# A Method to Build Core Article Ranked Lists in Interdisciplinary Department and Journal

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***Abstract***

*Due to the tremendous increase and variation in serial publications, faculties in university departments are finding it difficult to collect, generate and update their departmental core article ranked lists regularly and accurately. In addition, both students and researchers are finding it difficult to find and study the most significant papers for their departments or interested journals. Furthermore, editors want to trace and analyze the more highly cited articles published in their journals over different time spans. Therefore, the evaluation of a departmental and journal core article ranked list is an important task for faculties, students and editors. In this study, a Computer-Aided Paper Bibliometric System was implemented and four article citation ranking indicators (RCC, TCC, R/T PI and R/T CH) were proposed in order to generate a departmental and journal core article ranking list. These four indicators were designed to satisfy different audiences' requirements. Four departments and ten journals were taken as samples, with a Department of Information Management and journal of MIS Quarterly as the major one. Several citation patterns were found. All Turning Points (TP) were located at the 4th segment (TP Site: 0.28) for all departments and journals by the TCC indicator. Through the RCC indicator, TPs from different departments or journals were classified into two types. The TP site of Type I was 0.07 and Type II was 0.14. Both RCC and TCC also have their own similar scatter charts. These patterns could be helpful in deciding the core article area or evaluating the experiment results. After comparing these four indicators via the Coefficient of Correlation, both RCC and TCC can obtain more than 0.5 and 0.9 correlation factors with their own extended indicators. The experimental results show that (TCC, TPI, TCH) and (RCC, RPI, RCH) were measured to be at an acceptable level.*

***Keywords:*** *Computer-Aided Bibliometric System; Departmental core article; Journal core article; Citation analysis; Paper ranking*

## Introduction

Owing to the great increase in the number of serial publications, educational university faculties are finding it hard to collect and filter significant articles for their departments. Students or beginning researchers need to select and study outstanding articles in order to have an overall research picture for their departments. Senior scholars or editors want to know and analyze the most highly-cited papers in their relevant journals over different time spans. As a result, we propose a Computer-Aided Paper Bibliometric System and design four ranking indicators in order to generate a core article ranking list of departments and journals for the academic community. The four ranking indicators are TCC (Total Cited Counts), RCC (Reference Cited Counts), R/T PI (Reference/Total Period Impact) and R/T CH (Reference/Total Cited History).

In terms of related works, only the core article ranking method by subject (Scholar, 2005) or core journal ranking method by subject (Hirst, 1977, 1978; Holsapple, 1993; Jeffrey, 1998; Liker, 1995) or department (Guo, 2005) were found. But our focus here is on a core article ranking method by department and journal, which is different from other related works which we surveyed. As a result, we compare only our own four indicators to understand and analyze the differences between them. Both Coefficient of Correlation and Citation Network had been used to measure these indicators. Through the Citation Network Analysis, we show that TCH and RCH could find the original and milestone papers more accurate than other indicators. Author Self-Citation was shown to be a serious bias in this study too. And RCC/RPI/RCH removed this bias, which Web of Science (WOS) ignores (Thomson, 2005). In this study, we also try to disprove three myths. 1. Myth 1: Most department's top papers were submitted to (S)SCI journals. 2. Myth 2: Top papers always cite papers published in top journals. 3. Myth 3: Articles published in top journals would be highly cited. For these myths, we will show our experimental results to disprove them.

## Materials and Methods

### Materials

All the citation raw data sets were retrieved from the Thomson Corp. website (Thomson, 2005). The two major sources this study used are Journal Citation Report database (JCR) and Web of Science database (WOS). JCR stores the journal impact factor for every qualified journal, whereas WOS gathers information for articles published in the journal in the JCR list. We use not only articles' citation data but also journals' citation data. Four departments, Information Management, Computer Science, Library Science and Mech. Engineering, were selected in this research. In general, each article has 10 to 30 cited references. As for the source of journal citation data, we choose the top 10 journals in the E-Commerce subject areas from Guo (2005). They are *MIS Quarterly (MISQ), International Journal Electronic Commerce (IJEC), Journal of Marketing (JM), Journal of Marketing Research (JMR), Journal of Retailing (JR), Academy Management Review (AMR), Information System Research (ISR), Journal of Organizational Computing and Electronic Commerce (JOCEC), Decision Support System (DSS)* *and Journal of MIS (JMIS)*. The time span was from 1975 to 2004.

## Methods

### 1. The CAPBS system

The programming tool of Visual C++.Net was used to develop one system, called Computer-Aided Paper Bibliometric System (CAPBS). The source code is available on our supplement website (Guo, 2005). Figure 1 is the network topology architecture of CAPBS. Two on-line databases, JCR and WOS, were built by Thomson Corp. There are three sub-systems in CAPBS: Citations Parsing System, Core Article Ranking System and Citation Analysis System. TCC and RCC parsing modules were constructed and embedded in the Citation Parsing System. After exporting the citation raw data of department or journal, they were parsed by TCC and RCC parsing modules and stored in Data Warehouse. Elimination of Author Self-Citation was done by RCC Parsing Module. Mapping every journal to Journal Citation Report (JCR) in order to obtain Journal Impact Factor (JIF) was completed by the Citation Parsing System too. (JIF: Journal's Cited Counts divided by the number of papers published over the last two years.) Then TPI, TCH, RPI and RCH indicators were used to calculate and rank every article from interdisciplinary department and journal. Citation Analysis System assists with Turning Point analysis.

