An Analysis of the Social Influence of Chinese Red Books in an Open Science Environment: A Case Study of the Recommended Books of two First-class Universities in East China

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Abstract. The open science environment promotes the dissemination of red books, and the evaluation of the social influence of red books is of great significance. This study explores 23 indicators based on Chinese network media platforms and explores a set of evaluation system suitable for the social influence of Chinese red books. This paper uses CRITIC method and TOPSIS method to study the social influence of 155 red books recommended by two first-class universities in East China. The results show that the evaluation index system of social influence of red books proposed in this paper has certain extensibility, and the multi-dimensional publicity of red books and the construction of data integration platform of social influence of books should be strengthened in the future.

Keywords: Open science, Red book, Book evaluation, Influence evaluation, Altmetrics.

1 Introduction

Open science can provide free movement throughout the research life cycle [1], broadening the dissemination of red literature. The new form of academic exchange under the open science environment poses a challenge to the reform of China's scientific research evaluation system. Red books carry historical memory and spiritual wealth, so it is of great significance to evaluate and study the social influence of red books. Book evaluation includes quality evaluation and influence evaluation. This paper focuses on the social influence evaluation of red books. At present, there are abundant theoretical researches on the utilization of red resources and red culture, but less attention is paid to the research on the social influence of red books in the open science environment. Moreover, each discipline has its own development laws and differences, and the book evaluation index system of other disciplines cannot be simply applied to the field of red books. Therefore, this paper explores Altmetrics indicators based on Chinese network media platforms, explores a set of evaluation system applicable to the influence of Chinese red books, and solves the research gap in the current social influence of red books

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in an open science environment. Compared with the existing research methods, this paper focuses on the research of the social influence of books in the open science environment based on the data mining of Chinese network media platforms, and adds audio and video indicators to the research.

2 Overview of Relevant Research

With the rise of alternative metrology, researchers are paying more and more attention to the influence of online social media and network platforms on books. For example, some scholars conducted alternative measurement evaluation based on Douban [2], used Twitter reference count standardization formula to achieve cross-field impact comparison [3], studied OA book citations and social media attention [4], and found that social media, text mining and open access are emerging fields of relevant research attention [5]. At present, most studies analyze the influence of substitution measurement [6-8]. Although Altmetrics are included in the research, there is still a lack of targeted research on the social influence of books. In view of this research situation, this paper, based on the Chinese network media platform, mines Altmetrics indicators, constructs the index system of red books' social influence and carries out new exploration, so as to accurately and comprehensively reflect the social influence of red books.

3 Evaluation Index System of Social Influence of Red Books

3.1 Data Source and Indicator Meaning

1.Social platform： After preliminary search, WCV, WCL, WCS and WCW of Wechat are used as evaluation indicators in this paper. Due to the large number of mentions of red books in Wechat public accounts, it is difficult to obtain all data. By setting the "hottest" screening function of Wechat search, this paper selects the top tweet and takes the relevant index data of the tweet as the final data of the book. When the Wechat WCV of a book is 100,000 +, it is replaced by 100,000 because the specific value is not displayed. In this paper, there are three microblog indicators, including WBR, WBC and WBL. In addition, some blog posts and tweets mention or recommend more than one book, this article will delete this data, and only keep the main content of the blog posts and tweets focused on one book.

2.Network library： In this paper, the number of certain books mentioned by Baidu Library and Douding Library is used as an indicator to reflect the social influence of red books, and only the document of a certain book is retained in this paper.

3.Web encyclopedia： In this paper, the reference number of Baidu encyclopedia and Sogou encyclopedia related books is included in the evaluation system.

4.Online bookstore： When books involve multiple versions, this paper uses DDR, DDCC, DDE, DDC and DDQC, which are ranked first in Dangdang's comprehensive ranking, as the index. The score is the positive rate displayed on the platform, and the number of comments is based on the number of comments displayed on the platform. In particular, because the number of comments on Dangdang is difficult to count, the

number of comments on Dangdang in this article is replaced by the number of short pages displayed on Dangdang. Due to the large difference in the number of short reviews of different books, the median number of short reviews of all books (10 pages) was used to crawl the review quality content and clean it. The sentiment analysis API in Baidu AI Studio was used to classify the sentiment of comments into three types: positive, intermediate and negative, and assign scores of 2, 1 and -1 [9]. According to the four levels of ordinary, silver, gold and diamond displayed on the platform, Dangdang assigns scores of 1, 2, 3 and 4 to users of the four levels respectively [10-11]. The emotional polarity of each review is multiplied with the corresponding rating score, and the average value is taken to obtain the review quality index of the book.

