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Abstract

Taking China National Knowledge Infrastructure (CNKI) as the source of literature, this study made a bibliometric analysis on the trend of quantity of published literature, keywords of published literature, authors of published literature, institutions of published literature and publications of published literature above five aspects on the professional competency skills of library professionals in Mainland China from 2009 to 2019, and explained the development trend of the relevant research from a scientific point of view to provide a reference for the future construction of professional competency skills required for library professionals in Mainland China.

Keywords: *Library professionals; Competency skills; Bibliometrics; CNKI; Social network; Mainland China*

1.Introduction

Libraries are documentation and information centers as well as cultural centers that have diverse values, such as economic promotion value, space expansion value, and cultural symbolic value. To promote the sustainable development of library cause, library professionals should profoundly understand their responsibilities and obligations, and strive to improve their professional ability and service quality (Chen & Naga, 2019). With the development of great science and technology, the business center of the libraries is gradually changing from taking the collection as the center to digitalization as the center (Liu, 2012). The rapid growth of scientific literature has brought a huge challenge to human beings, which has a serious impact on the collection, management and utilization of literature. It has already led to the result that limited room for books, tight funds, and the most important thing is the shortage of manpower. The bitter truth is that more difficulties will be faced in properly storing and scientifically managing the collection literature. How to deal with library and information relevant services effectively has become an increasingly important issue.

Thus, the ever-changing professional environment in the digital era has put forward new requirements for library professionals in the breadth and depth of knowledge.

The theory of competency was proposed by the Harvard University professor McClelland in 1973 and quickly gained significant attention from scholars. It has been applied in many fields of human resource management research. He believed that competency is knowledge, skills, traits, or motivations that are directly similar or related to work performance or other important outcomes (McClelland, 1973). Researchers generally regard "competencies" as a synonym to "skills". Skill and competency are similar in some ways. On a basic level, they both identify an ability that an individual has acquired through training and experience. Compared with competency, skills are more specific in the purpose of performing the job functions competently (Ajeemsha & Madhusudhan, 2012). The study of library professionals' competency began in 1978 with Christine's case study of school librarian competency (Christine,1978). Compared with the research on the professional competency skills of library professionals worldwide, the relevant research started relatively late and the quantity of literature is relatively insufficient in Mainland China.

Bibliometric analysis is a research method that takes literature information as the research object and basis, which describes, evaluates and predicts the research in a certain field by using quantitative statistical methods for scientific literature (Sun & Lin, 2014). Bibliometric analysis has long been adopted and applied by research scholars worldwide in many fields, such as patent literature, chemical engineering, software engineering, biotechnology, social science, education and environmental engineering (Qiu, 2018). In Mainland China, the application of bibliometrics started relatively late, and the early application fields mainly concentrated in the field of Library and Information Science, and most of the researchers have the discipline background of Library and Information Science. Nowadays, the application of bibliometrics has been extended to many disciplines, and the academic background of scholars tends to be diversified in Mainland China. So far, there is still blank in the studies of bibliometric analysis on Chinese literature regarding library and information professionals in Mainland China.

2.Collection of the Data and Methods

In this study, bibliometrics analysis of research outputs on the competency skills of library professionals in Mainland China will be carried out to reveal the current development situation of this research area of Mainland China. CNKI (China National Knowledge Infrastructure) is the largest database of academic literature resources in Mainland China and covers almost all Chinese high-quality journals and degree dissertations of higher education (Xv, 2016). Therefore, CNKI will be very ideal source database adopted for academic retrieval. The searching title keyword is "图书

馆员"(library professional) and 【"能力"(Competency) or "技能"(Skill)】, the time span is from 1st September 2009 to 1st September 2019. A total of 239 literature were retrieved, and after excluding 14 invalid or irrelevant ones, a total of 225 literature were retained, including 223 journal articles and 2 master's degree thesis. Python language will be applied for the data processing and generation of the co-occurrence matrix. Python language is a relatively advanced computer language with a good structure, at the same time, it is a high-level script language combining interpretation, compilation, interaction and object-oriented (Li, 2017). The social network map will be operated by UCINET 6.0 software, inside knowledge maps, the size of the node indicates the frequency of each item, and the thickness of the connection line indicates the frequency of the two items co-occurrence.