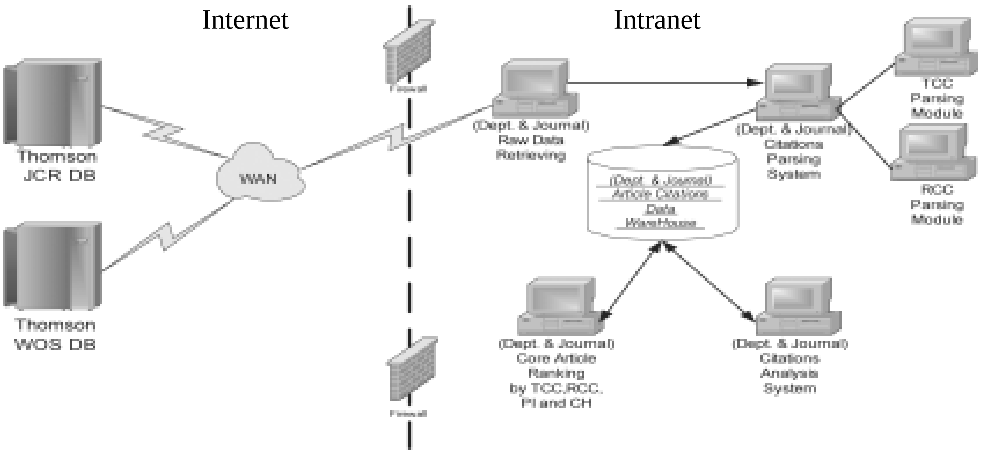


**Figure 1 CAPBS Architecture**

### 2. Term and definition

(1) RCC (Reference Cited Counts)

An indicator to rank departmental papers by reference counts. The dataset would be limited to retrieved articles. The authors' self-citations were removed. This indicator can provide a bird's view for classical articles. The audiences are surveyors.

(2) TCC (Total Cited Counts)

An indicator to rank departmental papers by total cited counts. The dataset was not limited to retrieved papers, but rather, the whole database would be parsed. This indicator is suitable to provide a focus view for classical articles. The audiences are usually senior scholars.

(3) R/T PI (Reference/Total Period Impact)

An indicator to rank departmental papers by cited counts and time period. Both new hot papers and classical papers would be normalized in order to be ranked together. The target audiences are junior scholars such as students.

(4) R/T CH (Reference/Total Cited History)

An indicator to rank departmental papers by cited counts and citation history weight. Both milestone and original articles would be filtered out by this indicator. The suitable audiences or end-users are historian or authors of review papers.

(5) TP (Turning Point)

It is that after ranking an article by TCC or RCC indicator, the accumulated citation counts would increase by the ranked papers. When cited counts don't grow significantly, this ranked article would be considered a TP.

**3. Four ranking indicators**

In order to generate the core article ranked list for interdisciplinary departments and journals, four indicators had been proposed. They are RCC, TCC, R/T PI and R/T CH. There are two major differences between $RCC_k$ (Reference Cited Counts) and $TCC_k$ (Total Cited Counts). The first one is the scope of dataset. $RCC_k$ (Formula 1) is used to parse retrieved articles' references and then calculate cited counts from the retrieved dataset. $TCC_k$ (Formula 2) is to get an article's total cited counts obtained from WOS DB directly. The dataset covers all papers in the WOS DB. The second difference is the Author's self-citations. $TCC_k$ does not subtract this self-citation as, $RCC_k$ which $RCC_k$ is suitable for limited sampling and survey. The dataset comes from its own specific department or journal. Due to the query results format of WOS databases, we cannot design the software to subtract authors' self citations by TCC indicator. This was the limitation from sources/materials. $RCC_k$ can provide a bird's eye view because many articles cite cross-disciplinary papers. As for $TCC_k$, its advantage is to provide scholars a paper-ranked list for his focus of journal or department. Further advantage and disadvantage analysis was discussed in section "Comparison of the four indicators". In addition, study samples would be four departments (Information Management, Computer Science, Library Science and Mech. Engineering) and ten journals (*MISQ, IJEC, JM, JMR, JR, AMR, ISR, JOCEC, DSS* and *JMIS*). These different departments were from different university schools. Different journals were from top 10 journals in E-commerce subject area (Guo, 2005). The reason to choose so many samples was that we wanted to know if the TP patterns exist in different department and journals.

$$RCC_k = \begin{cases} \dfrac{\left(\sum_{j=1}^{n}\sum_{i=1}^{m} R_{ij}\right)}{n}, if \quad A_k \neq A_j \\ \dfrac{\left(\sum_{j=1}^{n}\sum_{i=1}^{m} R_{ij} - \sum_{j=1}^{n}\sum_{i=1}^{m} S_{ij}\right)}{n} \quad , otherwise \end{cases} \qquad (1)$$

where $A_k$ The Interesting Article.

$A_i$ The Processing Reference.

$i$ Article' Reference (i=1,2,..m)

$j$ Query Results (j=1,2,..n)

$R_{ij}$ Cited Counts for Article k.

$S_{ij}$ Self-Citation Counts.

$$TCC_k = \sum_{i=1}^{p} T_i \Big/ n \qquad (2)$$

where $T_i$ Cited Counts for Article k.

$p$ Total Citing Papers in WOS DB.

$n$ Total Query Results.

