope of 1121 literatures of CRM. This paper implemented and classified CRM literatures using eight categories as publication year, citation, country/territory, institute name, document type, language, source title and subject area for different distribution status in order to explore how CRM technology trends and applications have developed in this period. For verifying the result analysis, the paper will perform the following steps to verify the reliability of Lotka's Law: collect data; list author and literature distribution table; calculate n value (slope); calculate c value; utilize K-S (Kolmogorov-Smirnov, K-S) test to evaluate if it matches Lotka's Law (Tsai, 2003).

The study provides a roadmap to guide future research and abstract the trend information so that CRM researchers can save some time since core knowledge will be concentrated in core categories. This implies that the phenomenon "success breeds success" is more common in higher quality publications.

MATERIALS AND METHODS

All documents used in this study were accessed from the database of the Social Science Citation Index (SSCI), obtained by subscription from the ISI, Web of Science, Philadelphia, PA, USA. In this study, we discuss the papers published in the period from 1989 to 2009 because there was no data prior to that year. The Social Sciences Citation Index is a multidisciplinary index to the journal literature of the social sciences. It fully indexes over 1,950 journals across 50 social sciences disciplines. It also indexes individually selected, relevant items from over 3,300 of the world's leading scientific and technical journals.

Bibliometrics is a type of research method used in library and information science. It utilizes quantitative analysis and statistics to describe patterns of publication within a given field or body of literature. Researchers may use bibliometric methods of evaluation to determine the influence of a single writer, for example, or to describe the relationship between two or more writers or works. One common way of conducting bibliometric research is to use the Social Science Citation Index (SSCI), the Science Citation Index (SCI) or the Arts and Humanities Citation Index (A and HCI) to trace citations.

There are some research domains using bibliometric methodology to analyze the trend and forecasts, such as ubiquitous computing, home networking, social capital, e-commerce, supply chain management, data mining and knowledge management (Yin and Chi, 2010; Yin and Yang, 2010; Yin and Chiang, 2010; Tsai, 2011, Tsai and Chi, 2011; Tsai and Chiang, 2011; Tsai and Yang, 2010).

Laws of bibliometrics

One of the main areas in bibliometric research concerns the

application of bibliometric laws. The three most commonly used laws in bibliometrics are: Lotka's law of scientific productivity, Bradford's law of scatter, and Zipf's law of word occurrence.

Lotka's law

Lotka's law describes the frequency of publication by authors in a given field. It states that "the number (of authors) making n contributions is about $1/n^2$ of those making one; and the proportion of all contributors, that make a single contribution, is about 60%" (Potter, 1988). This means that out of all the authors in a given field, 60% will have just one publication, and 15 percent will have two publications ($1/2^2$ times 0.60). Seven percent of authors will have three publications ($1/3^2$ times 0.60), and so on. According to Lotka's law of scientific productivity, only 0.6% of the authors in a field will produce more than 10 articles. Lotka's law, when applied to large bodies of literature over a fairly long period of time, can be accurate in general, but not statistically exact. It is often used to estimate the frequency with which authors will appear in an online catalog (Potter, 1988).

Lotka's law is generally useful for understanding the productivity patterns of authors in a bibliography (Gupta, 1987; Nicholls, 1989; Coille, 1977; Vlachy, 1978; Rao, 1980; Pao, 1985). In this article, Lotka's law is selected to perform bibliometric analysis to check on literature record count versus accumulated authors between 1989 and 2009 to perform author productivity inspection for discovering historical review and collecting the results for research tendency forecast in the near future. For verifying the analysis result, the paper implements K-S test to evaluate if the result matched Lotka's Law.

