The Bibliometrics Analysis of Customer Knowledge Management Based on Co-Word Analyses

LIU Yong[a],*; WANG Yongqing[a]

[a]School of Business Administration, South China University of Technology, Guangzhou, China
*Corresponding author.

Abstract

Customer knowledge management (CKM) is a crucial element in the field of knowledge management. By retrieving journal articles with the descriptor words "customer knowledge management" in WOS database, the author selects 3587 journal papers as the research object, then analyses the papers through bibliometrics. Researches show that the research on CKM is in accordance with Place's curve, which is valuable to study. The focus in the field of CKM is similar at home and abroad, especially some crossing field. Existing research can be divided into three themes: analyzing and mining customer knowledge management from the theory of technology/process, using customer knowledge to manage from the perspective of comprehensive/holism, sharing and interacting knowledge of enterprise both interiorly and exteriorly from the perspective of target/process.

Key words: CKM; Management; Co-words analysis

INTRODUCTION

With the advent of the knowledge economy, knowledge management has become the focus of corporate attention. Knowledge is considered to be a key factor in business— a competitive advantage, with customer knowledge being an important source of knowledge enterprise, industry and academia have gradually received attention.

Customer Knowledge Management (CKM) is a relatively new research concept. Wayland R Eand Cole PM (1997) refers CKM to be the insight into the source of customer knowledge, learning to use and applying information technology to build more profitable customer relationships. It is an extension of the customer relationship management (CRM). Harald Salomon (2005) argues that CKM however refers to effectively managing and utilizing existing knowledge and knowledge of customer needs. Besides the customer's knowledge includes: Knowledge about customers and customers has the knowledge. Itami, Nishino（2010）believe that the purpose of CKM is to have a better understanding of the target business customers (such as customer transaction records, product use and some personal preferences) and accumulated knowledge of customers in long-term operations.

In order to study research hotspots and trends in the field of customer knowledge management, this paper adopts the method keywords change trend and co-word analysis, showing the tendency of keywords and classification of existing research.

1. DATA ANALYSIS AND RESEARCH METHOD

1.1 Data Sources

Foreign literature retrieved from the Web of Science (WOS) database, on September 26, 2014. This paper select Core collection of Web of Science, literature types including Article, Meeting and Review papers, retrieval time range is 1998-2014，then use "customer knowledge management" as subject term to select 3,587 references. Based on the number of documents and keywords statistics (Figure 1), keyword frequency total

11,648 times, each paper has a 3.25 average keywords. The research about customer knowledge management increases rapidly before 2009, and in 2010-2013 to 340 papers published every year
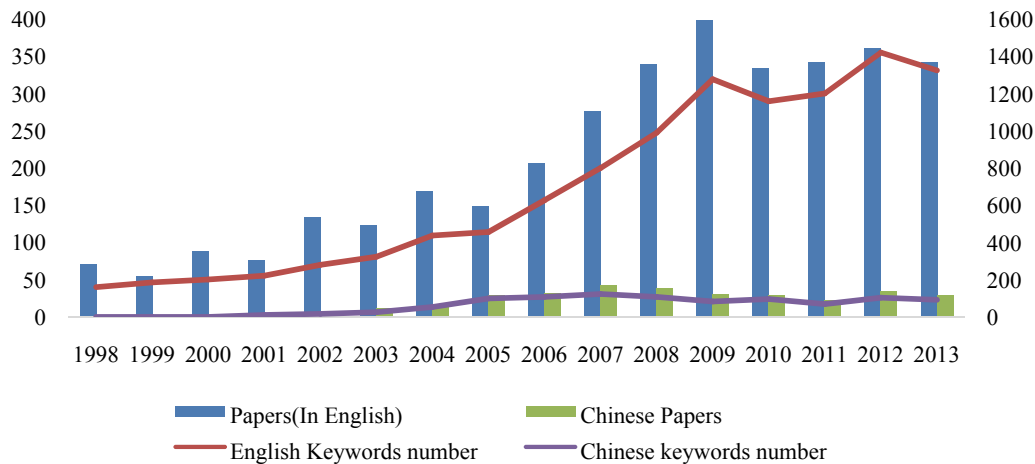
Figure 1
The Number of Customer Knowledge Management at Home and Abroad Research Literature and Keyword Frequency Annual Changes

Chinese literature data from China national knowledge infrastructure database. Select "customer knowledge management" as the key words, the result shows 324 references, keyword frequency total 1,011 times, average 3.12 each literature keywords. Between 2001 and 2007, the number of papers increased year by year, and in 2007 the total number of articles reached a climax, the overall maintained at about 30.