$RPI_k$ (RCC Period Impact), Formula 3.1, was extended from RCC. This factor's purpose is to let important new papers have more chance to be ranked highly. The ranked results would be more suitable for students or beginning researchers. The major difference between $TPI_k$ (TCC Period Impact) and $RPI_k$ was that $TPI_k$ was extended from TCC and so is suitable for the dataset from TCC, whereas $RPI_k$ was for RCC.

$$RPI_k = \frac{(RCC_k + 0.01)}{n} \Big/ (YR + 1 - PY) \qquad (3.1)$$

$$TPI_k = \frac{(TCC_k + 0.01)}{n} \Big/ (YR + 1 - PY) \qquad (3.2)$$

where $YR$ Current Year (ex:2004)

$PY$ Published Year (ex:1989)

$RCH_k$ (RCC Cited History), Formula 4.1, was designed to filter out the milestone and original papers in history, primarily for the senior researchers or authors of review papers. $TCH_k$ (TCC Cited History), Formula 4.2, was very close to $RCH_k$. This factor was extended from TCC and is suitable for the TCC dataset.

$$RCH_k = RCC_k (YR + 1 - PY) + \frac{1}{(YR + 1 - PY)} \qquad (4.1)$$

$$TCH_k = TCC_k(YR+1-PY) + \frac{1}{(YR+1-PY)} \quad \text{.................................} \quad (4.2)$$

## Results and Discussions

### Author Self-Citation

Author Self-Citation was a well-known noise for citation analysis (Snyder & Bonzi, 1998). We try to collect this data as Table 1 while we were processing our dataset. The SA ratios (Self-Citation Articles-to-Input Total Articles) for ten journals are all about 0.6; the SA ratios' range for four departments is from 0.6 to 0.8; journals' ST Ratio (Self-Citation Counts-to-Total Citation Counts) range is from 0.05 to 0.06; and departments' ST Ratios are all around 0.1.

**Table 1 The Author Self-Citation Ratio Table**

| Journal | SA Ratio | ST Ratio | Department | SA Ratio | ST Ratio |
|---|---|---|---|---|---|
| *MISQ* | 0.6 | 0.05 | Information Mang. | 0.6 | 0.08 |
| *IJEC* | 0.6 | 0.05 | Computer Science | 0.6 | 0.10 |
| *JM* | 0.6 | 0.05 | Library Science | 0.6 | 0.10 |
| *JMR* | 0.6 | 0.05 | Mech Eng | 0.8 | 0.13 |
| *JR* | 0.7 | 0.05 | | | |
| *AMR* | 0.5 | 0.05 | | | |
| *ISR* | 0.7 | 0.05 | | | |
| *JOCEC* | 0.6 | 0.06 | | | |
| *DSS* | 0.6 | 0.06 | | | |
| *JMIS* | 0.6 | 0.06 | | | |

### The turning point pattern

In our citation analysis, most departments and journals have the turning point patterns. The Turning Point (TP) means that after ranking a paper by TCC or RCC, the accumulated citation counts would increase by the ranked papers. When cited counts don't grow significantly, this is considered a TP. We divide ranked articles into 14 segments, each of which owns equal citation counts. Then we observe where the TP was located. In Figures 2A and 3A and Tables 2 and 4, we learn that all TPs were located at the 4th segment (TP Site: 0.28) for all departments and journals by TCC indicator. Using the RCC indicator, we also found that all TPs from different departments or journals could be classified into two types. The TP Site of Type I is 0.07 and Type II is 0.14 (Figure 2C, 3B and Table 3, 5). These TP patterns would be helpful in determining the core article area or evaluating the experimental results. The library may only subscribe to limited e-papers in the core article area instead of subscribing to a publishers' whole database. The causes to the different TP patterns from TCC and RCC indicators were dataset scale and citation counts intensity. The dataset scale from TCC is smaller than

RCC; while the citation counts intensity of TCC is lower than RCC. These reasons allow the TP of TCC be close to 0.28 and have a bow form. But it still has a special case. The TP for the Department of Information Management was that. Its TP generated by RCC indicator was 0.42, very different from others, as can be seen from Figure 2B and Table 3.

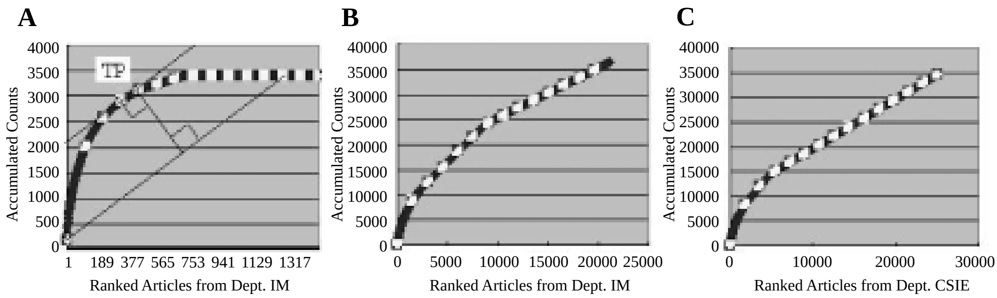


**Figure 2 Citation Turning Point of Departments**

A. Using TCC indicator for Dept. of IM

B. Using RCC indicator for Dept. of IM

C. Using RCC indicator for Dept. of CSIE

**Table 2 Four Departments' TP by TCC**

| | TP Site | TP Count | Total Count | TC Ratio | TP Angle |
|---|---|---|---|---|---|
| IM | 0.28 | 3244 | 3409 | 0.95 | 63 |
| Lib | 0.28 | 726 | 781 | 0.93 | 65 |
| CSIE | 0.28 | 4127 | 4312 | 0.96 | 64 |
| Accu | 0.28 | 5060 | 6817 | 0.74 | 70 |