Bradford's law

Bradford's law serves as a general guideline to librarians in determining the number of core journals in any given field. It states that journals in a single field can be divided into three parts, each containing the same number of articles: (1) a core of journals on the subject, relatively few in number, that produces approximately one-third of all the articles, (2) a second zone, containing the same number of articles as the first, but a greater number of journals, and (3) a third zone, containing the same number of articles as the second, but a still greater number of journals. The mathematical relationship of the number of journals in the core to the first zone is a constant n and to the second zone the relationship is n^2 . Bradford expressed this relationship as $1: n: n^2$. Bradford formulated his law after studying a bibliography of geophysics, covering 326 journals in the field. He discovered that 9 journals contained 429 articles, 59 contained 499 articles, and 258 contained 404 articles. So, it took 9 journals to contribute one-third of the articles, 5 times 9, or 45, to produce the next third, and 5 times 5 times 9, or 225, to produce the last third. As may be seen, Bradford's Law is not statistically accurate, strictly speaking. But it is still commonly used as a general rule of thumb (Potter, 1988).

Zipf's law

Zipf's law is often used to predict the frequency of words within a text. The Law states that in a relatively lengthy text, if you "list the words occurring within that text in order of decreasing frequency, the rank of a word on that list multiplied by its frequency will equal a constant. The equation for this relationship is: $r \times f = k$ where r is the rank of the word, f is the frequency, and k is the constant (Potter, 1988). Zipf illustrated his law with an analysis of James Joyce's *Ulysses*. "He showed that the tenth most frequent word occurred 2,653 times, the hundredth most frequent word occurred 265 times,

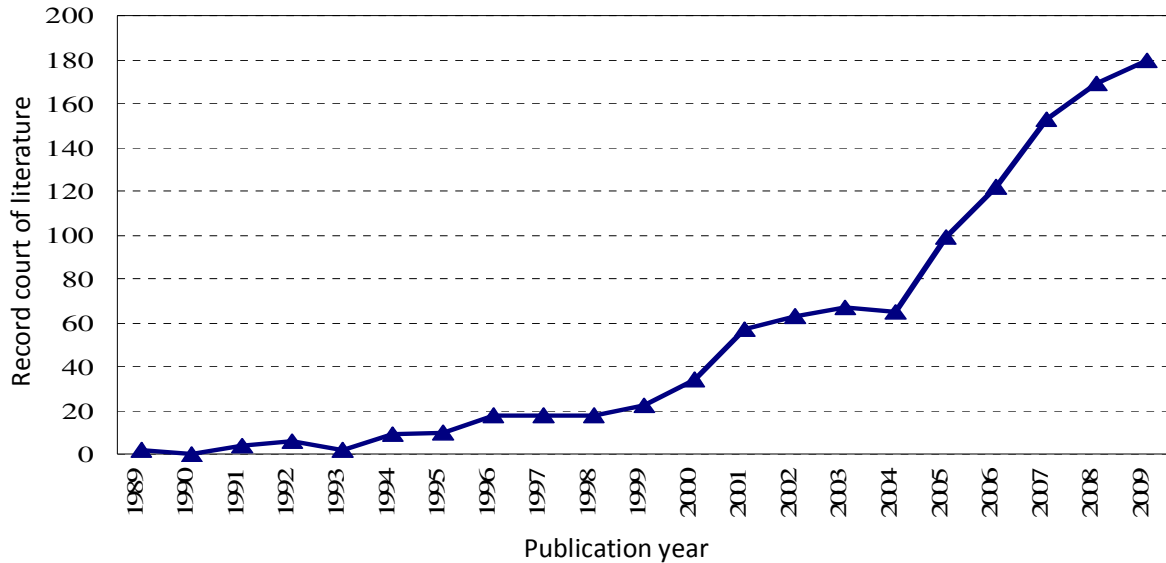


Figure 1. The tendency chart of literature growth of CRM (source: SSCI database).