American intelligence experts Derek De Solla Price found that the growth of the scientific literature exponential function relation with time. This function is called Place's curve. Studies have shown that price curve of discipline has a better fitting results in the birth and development phase. Take foreign literatures as an example, the annual amount papers are represented by Y, and the time series from 1998 to 2013 is represented by t (1-16). Fitting function:, then the result:.
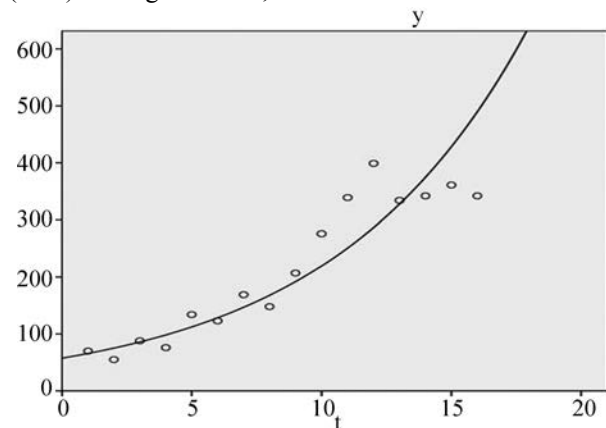
Figure 2
Place's Curve Based on Foreign Literatures

T-test result show in Table 1, P values of the two parameters (a, b) were 0.000, 0.000, that is to say, the result under the significant level of 0.001 is able to pass test. F-test's P value is.000, indicating that the overall model can be tested, and the goodness index of the model R^2 is 0.902, indicating this model can explain the relationship between the number of customer knowledge management Papers and timing of change. Meanwhile, the curve can predict the future status of issued related study do not reach saturation, there is still much research space.

Table 1
The Parameters of T Test Table

	Unstandardized discriminant coefficient		t	Sig.
	B	**Standard error**		
b	.134	.012	11.349	.000
a	57.519	6.560	8.768	.000

1.2 Research Method

Co-word Analysis are first proposed by the French literature metrologists M.C allon, J.L aw and A.R IP, which has a good application effect on the research hotspots. Co-word analysis application research is widespread at home and abroad, involving multiple disciplines, but the research of management discipline is less, so there is a lot yet to be excavated research space. Co-word analysis method involves three methods: cluster analysis, factor analysis, and Multi-Dimensional Scaling analysis.Keywords are an important feature of literature researches, which can concise accurately reflect the theme of the literature content, showing that the research purpose and the object of the article, so keywords can represent the literature research field and reveal a research focus in the field of change.

Emerging field of study is usually less research scholar, cited instability and has not formed a fixed academic

schools. Compared with cited method, co-word analysis based on keywords direct statistical analysis, which can applied to investigate the focus of the existing literature study, suitable for the emerging disciplines and new themes。

Firstly，this paper retrieve the literature of customer knowledge management, and extract the high frequency keywords, then build the high frequency keywords word matrix, at last use multi-dimensional scale map to analyze customer knowledge management major research topics.

2 CO-WORD ANALYSIS

2.1 Keywords Frequency Analysis

According to the high-low frequency words boundary fraction proposed by Donohue: $T=-1+0.5*\sqrt{1+8I}$ (I means the total number of keywords), the formula determines cut-off point of high-low frequency words. According to the number of keywords at home and abroad, the T values 123 and 37 respectively. If this is a standard, customer knowledge management at home and abroad only have four keywords meets the requirements. This paper selects the keywords with the highest 15th at home and abroad, high frequency keywords are almost same. In terms of data mining, supply chain management and e-commerce, research literature abroad far more than domestic (Table 2).