**Table 3 Four Departments' TP by RCC**

| | TP Site | TP Count | Total Count | TC Ratio | TP Angle |
|---|---|---|---|---|---|
| IM | 0.42 | 24388 | 36464 | 0.67 | 55 |
| Lib | 0.07 | 1168 | 7282 | 0.16 | 70 |
| CSIE | 0.07 | 8341 | 34737 | 0.24 | 72 |
| Accu | 0.14 | 13955 | 44382 | 0.31 | 60 |

## The Myths

There are three myths which this study provides indications to disprove them. 1. Myth 1: Most department's top papers were submitted to (S)SCI journals. 2. Myth 2: Top papers always cite papers published in top journals. 3. Myth 3: Articles published in top journals would be highly cited. In Figures 4 and 6 (A, B), we differentiate three types of citation patterns by hierarchical cluster. Most citations from departments and journals belong to Type II. In the Type II, the (S)SCI citation percent is very stable. For Myth 1, only Department of Accounting was more than 80 percent after we ranked papers by RCC indicator. As for Myth 2, from Figure 6A, we also find a similar situation as for the departments. Most top journals' SSCI citation are less than 80 percent. These pieces of evidence show that many articles highly cited were not submitted to (S)SCI journals. This situation is very general from the top 10 to 1000 articles in interdisciplinary departments and journals. For Myth 3, *MISQ* is the No. 1 journal for the Department of IM (Shiue, 2004). But it still has some articles that were not cited by any other articles in every time span (Figure 5). We thought that maybe there were some significant errors in these papers or their ideas were not practicable. After we reviewed these Max. and Min. cited articles in different time span, we found two interesting things. Review papers are more likely to be cited highly. (Ex: All the most highly-cited papers are review papers in 1984, 1991 and 1996. Furthermore, a hot topic does not guarantee since there are some articles which were not cited, even though their title was hot when it was published.

**Table 4 Ten Journals' TP by TCC**

| | TP Site | TP Count | Total Count | TC Ratio | TP Angle |
|---|---|---|---|---|---|
| *MISQ* | 0.28 | 9925 | 12459 | 0.80 | 65 |
| *IJEC* | 0.28 | 200 | 230 | 0.87 | 70 |
| *JM* | 0.28 | 26721 | 32185 | 0.83 | 71 |
| *JMR* | 0.28 | 25765 | 32853 | 0.78 | 69 |
| *JR* | 0.28 | 5586 | 6770 | 0.83 | 65 |
| *AMR* | 0.28 | 24658 | 31489 | 0.78 | 64 |
| *ISR* | 0.28 | 1718 | 2143 | 0.80 | 63 |
| *JOCEC* | 0.28 | 104 | 112 | 0.93 | 68 |
| *DSS* | 0.28 | 2419 | 2931 | 0.83 | 65 |
| *JMIS* | 0.28 | 407 | 452 | 0.90 | 68 |

**Table 5 Ten Journals' TP by RCC**

| | TP Site | TP Count | Total Count | TC Ratio | TP Angle |
|---|---|---|---|---|---|
| *IJEC* | 0.07 | 727 | 4232 | 0.17 | 62 |
| *JR* | 0.07 | 5424 | 19719 | 0.28 | 71 |
| *JOCEC* | 0.07 | 436 | 2887 | 0.15 | 60 |
| *DSS* | 0.07 | 4554 | 21970 | 0.21 | 67 |
| *MISQ* | 0.14 | 7080 | 18669 | 0.38 | 69 |
| *JM* | 0.14 | 15550 | 38372 | 0.41 | 69 |
| *JMR* | 0.14 | 15968 | 36932 | 0.43 | 69 |
| *AMR* | 0.14 | 16942 | 40849 | 0.41 | 69 |
| *ISR* | 0.14 | 3180 | 10213 | 0.31 | 66 |
| *JMIS* | 0.14 | 2623 | 8463 | 0.31 | 65 |