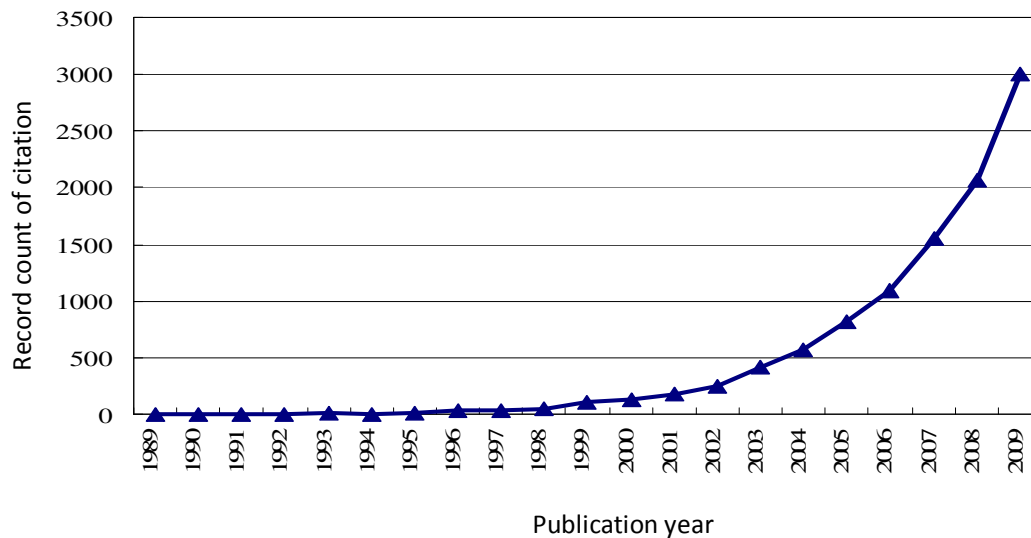


Figure 2. Citation status in each tear of CRM (source: SSCI database).

the two hundredth word occurred 133 times, and so on. Zipf found, then that the rank of the word multiplied by the frequency of the word equals a constant that is approximately 26,500" (Potter, 1988). Zipf's Law, again, is not statistically perfect, but it is very useful for indexers.

RESEARCH FINDING AND DISCUSSION

Distribution by publication year

The literature production of CRM has been rising since 1999 (Figure 1). The article distribution can be divided into three segments for development trend; these are 1989 to 1998, 1999 to 2003 and 2004 to 2009 three

periods. From 1989 to 1998, CRM did not draw many researchers' attention, the publication productivity per annum steadily increased, followed by a fast growth between 1999 and 2003 and reached by a sharp growth in 2006, rapidly peaked in 2009. The status demonstrates that CRM still has the potential to keep growing up scientifically in the future.

Distribution by citation

We can figure out that the citation distribution is increasing gradually and smoothly (Figure 2). The result

Table 1. Distribution of top 25 countries/territories and institution names 1989 to 2009 (source: SSCI database).

Ranking	Countries/ territories	NP	% of 1121	Institution names	NP	% of 1121	Country
1	USA	502	44.78	University of Wisconsin	18	1.61	USA
2	England	130	11.60	Michigan State University	16	1.43	USA
3	Taiwan	77	6.87	University of Connecticut	16	1.43	USA
4	Australia	48	4.28	University of Michigan	16	1.43	USA
5	Germany	48	4.28	Hong Kong Polytechnic University	15	1.34	China
6	Canada	45	4.01	University of Maryland	15	1.34	USA
7	China	43	3.84	University of Texas	15	1.34	USA
8	Spain	41	3.66	University of Melbourne	13	1.16	Australia
9	Netherlands	35	3.12	University of North Carolina	13	1.16	USA
10	Belgium	27	2.41	University of Pennsylvania	13	1.16	USA
11	Finland	27	2.41	Cranfield University	12	1.07	UK
12	South Korea	26	2.32	Erasmus University	12	1.07	Netherlands
13	Italy	19	1.69	Northwestern University	12	1.07	USA
14	France	18	1.61	University of Central Florida	12	1.07	USA
15	New Zealand	18	1.61	Arizona State University	11	0.98	USA
16	Sweden	18	1.61	Stanford University	11	0.98	USA
17	Scotland	15	1.34	University of Warwick	11	0.98	UK
18	Singapore	15	1.34	Duke University	10	0.89	USA
19	Ireland	13	1.16	Georgia State University	10	0.89	USA
20	Greece	12	1.07	London Business School	10	0.89	UK
21	Denmark	11	0.98	National Cheng Kung University	10	0.89	Taiwan
22	Israel	11	0.98	University of Ghent	10	0.89	Belgium
23	Austria	8	0.71	Boston College	9	0.80	USA
24	India	8	0.71	Dartmouth College	9	0.80	USA
25	Malaysia	8	0.71	Emory University	9	0.80	USA

NP=number of publication.

indicates that an existing upward trend is expected to continue in the future.