3. Analysis of the Data

3.1 Quantity trend of literature

Figure 1 below presents the distribution of literature over the past ten years. It can be seen that the number of literature produced has been steadily increasing year by year.
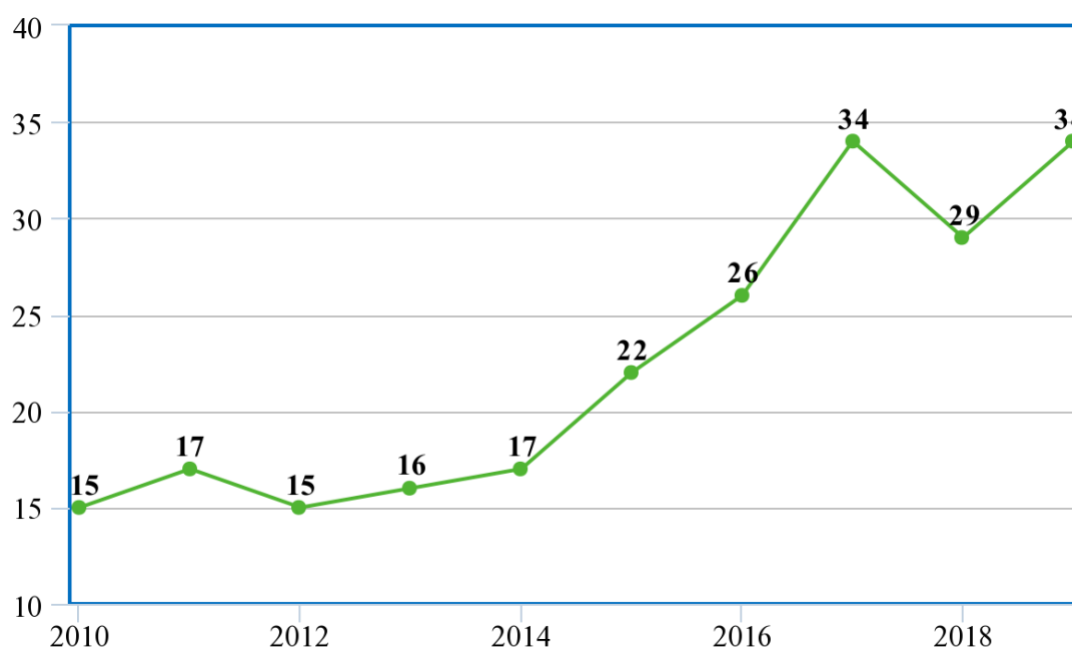

Figure 1 Statistical trend of literature quantity

3.2 Keywords analysis of literature

After merging some synonymous keywords, a total number of 348 keywords items

are obtained, following is the list of keywords with a frequency above "3". Keywords in Chinese language has been translated into English language accordingly.

Table 1: Keywords of occurrence frequencies

关键词	Translation (Keywords)	No.
图书馆员	Library professional	136
职业能力	Professional ability	35
高校图书馆	University library	32
高校馆员	University librarian	23
能力	Ability	22
图书馆	Library	18
服务能力	Service capabilities	12
专业能力	Special competence	12
素质	Quality	11
知识服务	Knowledge service	11
馆员能力	Librarian ability	10
大数据	Big Data	9
能力建设	Competency building	8
信息能力	Information capability	6
信息时代	Information age	5
高校	College	5
知识服务能力	Knowledge service capability	5
职业素养	Professional accomplishment	5
馆员素质	Librarian quality	5
美国	United States	5
能力提升	Ability enhanced	5
提升	Promote	5
继续教育	Continuing Education	5

全媒体	All-media	5
职业精神	Professionalism	5
信息素养	Information literacy	4
科研能力	Research ability	4
阅读推广	Reading promotion	4
阅读	Read	4
服务	Service	4
技能	Skill	3
互联网+	Internet+	3
工作能力	Ability of working	3
建设机制	Construction mechanism	3
职业技能	Vocational skills	3
策略	Strategy	3
培养	Cultivate	3
发展	Development	3
高职院校	Vocational college	3
专业阅读	Professional reading	3
核心能力	Core competence	3
阅读能力	Reading ability	3
提高	Improvement	3
建设	Building	3
途径	Method	3
服务创新	Service innovation	3