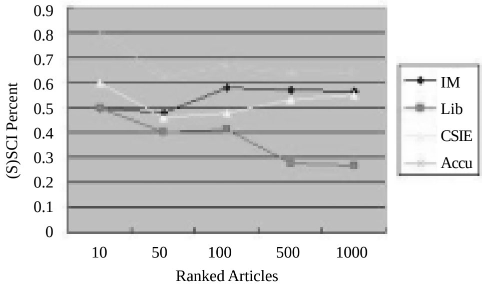


**Figure 4 The (S)SCI Citation Percent from 4 Dept**

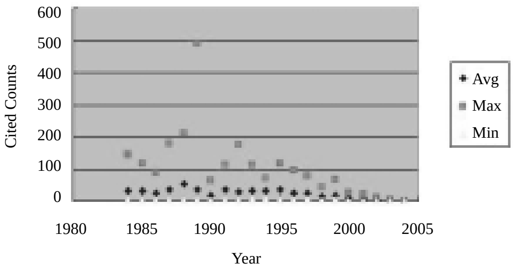


**Figure 5 MISQ's Papers Citation per Year**

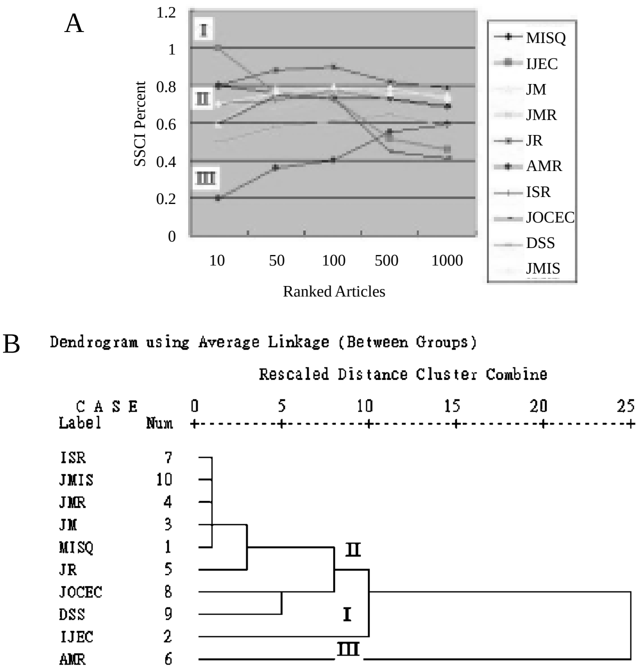


**Figure 6 Three Type of Citation Models in Interdisciplinary Journals by RCC**

A. The SSCI percent from 10 Journals' citations

B. Hierarchical cluster results for 10 journals

## Comparison of the four indicators

### 1. Citation network analysis

We created one complex citation network as Figure 7 in order to explain and compare our proposed indicators. The X-Axis is time. Every alphabetic word represents one paper. The arrow is a citation link.

In this citation network, both TCC and RCC would meet the problem to determine which one should be ranked No. 1 in the Figure 7. That was because both ‘D’ and ‘A’ papers would get equal weights in this case. In this situation, the original paper would not be ranked No. 1. This is why both TCC and RCC are not suitable to generate a ranking list for historian or author(s) of review paper. However, they could be extended to other purposes.

As for TPI or RPI, ‘D’ paper will have higher score than ‘A’ paper to be ranked No. 1, even though both ‘D’ and ‘A’ papers have six link-out papers. Thus, new papers would have more chances to be listed ahead. This would be very suitable to provide students with studying list of classical and latest hot papers to digest while they just enter a new field.

TCH and RCH had been designed to not only filter out highly cited papers but also search for the original papers. Therefore, an original paper ‘A’ would be ranked ahead of milestone paper ‘B’. In fact, Figure 7 is a real case. After we checked all papers in Thomson Corp.’s database, we also found that paper ‘A’ was an original paper rather than paper ‘L’. Generally speaking, original paper would also cite other papers. But original paper would be more highly cited in the early age than others. As a result, attributes of time and cited counts are important attributes in TCH and RCH indicators. Both web and scholar search engine provided by Google (Brin & Page, 1998; Scholar, 2005) also use similar ideas as the TCH/RCH indicator to rank webpages or papers. But the major difference between TCH/RCH and Google is the attribute of time, which is

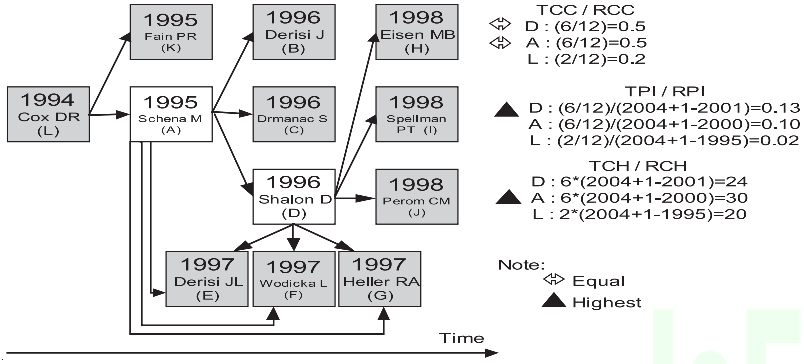


**Figure 7 Paper Citation Network Analysis**

important to paper citations but not for web page citation. It will reduce the time complexity to O(n) after taking full advantage of this attribute. The second difference is the scope or purpose. Departmental core article ranking list is our purpose rather than subject webpage/paper ranking list.

**2. Strength and weakness**

Each indicator had been designed for a different purpose and audience (Table 6). Both RPI/TPI and RCH/TCH were extended from the results of RCC and TCC, and they were based on RCC and TCC. After retrieving citation raw data of specific departments and journals from WOS DB, both RCC and TCC would parse raw data and calculate data in different ways. Due to the limitation of raw data content, TCC can not eliminate Author Self-Citation. But it can produce a ranking list with more in-depth focus for a journal. For example, TCC can rank all papers which had been published in one journal in every time span, which could not be achieved by RCC. However, RCC can generate one ranking list for related journals or fields, which would be helpful to provide a bird's eye view for a survey. In Figure 7, we show that new papers can be higher ranked by RPI/TPI. Therefore, it would be suitable to provide a new, hot and classical articles list for students and research beginners. As for Figure 7, we also show how RCH/TCH can filter out the original and milestone papers. That would benefit historians or authors of review paper so they could trace the research history or write a review paper.