Distribution by country/territory

USA, England and Taiwan are the top three country/territory ranking and the sum of the research output reaches 63.25% of the total publication. Australia, Germany and Canada also become the major academic work providers in the field of CRM (Table 1).

Distribution by institution name

U. of Wisconsin is the number 1 author affiliation in CRM research domain with 18 record counts (1.61%), Michigan State U., U. of Connecticut and U. of Michigan are all number 2 author institution in CRM research domain with 16 record counts (1.43%) (Table 1). After analyzing the locations of these affiliations, USA is still the most productive country within the research aspect in the world as well.

Distribution by subject area

It is very critical for future research trend and forecasts to summarize the information for CRM researchers to get better understanding about the distribution of major disciplines. The top three ranking of CRM research domains are business (468 record counts, 41.75%), followed by management (460 record counts, 41.03%) and operations research and management science (141 record counts, 12.58%) (Table 2). Besides, the analysis also figures out that there are other main research disciplines for CRM literature production such as industrial engineering, computer science, information systems, information science and library science, applied psychology, computer science and artificial intelligence, manufacturing engineering and computer science and interdisciplinary applications.

Distribution by source title

It is very important to highlight the data for CRM researchers to get close approaching to the distribution of top 25 journal title in future research trend and forecasts.

Table 2. Distribution of top 25 subject areas and source titles from 1989 to 2009 (source: SSCI database).

Ranking	Subject area	NP	% of 1121	Source title	NP	% of 1121
1	Business	468	41.75	Industrial Marketing Management	69	6.16
2	Management	460	41.03	Journal of Marketing	44	3.93
3	Operations Research and Management Science	141	12.58	Total Quality Management and Business Excellence	35	3.12
4	Engineering, Industrial	76	6.78	International Journal of Service Industry Management	33	2.94
5	Computer Science, Information Systems	64	5.71	Journal of Business Research	28	2.50
6	Information Science & Library Science	59	5.26	Expert Systems with Applications	26	2.32
7	Psychology, Applied	55	4.91	Service Industries Journal	24	2.14
8	Computer Science, Artificial Intelligence	44	3.93	Industrial Management and Data Systems	23	2.05
9	Engineering, Manufacturing	37	3.30	International Journal of Operations and Production Management	21	1.87
10	Computer Science, Interdisciplinary Applications	35	3.12	Supply Chain Management-an International Journal	21	1.87
11	Economics	31	2.77	European Journal of Marketing	19	1.69
12	Engineering, Electrical & Electronic	26	2.32	Journal of Marketing Research	19	1.69
13	Industrial Relations and Labor	18	1.61	Journal of Service Research	19	1.69
14	Computer Science, Software Engineering	17	1.52	Journal of the Academy of Marketing Science	19	1.69
15	Anthropology	16	1.43	Journal of Product Innovation Management	16	1.43
16	Health Policy and Services	15	1.34	Journal of Business and Industrial Marketing	15	1.34
17	Engineering, Multidisciplinary	14	1.25	Decision Sciences	14	1.25
18	Ergonomics	14	1.25	Decision Support Systems	14	1.25
19	Public Administration	13	1.16	European Journal of Operational Research	14	1.25
20	Public, Environmental and Occupational Health	12	1.07	Management Science	14	1.25
21	Behavioral Sciences	11	0.98	Marketing Science	14	1.25
22	Communication	11	0.98	International Journal of Production Economics	13	1.16
23	Psychology	11	0.98	Journal of Retailing	12	1.07
24	Archaeology	10	0.89	MIT Sloan Management Review	12	1.07
25	Health Care Sciences and Services	10	0.89	International Journal of Electronic Commerce	11	0.98

NP=number of publication.