5.Book Review website： When the books involve multiple versions, this paper selects the five indexes DBBR, DBBH, DBBE, DBBC and DBBQC of the books with the most book reviews on Douban. The score is based on the book score given by Douban reading page. The DBBH index includes the total number of people who have "read", "reading" and "want to read". DBBC is the total number of short comments by users who have "read", "read" and "want to read". The book reviews of "read" users are more objective. Therefore, DBBQC adopts the short reviews of "read" users that can be climbed by the platform, and uses the same method as DDQC to judge the emotional tendency of reviews. According to the "How many people are useful" displayed at the end of each review on Douban Books, the interval values are assigned as [0,10] [11,20] [21,30] and [31, +∞] divides the useful numbers and assigns them grade scores of 1, 2, 3 and 4 [10-11], multiplifies the emotional polarity score of each review content with the grade score, and takes an average value to obtain the quality index of book reviews.

6.Audio and video platform： In this paper, Bilibili books are used to sort the first video playback volume and the highest audio playback volume of Ximalaya album.

3.2 Construction of Evaluation Index System

Based on previous studies and combined with the characteristics of social influence communication of red books, this paper constructs an evaluation index system of social influence of red books, as shown in Table 1:

Table 1. Evaluation index system of social influence of red books

Indicator source	Indicator name	Data source
Social platform	Number of Weibo retweets(WBR) Number of Weibo comments(WBC) Number of Weibo likes(WBL) Wechat Official Account views(WCV) Wechat Official Account likes(WCL) Number of shares on Wechat Official Account (WCS) Wechat Official Account 'Currently Watching' count (WCW)	Weibo Wechat
Network library	Number of mentions in Baidu Wenku(BDWKM) Number of mentions in DouDing Wenku (DDWKM)	Baidu Wenku

		DouDing Wenku
Web encyclopedia	Number of entries in Baidu Baike (BDBKE) Number of entries in Sogou Baike(SGBKE)	Baidu Baike Sogou Baike
Online bookstore	Dangdang rating(DDR) Dangdang collection count (DDCC) Dangdang evaluation person-times on Dangdang (DDE) Number of comments on Dangdang(DDC) Quality of comments on Dangdang(DDQC)	Dangdang
Book Review website	Douban Books rating(DBBR) Douban Books heat(DBBH) Douban Books evaluation person-times(DBBE) Number of comments on Douban Books(DBBC) Quality of comments on Douban Books(DBBQC)	Douban Books
Audio and video platform	Ximalaya playback volume (XPV) Bilibili playback volume(BPV)	Ximalaya Bilibili

Standard deviation analysis was carried out on the 23 indicators collected. The standard deviation of each indicator was quite different, the highest standard deviation was XPV value, and the lowest standard deviation was DBBQC only 0.65. This reflects the large gap between the social influence of books in different dimensions, and also proves that the index system of social influence of books constructed in this paper can evaluate the social influence of books in many aspects.

4 An Empirical Study on Social Influence Evaluation of Red Books

4.1 Data Source and Processing

This paper selects 155 red bibliographies recommended by two first-class universities in East China as research samples, which are authoritative and representative, and can provide reference for the promotion of red bibliographies in universities. The wechat platform was used to search the recommended red bibliography of double first-class universities in East China. In view of the incomplete title information of the recommended bibliography of some universities, this paper verified and supplemented the title by comparing the recommended bibliography photos. For bibliographies that lack author information and are difficult to complete, they are removed from the sample. In addition, for books with incomplete title information, comparison and supplement are made through multiple platforms such as Baidu Encyclopedia, Duxiu and Douban to ensure the accuracy of the data. When it comes to multi-edition books, select the most index data for statistics; Involving multiple volumes of books, according to the multi-volume book title search. Through python program crawling and manual acquisition of index data, the bibliographic retrieval work in this study ended on October 3, 2024.