**Table 6 The Strengths, Weaknesses, Audience and Purpose Analysis for Different Indicators**

| | RCC | TCC | RPI | TPI | RCH | TCH |
|---|---|---|---|---|---|---|
| Strength | No self-citation<br>A bird's view | Focus<br>Impact factor | Hot topic<br>Normalize time | Hot topic<br>Normalize time | Original<br>Mile stone | Original<br>Mile stone |
| Weakness | Focus<br>Time complexity | Self-citation<br>A bird view | Fever-phenomenon | Fever-phenomenon | Blooming-research | Blooming-research |
| Audience | Surveyor | Senior | Beginner, general student | Beginner, general student | Senior historian | Senior historian |
| Purpose | Survey | Senior | Hot research | Hot research | Trace | Trace |

**3. Correlation and distance**

Coefficient of Correlation (Chen & Cheng, 2002) was applied to calculate the distance between different ranking indicators. This correlation factor would be helpful to measure the correlation between two data sets. The Pearson factor and its two sets of serial data *X={X1, X2, ....., Xn}* and *Y={Y1, Y2, ....., Yn}* were defined as in Formula 5. Both the *MISQ* journal and the Department of IM were the analysis examples. All the correlation factors between indicators are in Tables 7 and 8, highlighted in three shades and clustered into three groups. TCC/TPI/TCH have higher Coefficient of Correlation

**Table 7 Distances between Indicators in *MISQ***

| | RCC | RPI | RCH | TCC | TPI | TCH |
|---|---|---|---|---|---|---|
| *RCC* | 1 | 0.53 | 0.78 | 0.4 | -0.03 | 0.44 |
| *RPI* | 0.53 | 1 | -0.01 | 0.36 | 0.2 | 0.2 |
| *RCH* | 0.78 | -0.01 | 1 | 0.36 | 0.2 | 0.2 |
| *TCC* | 0.4 | 0.36 | 0.36 | 1 | 0.92 | 0.95 |
| *TPI* | -0.03 | 0.2 | 0.2 | 0.92 | 1 | 0.77 |
| *TCH* | 0.44 | 0.2 | 0.2 | 0.95 | 0.77 | 1 |

**Table 8 Distances between Indicators in Dept IM**

| | RCC | RPI | RCH | TCC | TPI | TCH |
|---|---|---|---|---|---|---|
| *RCC* | 1 | 0.50 | 0.46 | 0.10 | 0.10 | -0.08 |
| *RPI* | 0.50 | 1 | -0.16 | -0.04 | 0.13 | -0.29 |
| *RCH* | 0.46 | -0.16 | 1 | 0.25 | -0.06 | 0.35 |
| *TCC* | 0.10 | -0.04 | 0.25 | 1 | 0.99 | 0.98 |
| *TPI* | 0.10 | 0.13 | -0.06 | 0.99 | 1 | 0.95 |
| *TCH* | -0.08 | -0.29 | 0.35 | 0.98 | 0.95 | 1 |

than RCC/RPI/RCH. Correlation factors in the left hand upper corner with deep gray color always surpass those in the right hand lower corner with light gray in Tables 7 and 8. The right hand upper corner with black color has the lowest factors. To sum up, the rule was “TCC/TPI/TCH > RCC/RPI/RCH > Overlapping” for journals and departments. The main causes for this were that the dataset of RCC/RPI/RCH was larger than TCC/TPI/TCH, and the distance between records was short. This causes the ranking sequences to change significantly after RPI and RCH were applied. As for the overlapping area, their lower correlation factors were expected because the dataset size from RCC and TCC was not exactly equal. Additionally, RPI and TPI had been designed for filter out important new articles. Therefore, their lower correlation factors were also expected. Because both RCC and TCC can get more than 0.5 and 0.9 correlation factors with their own extended indicators. Therefore, the experimental results show that (TCC, TPI, TCH) and (RCC, RPI, RCH) were measured to be at an acceptable level. In Table 9, we list the top 30 papers and the overlapping ranking numbers from different ranking indicators for *MISQ* journals. In Table 10, we list the top 30 overlapping papers in IM department by different indicators. There are many subject areas in department of IM such as electronic commerce, e-learning, database, network, artificial intelligence and so on. Due to many subject areas in one department as IM department, the data sets would be larger than one journal (Ex: *MISQ*) with focus subject area. Therefore, the ranking numbers on the same paper would have larger variations by different ranking indicators in the department of IM (Table 10) rather than the journal of *MISQ* (Table 9).

$$Corr(x,y) = \frac{\sum x_i y_i - \sum x_i \sum y_i / n}{\sqrt{(x_i^2 - \sum x_i \sum x_i / n) - (y_i^2 - \sum y_i \sum y_i / n)}} \quad (5)$$