The top three ranking of CRM research sources are industrial marketing management (69 record counts, 6.16%), followed by journal of marketing (44 record counts, 3.93%) and total quality management and business excellence (35 record counts, 3.12%) (Table 2). Moreover, it also discovered that there are major research sources

for CRM literature production such as international journal of service industry management, journal of business research, expert systems with applications, service industries journal, industrial management and data systems, international journal of operations and production management and supply chain management: an international

journal.

Distribution by document type

The distribution of document type from 1989 to 2009 indicates that the most popular publication

Table 3. Distribution of document types and languages from 1989 to 2009 (source: SSCI database).

Document type	NP	% of 1121	Language	NP	% of 1121
Article	936	83.50	English	1092	97.41
Review	76	6.78	German	9	0.80
Proceedings Paper	74	6.60	Spanish	7	0.62
Editorial Material	15	1.34	Czech	3	0.27
Book Review	13	1.16	Slovak	3	0.27
News Item	4	0.36	French	2	0.18
Correction	2	0.18	Portuguese	2	0.18
Note	1	0.09	Japanese	1	0.09
Total	1121	100	Russian	1	0.09
			Swedish	1	0.09
			Total	1121	100

NP=number of publication.

document type is article (936 record counts, 83.50% (Table 3). The result demonstrates that article is the major trend of literature format in CRM research domain.

Distribution by language

English is the major language for CRM researchers in their academic works (1092 record counts, 97.41%) (Table 3). The status indicates that English is still the main tendency in CRM research domain.

The literatures productivity analysis of CRM by Lotka's law

The following steps will be used to verify the reliability of Lotka's Law:

- i. Collect data
- ii. List author and literature distribution table
- iii. Calculate n value (slope)
- iv. Calculate c value
- v. Utilizing K-S test to evaluate if the result matched Lotka's Law

Collect data, list author and literature distribution table

This calculated the author quantity by the equality method from 1121 literatures which were retrieved by index on SSCI. Thus, it obtained altogether, 2267 of authors on research aspect of CRM (Table 4). According to Table 4, this would be a total of 2739 articles with 2267 authors with an average of 0.83 authors for each article. The result indicates that the literatures of CRM were usually generated by a single author.

Calculate n value (slope)

By the result of the calculation in Table 5, it could be brought into Lotka's Law's equation to calculate n value:

$$n = \frac{N \sum XY - \sum X \sum Y}{N \sum X^2 - (\sum X)^2} \quad (1)$$

Table 5 shows the values in the equation,

$$n = \frac{16 * (3.94) - (13.32) * (10.68)}{16 * (12.85) - (13.32) * (13.32)} \quad (2)$$

Then n = -2.815262

Calculate c value

After that, we also found c = 0.8038094, the equation is as shown thus:

$$c = \frac{1}{\sum_1^{p-1} \frac{1}{x^n} + \frac{1}{(n-1)(p^{n-1})} + \frac{1}{2p^n} + \frac{n}{24(p-1)^{n+1}}} \quad (3)$$

P = 20

x = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

When we got n = -2.815262 and c = 0.8038094, it explored:

$$f(x) = \frac{0.8038094}{x^{2.815262}} \quad (4)$$

Table 4. Distribution of author productivity of CRM.

NP	Author(s)	NP	Accumulated record	Accumulated record (%)	Accumulated author (s)	Accumulated author(s) (%)
16	1	16	16	0.58	1	0.04
15	0	0	16	0.58	1	0.04
14	0	0	16	0.58	1	0.04
13	0	0	16	0.58	1	0.04
12	0	0	16	0.58	1	0.04
11	0	0	16	0.58	1	0.04
10	2	20	36	1.31	3	0.13
9	1	9	45	1.64	4	0.18
8	0	0	45	1.64	4	0.18
7	2	14	59	2.15	6	0.26
6	5	30	89	3.25	11	0.49
5	8	40	129	4.71	19	0.84
4	13	52	181	6.61	32	1.41
3	56	168	349	12.74	88	3.88
2	211	422	771	28.15	299	13.19
1	1968	1968	2739	100.00	2267	100.00

NP: number of publication.

Table 5. Calculation of the exponent n for CRM.