The following matrix as shown below in Table 2 listed the frequency of every two items of keywords with a frequency higher than "3" correspondingly. The data need to be imported into the UCINET 6.0 to generate a social network map shown in below Figure 2 based on keyword co-occurrence.
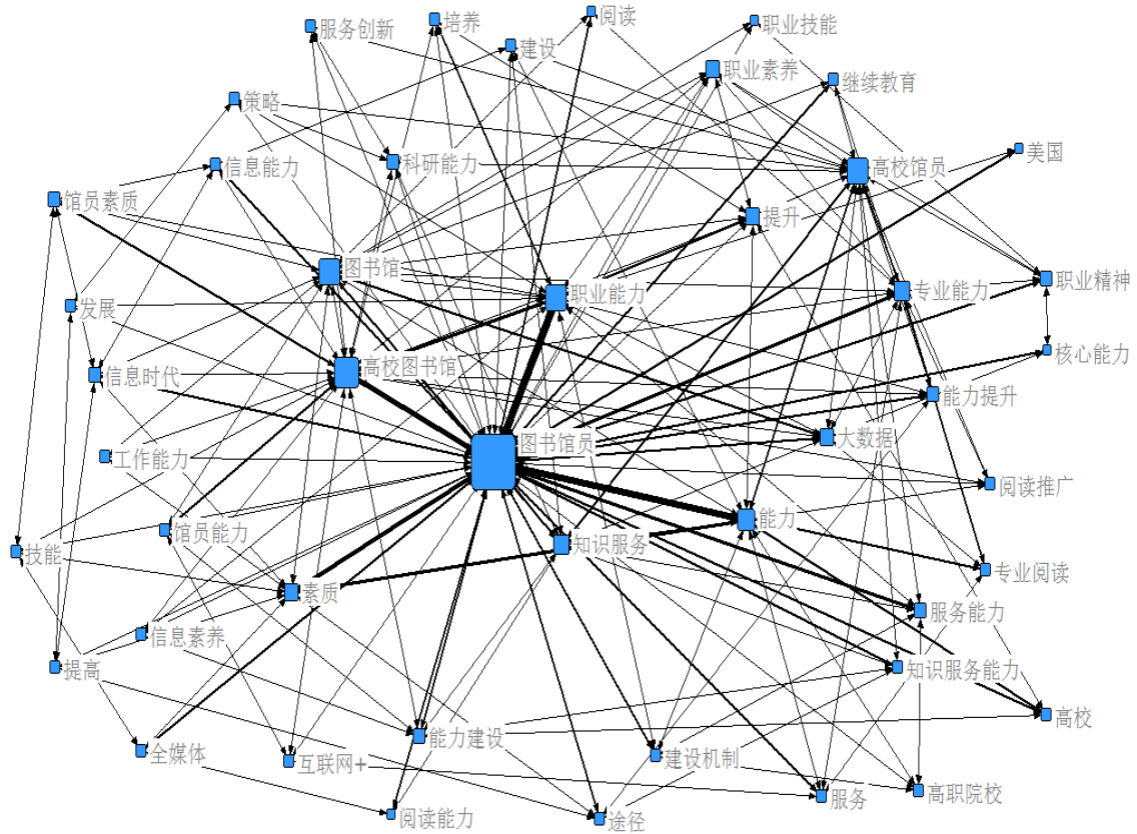
Table 2: Keywords of co-occurrence matrix

Figure 2: Network map of keywords

From the above network map, it can be showed that "图书馆员(Library professional)", "职业能力(Professional competency)" "高校图书馆(University library)" "高校馆员(University librarian)" and "能力(Ability)" are significantly important. Also, "图书馆员(Library professional) & 职业能力(Professional competency)"; "图书馆员(Library professional) & 高校图书馆(University library)"; "图书馆员(Library professional) & 能力(Ability)"; "图书馆员(Library professional) & 服务能力(Service capabilities)"; "图书馆员(Library professional) & 专业能力(Special competence)"; "图书馆员(Library professional) & 素质(Quality)"; "职业能力(Library professional) & 高校图书馆(University library)"; along with "能力(Library professional) & 素质 (Quality)" has the most related link.

3.3 Authors analysis of literature

There are a total of 267 authors extracted from the sampled literature. Table 3 below is the list of authors' names with a frequency higher than "2". Authors names in Chinese language has been translated into English version accordingly. The most prolific author is 陶倩(Tao Qian), who produced three literature.