Table 2
The Key Word Frequency Statistics (15th)

Chinese keywords list	Word frequency	Foreign language keywords list	Word frequency
CKM	184	Knowledge management	339
Customer knowledge	74	CRM	179
Knowledge management	56	Data mining	170
CRM	48	Management	154
CKM ability	17	Knowledge	122
Data mining	14	Innovation	110
Customer value	17	Customer	82
Knowledge sharing	9	Supply chain management	76
Empirical study	8	Performance	58
Performance evaluation	8	Customer knowledge management	50
Knowledge transfer	7	E-commerce	50
Customer knowledge acquisition	7	Marketing	50
Enterprise competition	6	Customer satisfaction	48
Corporate	6	Intellectual capital	47
Knowledge economics age	6	Customer knowledge	42

The data of high frequency keywords from 2008 to 2013 can be divided into four trends: downward trend, steady trend, rising trend and the rapid increase (RI). The high frequency keywords changes in six years as shown in Table 3. Specific changes are as follows

a) Downward trend: Knowledge management, customer knowledge management and customer knowledge, because the in-depth study of knowledge management, research priorities subdivided into multiple related keywords.

b) Rising trend: CRM, customer and so on, these keywords may become a hot topic for future research, especially on the relationship between knowledge management and performance, intellectual capital and supply chain management affect relations.

c) The rapid increase: Innovation, E-commerce, Marketing and Customer satisfaction, researchers must focus on this subject, which reflects that the combination of customer knowledge management and other fields, and create a new academic field.

d) Steady trend: data mining and management.

Table 3
The High Frequency Keywords Changes

Keywords list	2008	2009	2010	2011	2012	2013	Trend
Knowledge management	47	44	32	37	29	21	Downward
Customer relationship management	14	25	20	20	23	17	Rising
Data mining	15	28	15	11	14	15	Steady
Management	15	16	15	18	21	9	Steady
Knowledge	16	21	10	12	18	10	Downward
Innovation	10	15	8	20	16	16	RI
Customer	9	10	9	9	12	9	Rising
Supply chain management	7	4	7	9	12	6	Rising
Performance	7	7	6	9	5	10	Rising
Customer knowledge management	8	3	3	9	5	6	Downward
E-commerce	1	8	5	4	2	5	RI
Marketing	3	8	1	7	6	13	RI
Intellectual capital	4	12	3	2	9	5	Rising
Customer satisfaction	3	5	3	10	10	6	RI
Customer knowledge	7	7	2	4	2	5	Downward

2.2 Co-Word Matrix

First of all, this paper established a keyword matrix, and then translate co-word matrix into correlation matrix. The value shows the distance of the two key words, the bigger

the better. The value is small, showing that the farther distance between two keywords. There are too much "0" in the similarity matrix, and it leads to error is too large, so this paper generates dissimilarity matrix based on co-word matrix. The calculation method of similarity matrix: Ochiia coefficient $= \frac{C_{AB}}{\sqrt{AB}}$, C_{AB} is the number of keywords A and keyword B appear together, A and B are respectively the number of keywords A and keyword B. Finally, this paper select the frequency is greater than or equal to 40 times, forming dissimilarity matrix 58×58 (Table 4).

Table 4
Dissimilarity Matrix (Part)

|	KM	CRM	Data mining	Management	...
KM	0	0.9895	0.9991	0.9976	...
CRM	0.9895	0	0.9756	0.9926	...
Data mining	0.9991	0.9756	0	0.9986	...
management	0.9976	0.9926	0.9986	0	...
...	...	...	...	...	...

2.3 Multidimensional Scaling Analysis

In multidimensional scaling map, the object that being analyzed are continuously stellate distributed to punctate distribution, what's more, Position between each point represents the similarity between objects, and then highly similar objects together to form a category. Multidimensional scaling base map is multidimensional scaling analysis of high-frequency two-dimensional matrix distinct keyword-scale analysis, to obtain the corresponding results related to the visual results. Multidimensional scaling map is based on multidimensional scaling, select the "Measure-ALSCAL (distance data, symmetrical shape)" function in SPSS19.0 statistical software, then the results shown in Figure 3.

According to Figure 3, the current research about CKM can be divided into three areas by research content and level.