NP (x)	Author(y)	X=log(x)	Y=log(y)	XY	XX
16	1	1.20	0.00	0.00	1.45
15	0	1.18	--	--	1.38
14	0	1.15	--	--	1.31
13	0	1.11	--	--	1.24
12	0	1.08	--	--	1.16
11	0	1.04	--	--	1.08
10	2	1.00	0.30	0.30	1.00
9	1	0.95	0.00	0.00	0.91
8	0	0.90	--	--	0.82
7	2	0.85	0.30	0.25	0.71
6	5	0.78	0.70	0.54	0.61
5	8	0.70	0.90	0.63	0.49
4	13	0.60	1.11	0.67	0.36
3	56	0.48	1.75	0.83	0.23
2	211	0.30	2.32	0.70	0.09
1	1968	0.00	3.29	0.00	0.00
Total	2267	13.32	10.68	3.94	12.85

NP= number of publication; x= number of publication; y=author; X = logarithm of x; Y = logarithm of y.

Referring to the datum from Table 4, authors with only one literature is 86.81% (100 - 13.19%), which is close to primitive c value 80.38% generated by Lotka's law. After that, it can follow the calculation to get n and c value by the least squares law, carry onto the further proceeding examination for Lotka's law compliance.

According to Pao's (1989) suggestion, the absolute value of n should be between 1.2 and 3.8 which, formed by the generalized Lotka's Law, matches the reference

data by observation. The distribution chart is as shown in Figure 3.

Utilizing K-S (Kolmogorov-Smirnov, K-S) test to evaluate if matched Lotka's Law

For discussing the value of n and c, we got $n = -2.815262$ and $c = 0.8038094$ generated by Lotka's Law, the result

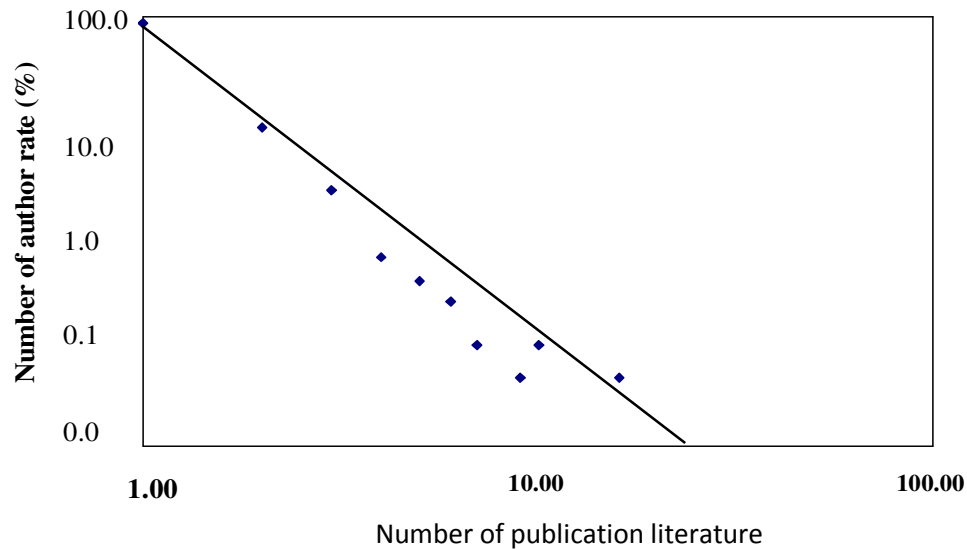


Figure 3. Distribution of literature productivity of author on CRM research aspect.

Table 6. The K-S test for CRM.