**Table 9 Top 30 Papers in *MISQ* and the Overlapping between Different Indicators**

| | TCC-Rn | TPI-Rn | TCH-Rn | RCC-Rn | RPI-Rn | RCH-Rn |
|---|---|---|---|---|---|---|
| Davis FD, 1989, *MIS Quart*, v13, p.319 | 1 | 1 | 1 | 7 | 7 | 38 |
| Doll WJ, 1988, *MIS Quart*, v12, p.259 | 2 | 3 | 2 | 340 | 515 | 539 |
| Dennis AR, 1988, *MIS Quart*, v12, p.591 | 3 | 5 | 3 | 108 | 136 | 178 |
| Brancheau JC, 1987, *MIS Quart*, v11, p.23 | 4 | 8 | 4 | 21 | 29 | 50 |
| Adams DA, 1992, *MIS Quart*, v16, p.227 | 5 | 2 | 12 | 83 | 50 | 242 |
| Daft RL, 1987, *MIS Quart*, v11, p.355 | 6 | 9 | 5 | 74 | 95 | 120 |
| Dickson GW, 1984, *MIS Quart*, v8, p.135 | 7 | 26 | 6 | 10 | 27 | 21 |
| Huber GP, 1984, *MIS Quart*, v8, p.195 | 8 | 27 | 7 | 62 | 112 | 75 |
| Straub DW, 1989, *MIS Quart*, v13, p.147 | 9 | 13 | 11 | 106 | 115 | 202 |
| Benbasat I, 1987, *MIS Quart*, v11, p.369 | 10 | 19 | 8 | 30 | 43 | 63 |
| Compeau DR, 1995, *MIS Quart*, v19, p.189 | 11 | 4 | 34 | 100 | 33 | 490 |
| Srinivasan A, 1985, *MIS Quart*, v9, p.243 | 12 | 38 | 9 | 185 | 332 | 214 |
| Gallupe RB, 1988, *MIS Quart*, v12, p.277 | 13 | 25 | 14 | 109 | 137 | 179 |
| Sanders GL, 1985, *MIS Quart*, v9, p.77 | 14 | 41 | 10 | 142 | 274 | 166 |
| Niederman F, 1991, *MIS Quart*, v15, p.475 | 15 | 17 | 20 | 104 | 82 | 253 |
| Orlikowski WJ, 1993, *MIS Quart*, v17, p.309 | 16 | 11 | 28 | 125 | 69 | 429 |
| Watson RT, 1988, *MIS Quart*, v12, p.463 | 17 | 29 | 15 | 73 | 78 | 134 |
| Bakos JY, 1991, *MIS Quart*, v15, p.295 | 18 | 18 | 22 | 169 | 196 | 423 |
| Raymond L, 1985, *MIS Quart*, v9, p.37 | 19 | 46 | 13 | 141 | 273 | 165 |
| Thompson RL, 1991, *MIS Quart*, v15, p.125 | 20 | 21 | 24 | 70 | 49 | 176 |
| Johnston HR, 1988, *MIS Quart*, v12, p.153 | 21 | 37 | 16 | 72 | 77 | 133 |
| Zigurs I, 1988, *MIS Quart*, v12, p.625 | 22 | 39 | 17 | 177 | 249 | 309 |
| Brancheau JC, 1996, *MIS Quart*, v20, p.225 | 23 | 7 | 48 | 309 | 120 | 1423 |
| Delone WH, 1988, *MIS Quart*, v12, p.51 | 24 | 44 | 19 | 335 | 510 | 534 |
| Webster J, 1992, *MIS Quart*, v16, p.201 | 25 | 23 | 33 | 223 | 209 | 620 |
| Gookhue DL, 1995, *MIS Quart*, v19, p.213 | 26 | 12 | 45 | 214 | 103 | 849 |
| Iacovou CL, 1995, *MIS Quart*, v19, p.465 | 27 | 14 | 47 | 1106 | 1085 | 6299 |
| Bakos JY, 1986, *MIS Quart*, v10, p.107 | 28 | 58 | 18 | 58 | 88 | 90 |
| Mukhopadhyay T, 1995, *MIS Quart*, v19, p.137 | 29 | 15 | 49 | 648 | 492 | 2866 |
| Hartog C, 1986, *MIS Quart*, v10, p.351 | 30 | 67 | 21 | 59 | 89 | 91 |

**Table 10 Top 30 Overlapping Papers in Dept. of IM by Different Indicators**

| | TCC-Rn | TPI-Rn | TCH-Rn | RCC-Rn | RPI-Rn | RCH-Rn |
|---|---|---|---|---|---|---|
| Cooper RB, 1990, *Manage Sci*, v36, p.123 | 2 | 2 | 1 | 5435 | 8923 | 6104 |
| Bechtold SE, 1990, *Manage Sci*, v36, p.1339 | 7 | 24 | 4 | 1012 | 1977 | 1769 |
| Chen YL, 1990, *Comput Oper Res*, v17, p.153 | 9 | 32 | 8 | 17537 | 16965 | 11490 |
| Hwang MS, 2000, *IEEE Trans Consum Electron*, v46, p.28 | 10 | 3 | 27 | 68 | 5 | 1719 |
| Wang ETG, 1995, *Manage Sci*, v41, p.401 | 12 | 15 | 11 | 14154 | 12260 | 14525 |
| Chen TS, 1998, *IEEE Trans Image Processing*, v7, p.1485 | 15 | 11 | 28 | 255 | 67 | 2620 |
| Chen NS, 1991, *Inf Processing Lett*, v39, p.147 | 16 | 65 | 12 | 984 | 1733 | 2021 |
| Chen TS, 1997, *IEEE Trans Image Processing*, v6, p.1185 | 17 | 27 | 32 | 528 | 238 | 3631 |
| Yao JS, 1996, *Inform Sciences*, v93, p.283 | 22 | 38 | 29 | 797 | 637 | 4269 |
| Wu TC, 1995, *Comput Commun*, v18, p.959 | 24 | 50 | 25 | 70 | 41 | 438 |
| Chen TS, 1997, *IEEE Trans Circ Syst Video T*, v7, p.555 | 26 | 37 | 39 | 2583 | 2200 | 10781 |
| Jeng BC, 1995, *Expert Syst Appl*, v8, p.135 | 27 | 54 | 30 | 3071 | 3553 | 9026 |
| Bechtold SE, 1994, *Eur J Oper Res*, v74, p.540 | 28 | 67 | 23 | 3729 | 5058 | 8585 |
| Jacobs LW, 1993, *Decision Sci*, v24, p.148 | 29 | 77 | 18 | 361 | 361 | 1215 |
| Chang SC, 1998, *Eur J Oper Res*, v109, p183 | 31 | 35 | 49 | 2513 | 1860 | 11887 |
| Lin JS, 1995, *Networks*, v25, p131 | 34 | 59 | 33 | 111 | 60 | 635 |
| Chou TSC, 1994, *J Atuom Reasoning*, v12, p157 | 36 | 75 | 26 | 3722 | 5051 | 8578 |
| Lin JCC, 2000, *Int J Inform Manage*, v20, p.197 | 38 | 18 | 93 | 740 | 131 | 8987 |
| Hwang MS, 1999, *IEEE Trans Consum Electron*, v45, p.286 | 39 | 29 | 68 | 1390 | 372 | 9813 |
| Hwag MS, 1999, *Int J Comput Math*, v70, p.657 | 40 | 30 | 69 | 521 | 117 | 5640 |
| Huang CY, 1995, *Patt Recog*, v28, p.409 | 42 | 68 | 36 | 90 | 49 | 521 |
| Chen CT, 2000, *Fuzzy Set System*, v114, p.1 | 44 | 22 | 97 | 10423 | 4608 | 19744 |
| Hwang MS, 1999, *Comput Commun*, v22, p.742 | 46 | 34 | 81 | 321 | 53 | 4254 |
| Lin YK, 2001, *Comput Oper Res*, v28, p.1277 | 47 | 13 | 124 | 150 | 8 | 4253 |
| Kao TW, 1993, *Patt Recog*, v26, p.277 | 50 | 114 | 35 | 354 | 354 | 1208 |
| Chien HY, 2002, *Comput Security*, v21, p.372 | 54 | 8 | 164 | 514 | 19 | 11288 |
| Sun HM, 1999, *Comput Commun*, v22, p.717 | 56 | 39 | 94 | 252 | 43 | 3345 |
| Yin PY, 1998, *Pattern Recogition Lett*, v19, p.1017 | 58 | 53 | 82 | 326 | 108 | 3349 |
| Chang CC, 1997, *J Vis Commun Image Represent*, v8, p.27 | 60 | 70 | 64 | 2621 | 2238 | 10819 |
| Chen ALP, 1996, *IEEE Trans Knowl Data En*, v8, p.273 | 61 | 82 | 53 | 2928 | 3261 | 10035 |