Topic A：Based on technology / process analysis on the customer's knowledge analysis and mining, Topic A stress the important role of information technology as well as the main operational processes of customer knowledge management，which led to the corporate find valuable information and content. Through customer knowledge acquisition, sharing, innovation and application, it is easy to exert the leverage of customer knowledge to select and manage customers, and constantly optimize the customer value. In addition, decision's makers can make accurate and timely decisions, improve innovation ability, avoid repetitive labor and mistakes. It is noteworthy that in the Internet economy era, customer knowledge management is more important, because the Internet technology is more convenient to collect and store large amounts of user data, that is to say, customer data analysis and data mining is big data in the application of CKM.
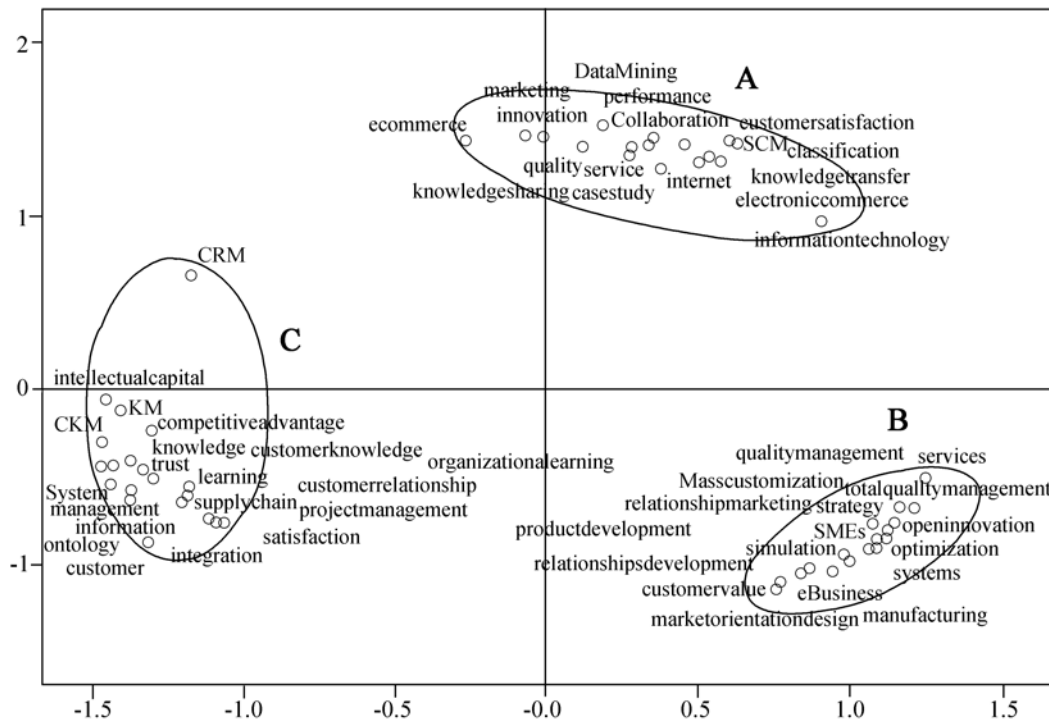
Figure 4
Keywords Multidimensional Scale Map

Topic B：Elaborating knowledge management from a comprehensive / holistic view, Topic B is based on functions of the company, as well as it considers customer knowledge management is customer relationship

management and knowledge management integration. Through specific methods and systems, other resources of the enterprise and customer knowledge together to create and enhance their ability to service customers and competitive advantages, and further optimize the value chain through the relevant corporate functions. Employees are the most important capital of the enterprise, because the employees are carriers of knowledge, but also the body of knowledge generation, so the study that human resource management practices enhance the ability of CKM from the perspective of knowledge management, propose ideas about mechanism of organizational performance. Some scholars believe that companies can use social media to support customer knowledge management strategy, not only apply to Internet companies, but also to traditional companies. Customer knowledge management applications in the enterprise consist of three levels：to manage the required knowledge for the customers, to manage the knowledge from the customers, and to manage the knowledge between the customers. Enterprises should make use of Internet technology forums and community, and improve the communication and exchange mechanism,

Topic C：Exploring the knowledge interaction and sharing among the enterprise and its internal and the external environment from the target / process point, Topic C emphasizes the knowledge interaction and sharing between customers and the internal and external stakeholders of the enterprise. The goal of Customer knowledge management is to improve enterprise competitive advantage and corporate performance. Customer knowledge management process is accompanied by digging deep customer knowledge and value rising. In order to serve our customers better and build the organization core competencies, it is necessary to invest in interactive learning, and increase customer conversion barriers that the cost to entry new competitors. For example, Customers participate in new product research and development, the customer is an important external information source of the enterprise. Enterprise can understand customer expectations of products and the potential demand, and reduce the risk of development of uncertainty, enhance research and development success rate in research and development stage, A combination of both can speed up the delivery of new products, improve product quality and customer satisfaction, the enterprise in new product development process, the customer as important participants, can realize win-win.