Table 3: Occurrence frequencies of authors

作者	Translation (Author)	No.
陶倩	Tao Qian	3
陈红梅	Chen Hongmei	2
郁丹彦	Yu Danyan	2
李红	Li Hong	2
杨允仙	Yang Yunxian	2
王宁	Wang Ning	2
缪家鼎	Miao Jiading	2
刘泳洁	Liu Yongjie	2
唐虹	Tang Hong	2
刘小晶	Liu Xiaojing	2
朱文沛	Zhu Wenpei	2
肖强	Xiao Qiang	2
郑立新	Zheng Lixin	2
黄丽娟	Huang Lijuan	2

As shown in following Table 4 below, 80% of articles are published by a single author, 15.11% of articles are published by cooperation of two authors, 4.44% of articles are published by cooperation of three authors, and 0.44% of articles are published by cooperation of four authors.

Table 4: Cooperation of authors

No. of people	1	2	3	4
No. of paper	180	34	10	1
Percentage	80%	15.11%	4.44%	0.44%

Price's law is used to determine the minimum number of articles required by core authors, following is the Price' law formula:

$$N = 0.749 \sqrt{Max}$$

"Max" refers to the number of articles published by the author with the largest number of articles, and "N" is the minimum number of articles for candidate core authors (Yang & Si, 2013). From the above Table, it can be seen that the author with the most articles is Tao Qian, and the number of articles is 3. Therefore, the final result of N is about 1.297. Fourteen authors have published two or more articles. The following Table 5 shows the number and proportion of authors who produced literature as first author.

Table 5: The statistics of authors who produced literature as first author

No. of paper	No. of author (first author)	Percentage
0	2	14.30%
1	6	42.85%
2	6	42.85%
3	0	0%

The following matrix as shown below in Table 6 is the listed number of occurrences of every two authors with a frequency higher than "2" correspondingly. The data need to be imported into the UCINET 6.0 to generate a social network map shown in below Figure based on authors' cooperation co-occurrence. From Figure 3 shown below, it can be seen that there are four authors group existing, and there is a low degree of cooperation between the two authors in each group. It is noted that six authors located on the left side has no academic cooperation with rest authors in the knowledge map.

Table 6: Authors co-occurrence matrix

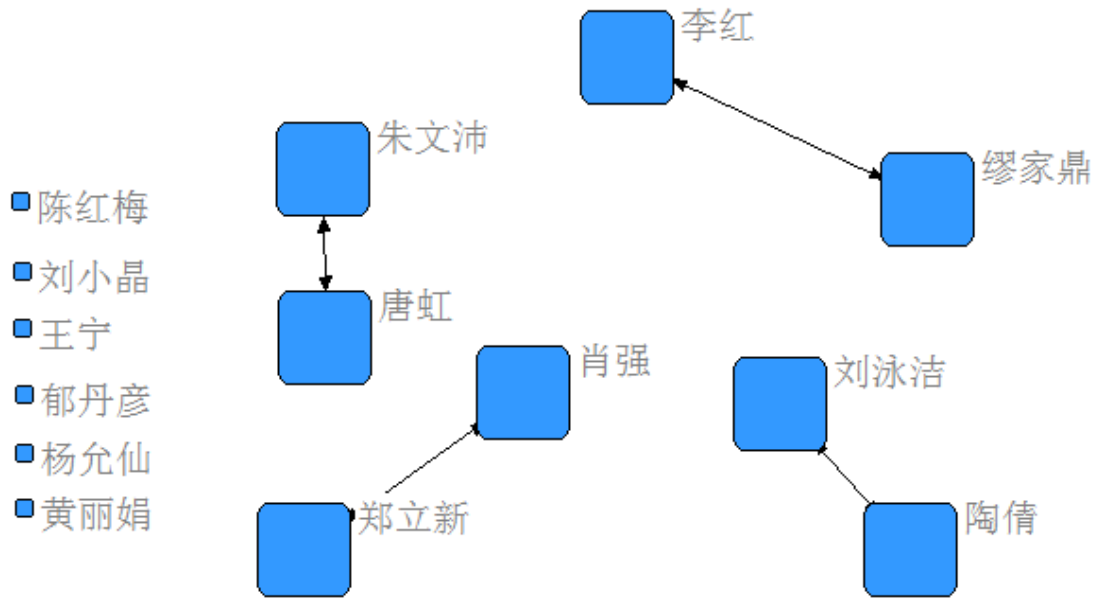|	陶倩	陈红梅	刘小晶	王宁	朱文沛	唐虹	刘泳洁	黄丽娟	李红	缪家鼎	杨允仙	郑立新	肖强	郁丹彦
陶倩	0	0	0	0	0	0	2	0	0	0	0	0	0	0
陈红梅	0	0	0	0	0	0	0	0	0	0	0	0	0	0
刘小晶	0	0	0	0	0	0	0	0	0	0	0	0	0	0
王宁	0	0	0	0	0	0	0	0	0	0	0	0	0	0
朱文沛	0	0	0	0	0	2	0	0	0	0	0	0	0	0
唐虹	0	0	0	0	2	0	0	0	0	0	0	0	0	0
刘泳洁	2	0	0	0	0	0	0	0	0	0	0	0	0	0
黄丽娟	0	0	0	0	0	0	0	0	0	0	0	0	0	0
李红	0	0	0	0	0	0	0	0	0	2	0	0	0	0
缪家鼎	0	0	0	0	0	0	0	0	2	0	0	0	0	0
杨允仙	0	0	0	0	0	0	0	0	0	0	0	0	0	0
郑立新	0	0	0	0	0	0	0	0	0	0	0	0	2	0
肖强	0	0	0	0	0	0	0	0	0	0	0	2	0	0
郁丹彦	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 3: Network map of authors cooperation