## Conclusions

There are several kinds of researchers in the academic community including students, editors and professors. In general, they all face a tremendous load of increasing papers, and they often need to select significant works, either the earliest or the latest for their department or journal. Therefore, we construct the CAPBS system and design four paper ranking indicators (RCC, TCC, R/T PI and R/T CH) to generate a core article ranked list of departments and journals for these audiences. Due to the requirements and materials, RCC was designed to provide a bird's eye view to surveyors and TCC was for a focused view to the senior researchers. Surveyors and senior researchers are their own target audiences. R/T PI was created to let recent highly-cited papers and classical papers be ranked ahead. Therefore, this indicator would be suitable to provide ranking lists to students or research beginners. The latest hot papers would not be filtered out by this indicator. R/T CH was very suitable to look for original and milestone papers. Generally speaking, historian or author(s) of review papers has the requirement to look for papers like this in order to understand the research history. Several Turning Point (TP) patterns were found in this study, and the TP sites were located at approximately 0.28 for all departments and journals by the TCC method. As for the RCC method, the TPs from different departments or journals were classified into two types. The TP site of Type I is 0.07 and Type II is 0.14. Both RCC and TCC also have their own similar scatter charts. These patterns could be helpful in deciding the core article area or evaluating the experimental results. The libraries may only subscribe to limited e-papers in the core article area instead of subscribing to a publishers' whole database. In this study, we also disprove three traditional myths. In the first, only 80% or lower of a department's top 10 papers were submitted to (S)SCI journals. Secondly, less than 80% of top journals' citing articles were published in (S)SCI journals. In the third, there are always some top journal's papers that were not cited by any other papers in every time span. Finally, we use Coefficient of Correlation and Citation Network to show that our proposed indicators performed at an acceptable level.

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## References

Brin, S., & Page, L. (1998). The anatomy of a large-scale hypertextual web search engine, *WWW7/Computer Network*, 30(1-7), 107-117.

Chen, S. Y., & Cheng, B. (2002). *Statistics*, Hwatai Press, Taiwan, 14-5.

Guo, G. M. (2005). 1/7-last update, A method for building core journal ranked lists in electronic commerce subject area, Available: www.openfind.idv.tw.

Hirst, G. (1978). Discipline impact factors: A method for determining core lists, *Journal of the American Society for Information Science*, 29, 171-172.

Hirst, G. & Talent, N. (1977). Computer science journals: An iterated citation analysis, *IEEE Transactions on Professional Communication*, 20(4), 233-238.

Holsapple, C. W., Johnson, L. E., Manakyan, H. & Tanner, J. (1993). A citation analysis of business computing research journals, *Information Management*, 25(5), 231-244.

Jeffrey, D. K., Kristin, H. G. & Cynthia, D. (1998). A method for building core journal lists in interdisciplinary subject areas, *Journal of Document*, 54(4), 477-488.

Liker, J. (1995). Results of survey of management journals for TIM research, *TIM Newsletter*, 7(2), 5-8.

Scholar Search Engine. (2005). 1/7-last update, Available: scholar.google.com.

Shiue, Y. C., & etc. (2004), A computer-aided bibliometrics system for journal citation analysis and departmental core journal ranking list generation, *Journal of Educational Media & Library Sciences*, 42(2), 199-219.

Snyder, H. & Bonzi, S. (1998). Patterns of self-citation across disciplines, *Journal of Information Science*, 24(6), 431-435.

Thomson Corp. (2005). 1/3-last update, ISI Web of Knowledge and Journal Citation Report, Available: www.isinet.com.