SUMMARY AND PROSPECT

This paper chooses 3,587 articles whose subjects are on the customer knowledge management from the WOS database as research object, carries out a common words analysis of a total of 7,761 keywords, draws out a knowledge network of high frequency keywords, and categorizes the fields of the knowledge management and research of foreign customers. This thesis discovers the following 3 points.

Firstly, as for the number of the published articles, the number of documents in the field of customer knowledge management is increasing year by year, and the trend of the published article volume and the change of time in the field of customer knowledge management is in line with the Price's curve, which show that there is still a lot of research space in this field.

Secondly, the research focuses both at home and abroad stay the same, and on the whole they keep pace with each other. The differences are that in foreign counties, the researches on such aspects as customer knowledge management, data mining, management of supply chains, e-commerce, and so on, are deeper. In addition, the combination of innovation, e-commerce, marketing and customer satisfaction degree and the field of customer knowledge management created a new academic intersection, which should be paid attention to by scholars.

Finally, the study on customer knowledge management is divided into three aspects: To analyze the customer knowledge and dig out the valuable customer information and content from the technical/ process theory, so as to optimize the customer value; to take use of the knowledge management from a comprehensive / overall perspective, namely the customer knowledge management based on the functional perspective of the company, which includes three levels: to manage the required knowledge for the customers, to manage the knowledge from the customers, and to manage the knowledge between the customers; to explore the knowledge interaction and sharing among the enterprise and its internal and the external environment from the target / process point, and to emphasize the knowledge interaction and sharing between customers and the internal and external stakeholders of the enterprise in perspective of knowledge management.

Some problems in this paper are worth further thinking. Although the keywords reflect the core idea of literature, they are mostly subjective judgments and will affect the objectivity of the keywords analysis. In the latter research, it can focus on the study on the research organization, the citation analysis and the highly cited papers in the field of customer knowledge management.

REFERENCES

Alton, Y., K., & Chua, S. B. (2013). Customer knowledge management via social media: The case of starbucks. *Journal of Knowledge Management, 17*(2), 237-249

Carbonell, P., et al. (2009). Customer involvement in new service development: An examination of antecedents and outcome. *Journal of Product Innovation Management, 26*(5), 536-550.

Chen, J., Damanpour, F., & Reilly, R. P. (2010). Understanding antecedents of new product development speed: A meta-analysis. *Journal of Operations Management, 28*(1), 17-33.

Feng, Xu., Lu, R. Y., & Peng, L. (2009). Research on the relationships between work motivation received self-efficacy and employee' individual innovation behavior in Chinese service industry. *R&D Management,* (6), 42-48.

Huang, F., Qing, H., Hua, W. N., Liu, Y. H., & Yin, Z. M. (2013). Research focus and groups of authors in field of international digital library. *Journal of Intelligence, 32*(1), 118-123.

Itami, H., & Nishino, K. (2010). Killing two birds with one stone. *Long Range Planning, 43,* 364-369.

Khodakarami, F., & Chan, Y. E. (2014). Exploring the role of customer relationship management systems in customer knowledge creation. *Information & Management, 51*(1), 27-42.

Lin, R. J., Chen, R. H., & Chiu, K. K. S. (2010). Customer relationship management and innovation capability: An empirical study. *Industrial Management and Data Systems, 110* (1), 111-133.

Lopez-Nicolas, C., & Molina-Castillo, F. J. (2008). Customer Knowledge Management and E-commerce: The role of customer perceived risk. International Journal of Information Management, *28*(2), 102-113.

Presutti, M., Boari, C., & Fratocchi, L. (2007). Knowledge acquisition and the foreign development of high-tech start-ups: A social capital approach. *International Business Review.*

Rowley, J. E. (2002). Reflections on customer knowledge management in e-business. *Qualitative Market Research,* (5), 268-280

Tuzhilin, A. (2012). Customer relationship management and Web mining: The next frontier. *Data and Knowledge Discovery, 24*(3), 584-612

Wayland, R. E., & Cole, P. M. (1997). *Customer connections: New strategies for growth.* Boston: Harvard Business School Press.

Wei, R. B. (2006). Based on analysis of keyword research topics of information science. *Information Science,* (9), 1400-1404.

Wu, X. Q. (2012). Based on keywords co-occurrence frequency hot spot analysis method study. *Information Studies: Theory & Application, 35*(8), 115-119.

Zhang, H. Q., & Lu, R. Y. (2012). The empirical research of the effect of customer knowledge management on service innovation capability. *Science of Science and Management of S. & T., 33*(8), 66-73.