4.2 Data Analysis

1.Correlation analysis: The correlation test method can be used to study the degree of correlation between indicators. On the premise that the known data did not conform to the positive distribution, Spearman coefficient was used to conduct correlation test in this paper, and the test results were shown in Figure 1, where "*" represented the significance level. As can be seen from the figure, within the same platform, there is a strong correlation between indicators, such as the correlation between DDC and DDQC as high as 0.949. In addition, the correlation coefficients between WBR and WBC belonging to the same microblog platform and WBL are 0.939 and 0.929 respectively, indicating a strong correlation, which may be due to the consistency of users' behaviors on the same platform. When the indicators come from different platforms, the correlation between them is weak, although there is still a certain correlation, but the correlation coefficient is low. Therefore, when evaluating the social influence of books, multiple representative platforms should be selected as far as possible to ensure more comprehensive and accurate evaluation results.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
WBR(1)	1																						
WBC(2)	0.939**	1																					
WBL(3)	0.929**	0.910**	1																				
WCV(4)	0.619**	0.589**	0.656**	1																			
WCL(5)	0.538**	0.492**	0.554**	0.861**	1																		
WCS(6)	0.447**	0.439**	0.427**	0.688**	0.638**	1																	
WCW(7)	0.609**	0.581**	0.646**	0.868**	0.779**	0.644**	1																
BDWKM(8)	0.523**	0.571**	0.539**	0.450**	0.332**	0.358**	0.427**	1															
DDWKM(9)	0.475**	0.545**	0.534**	0.420**	0.322**	0.281**	0.390**	0.755**	1														
BDBKE(10)	0.486**	0.520**	0.459**	0.400**	0.311**	0.354**	0.370**	0.485**	0.445**	1													
SGBKE(11)	0.533**	0.543**	0.554**	0.499**	0.455**	0.374**	0.507**	0.579**	0.541**	0.515**	1												
DDR(12)	0.338**	0.389**	0.358**	0.288**	0.214**	0.201*	0.287**	0.500**	0.481**	0.397**	0.415**	1											
DDCC(13)	0.528**	0.514**	0.528**	0.552**	0.453**	0.327**	0.483**	0.397**	0.262**	0.450**	0.400**	0.262**	1										
DDE(14)	0.419**	0.468**	0.436**	0.372**	0.288**	0.263**	0.356**	0.621**	0.570**	0.495**	0.500**	0.952**	0.398**	1									
DDC(15)	0.450**	0.485**	0.467**	0.395**	0.317**	0.286**	0.377**	0.651**	0.580**	0.519**	0.535**	0.784**	0.491**	0.910**	1								
DDQC(16)	0.418**	0.453**	0.446**	0.365**	0.295**	0.261**	0.350**	0.605**	0.562**	0.439**	0.490**	0.783**	0.392**	0.869**	0.949**	1							
DBBR(17)	0.554**	0.592**	0.560**	0.493**	0.388**	0.351**	0.488**	0.579**	0.477**	0.451**	0.423**	0.488**	0.475**	0.582**	0.615**	0.563**	1						
DBBH(18)	0.504**	0.555**	0.494**	0.464**	0.371**	0.329**	0.468**	0.630**	0.510**	0.483**	0.485**	0.572**	0.396**	0.657**	0.664**	0.617**	0.874**	1					
DBBE(19)	0.573**	0.614**	0.586**	0.540**	0.434**	0.374**	0.546**	0.644**	0.544**	0.507**	0.507**	0.536**	0.508**	0.648**	0.682**	0.619**	0.956**	0.910**	1				
DBBC(20)	0.486**	0.543**	0.496**	0.481**	0.375**	0.357**	0.492**	0.609**	0.500**	0.471**	0.443**	0.507**	0.395**	0.585**	0.607**	0.566**	0.863**	0.928**	0.889**	1			
DBBQC(21)	0.409**	0.480**	0.428**	0.371**	0.281**	0.302**	0.399**	0.472**	0.395**	0.408**	0.382**	0.392**	0.328**	0.464**	0.474**	0.419**	0.779**	0.790**	0.750**	0.855**	1		
XPV(22)	0.705**	0.662**	0.673**	0.629**	0.525**	0.464**	0.563**	0.589**	0.504**	0.442**	0.561**	0.337**	0.525**	0.423**	0.454**	0.405**	0.545**	0.497**	0.590**	0.502**	0.351**	1	
BPV(23)	0.703**	0.739**	0.676**	0.532**	0.442**	0.469**	0.523**	0.668**	0.550**	0.524**	0.573**	0.383**	0.443**	0.475**	0.490**	0.424**	0.554**	0.513**	0.600**	0.536**	0.415**	0.790**	1