NP	Observation by author(s)	Accumulated value Sn(x)	Expected value by author(s)	Accumulated value Fo(x)	ABS value Fo(x)-Sn(x)
1	0.8681	0.8681	0.8038	0.8038	0.0643
2	0.0931	0.9612	0.1142	0.9180	0.0432
3	0.0247	0.9859	0.0365	0.9545	0.0314
4	0.0057	0.9916	0.0162	0.9707	0.0209
5	0.0035	0.9951	0.0087	0.9794	0.0158
6	0.0022	0.9974	0.0052	0.9845	0.0128
7	0.0009	0.9982	0.0034	0.9879	0.0103
8	0.0000	0.9982	0.0023	0.9902	0.0080
9	0.0004	0.9987	0.0017	0.9919	0.0068
10	0.0009	0.9996	0.0012	0.9931	0.0065
11	0.0000	0.9996	0.0009	0.9940	0.0055
12	0.0000	0.9996	0.0007	0.9948	0.0048
13	0.0000	0.9996	0.0006	0.9954	0.0042
14	0.0000	0.9996	0.0005	0.9958	0.0037
15	0.0000	0.9996	0.0004	0.9962	0.0033
16	0.0004	1.0000	0.0000	0.9962	0.0038

NP= number of publication; Sn(x) = observed cumulative frequency; Fo(x) = theoretical cumulative frequency; D = maximum deviation.

demonstrated that the CRM literature author distribution and the primitive Lotka's Law are matched approximately (Figure 3). In order to examine whether the theoretical value and the observation value are tallied, the study uses K-S test to evaluate the suitability of Lotka's Law. Regarding the n and c value which gained by the formula, it is possible to calculate the expected value and the accumulation value of author, following by K-S test examination. From Table 6, we can find Dmax (Dmax = ABS Value Fo(x)-Sn(x)) = 0.0643. According to K-S test,

the threshold value is:

$$1.63 / \sqrt{2267} = 0.032234 \quad (5)$$

Because Dmax is larger than the K-S test threshold value, the result also indicated that the distribution of author productivity is not matched by the Lotka's Law. The consequence means the Lotka's Law is not suitable for the literature author productivity distribution in CRM research domain (Potter, 1981).

Conclusion

This paper analyzes CRM technology trends and forecasts by bibliometric analysis from 1989 to 2009 with topic as "customer relationship management" in SSCI database. The bibliometric analytical technique was used to examine the topic in SSCI journals from 1989 to 2009, based on the scope of 1121 literatures. This paper surveys and classifies CRM literatures using eight categories as: publication year, citation, country/territory, institute name, document type, language, subject area and source title for different distribution status in order to explore how CRM technologies and applications have developed in this period and analyze CRM and CRM technology forecasts under the above result. Also, the paper performs K-S test to verify the reliability of Lotka's Law. The results contributed in this paper have several important implications:

- i. Based on the distribution of publication year, CRM still has the potential to keep growing up in the future.
- ii. An existing upward trend is expected to continue in the future from the distribution of citation.
- iii. USA, England and Taiwan are the top three countries/territories and the sum of the research output reaches 63.25% of the total publication. Australia, Germany and Canada also become the major academic work providers in the field of CRM.
- iv. U. of Wisconsin is the top specific scholarly affiliation in CRM research domain. After analyzing the locations of these affiliations, USA is still the most productive country within the research aspect in the world as well.
- v. Article is the main trend of document type in the research domain.
- vi. English is still the major tendency of language in the research domain.
- vii. The most relevant disciplines for CRM subject category provided by business, management, operations research and management science, industrial engineering, computer science, information systems, information science and library science, applied psychology, computer science and artificial intelligence, manufacturing engineering and computer science and interdisciplinary applications and they will become the most important categories for CRM researchers.
- viii. The most enthusiastic supports for CRM scholarly publishing enterprise come from industrial marketing management, journal of marketing, total quality management and business excellence, international journal of service industry management, journal of business research, expert systems with applications, service industries journal, industrial management and data systems, international journal of operations and production management and supply chain management-an international journal and they will turn into the most critical journals for CRM researchers.
- ix. The distribution of author productivity result indicates that the literature of CRM was usually generated by

single author.

x. According to Kolmogorov-Smirnov test, the distribution of frequency indexes of author productivity is suitable for Lotka's Law.

The analysis provides a roadmap to guide future research and abstract the trend information so that CRM researchers can save some time since core knowledge will be concentrated in core categories. This implies that the phenomenon "success breeds success" is more common in higher quality publications.

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