* p<0.05 ** p<0.01

Fig. 1. Correlation analysis of evaluation index

2.Index weight calculation: In the calculation and selection of index weights, the common methods such as fuzzy comprehensive evaluation have the problems of time consuming and force consuming and large subjectivity. Therefore, this paper chooses the objective weighting method of CRITIC to calculate the weights of the above indicators. After calculating the index weight, TOPSIS method is used for comprehensive evaluation of books. The CRITIC method determines the comparison intensity and conflict intensity of the weight factors of different indicators. The basic steps of calculating the weight of indicators are as follows: the first step is to de-dimensionalize data. The second step is to calculate the intensity of contrast. The third step is to calculate the conflict intensity. The fourth step is to calculate the information content of the index. The fifth step is to calculate the final index weight. Through the above steps, the weights of 23 indicators are as follows: (3.31%, 3.85%, 2.77%, 6.66%, 4.54%, 3.53%, 2.57%, 4.14%, 5.31%, 4.34%, 5.40%, 12.28%, 2.65%, 2.05%, 2.32%, 5.72%, 10.04%, 2.46%, 2.42%, 2.57%, 5.85%, 2.95%, 2.27%), and the order of weight names is consistent with Table 1. The weight of DDR ranks first, at 12.28%, because it has the largest comparison intensity, that is, the strongest variability and the greatest volatility of the index,

indicating that the higher the score of the book in the online bookstore, the easier it is to attract more readers' attention.

3.Comprehensive evaluation： The basic idea of TOPSIS method is to sort each evaluation object by comparing the closeness between each evaluation object and the optimal solution and the worst solution. The specific steps of this method are as follows: First, the weighted index matrix is constructed. The second step is to calculate the best and worst values of each index in the weighted matrix. The third step is to calculate the Euclidean distance of each book to the index optimal solution and the worst solution. The fourth step is to calculate the relative distance of each evaluation object. The closer the value is to 1, the higher the score of the evaluation object, the higher the ranking.

4.3 Analysis of High-Impact Red Books

After the 23 index data of the empirical objects are substituted, the comprehensive ranking chart of book influence is drawn according to the influence scores of each book calculated by TOPSIS method (see Figure 2). As can be seen from the chart, the relative proximity of each book is within the range of [0.004, 0.61], and the difference between the highest score and the lowest score is large, indicating that the influence of different books has a large gap.

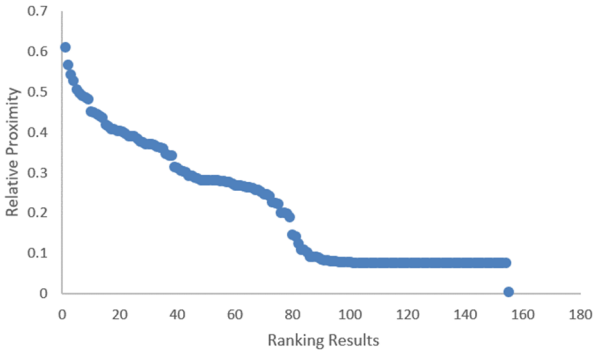

Fig. 2. Book influence score comprehensive ranking

5 Conclusion and Suggestion

This paper selects Chinese network media platforms and indicators, and constructs a set of indicators for evaluating the social influence of red books. The results of the study are as follows: First, the high-impact books are mostly novels, and the users of online media platforms tend to read red novels. Novels are more attractive, easy to arouse readers' interest in reading, and easier to be spread and discussed on the Internet. In addition, the top-ranked books have been adapted into films and TV dramas, which have gained wide dissemination and attention, which has indirectly promoted the influence of the original books. Second, the top books are mentioned to different degrees on most online media platforms, such as *Ordinary World*, *Four Generations Under One*

Roof, *Red Star Over China*. Conversely, The lower-ranked books are only mentioned on a few platforms, such as *The Track Across History (1949-2019)*, and the metrics are not ideal, thus highlighting the crucial role of social media promotion in the modern book market. Third, the number of audio and video plays has gradually become an effective way to publicize and promote books. The audio and video views of the top ten books are among the best.

This paper puts forward the following suggestions: First, increase the multi-dimensional publicity of books. Organizations and institutions should promote red books through multiple channels and forms, use media platforms to strengthen the integration and development of red books with film, television, audio and other media, and attract more audiences to participate in a vivid and intuitive form to promote the spread of red culture. Second, accelerate the construction of social impact data integration platform. During the empirical process, it is not difficult to find that some platforms have problems such as low data coverage and relatively dispersed data sources. As a medium connecting books and book users, network media platform has become an important data source for social influence evaluation of red books in an open scientific environment, and the authenticity and openness of network media platform affect the whole process of red book evaluation. There are many online media platforms in China, and data collection strategies need to be formulated separately, which increases the difficulty of data acquisition. Through the research, we hope to further promote the establishment of the integrated platform to ensure the effectiveness and stability of data.
This paper also has some shortcomings: the empirical research objects in this paper are limited and there is a lack of in-depth mining of review texts. In the future, data can be obtained from different regions and natural language processing technology can be used to enhance the depth of the review text.

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