The literature published by author cooperation group of Zhu Wenpei and Tang Hong have been cited 8 times by journal articles and 2 times by degree dissertations (Tang & Zhu, 2017; Zhu & Tang, 2018). The literature published by author cooperation group of Li Hong and Miao Jiading have been cited 5 times by journal articles and once by degree dissertations (Li & Maio, 2012; Li & Miao, 2014). The literature published by author cooperation group of Xiao Qiang and Zheng Lixin have been cited 8 times by journal articles and 2 times by degree dissertations (Zheng & Xiao, 2011; Zheng & Xiao & Wen, 2011). The literature published by author cooperation group of Liu Yongjie and Tao Qian have been cited 15 times by journal articles and 5 times by degree dissertations (Tao & Liu, 2016; Liu & Tao, 2017).

3.4 Authors' organization analysis of literature

There are a total of 221 organizations in which the authors were affiliated appeared in the literature, following Table 7 is the list of organizations with a frequency higher than "2". Authors' organizations in Chinese language has been translated into English version accordingly. Among them, only "School of Economics and Management, South China Normal University" and "School of Social Development, Yangzhou University" belong to teaching and research departments, rest organizations all belong to libraries.

Table 7: Occurrence frequencies of organizations

机构	Translation (Organization)	No.
贵州财经大学图书馆	Guizhou University of Finance and Economics Library	3
重庆图书馆	Chongqing Library	3
华南师范大学经济与管理学院	School of Economics and Management, South China Normal University	3
湖北文理学院图书馆	Hubei University of Arts and Science Library	2
钦州学院图书馆	Qinzhou University Library	2
湖北经济学院	Hubei University of Economics	2
辽宁大学图书馆	Liaoning University Library	2
吉首大学图书馆	Jishou University Library	2
怀化学院图书馆	Huaihua University Library	2
湖北第二师范学院图书馆	Hubei Second Normal University Library	2
贵阳学院图书馆	Guiyang University Library	2
长春大学图书馆	Changchun University Library	2
湖南工学院图书馆	Hunan Institute of Technology Library	2
河源职业技术学院图书馆	Heyuan Vocational and Technical College Library	2
井冈山大学图书馆	Jinggangshan University Library	2
扬州大学社会发展学院	School of Social Development, Yangzhou University	2
淮南师范学院图书馆	Huainan Teachers College Library	2

As shown in following Table 8, 94.22% of articles are published by single organization, 4% of articles are published by cooperation of two organizations, and 1.78% of articles are published by cooperation of three organizations.

Table 8: Cooperation of organizations

No. of organization	1	2	3
No. of paper	212	9	4
Percentage	94.22%	4%	1.78%

3.5 Journals analysis of literature

There are a total of 113 journals extracted from the sampled literature, following Table 9 is the list of journals appeared more than twice. Journal names in Chinese language has been translated into English version accordingly. Among them, 32 journals belong to LIS professional journals, rest 81 journals belong to other discipline journals.

Table 9: Occurrence frequencies of journals

期刊	Translation (Journal)	No.
科技情报开发与经济	Science and Technology Information Development and Economy	16
图书情报工作	Library and Information Work	9
内蒙古科技与经济	Inner Mongolia Science Technology and Economy	8
大学图书情报学刊	Journal of Library and Information Science	7
图书馆学刊	Library Journal	7
河南图书馆学刊	Journal of Henan Library Science	7
办公室业务	Office business	6
黑龙江史志	History of Heilongjiang	5
高校图书馆工作	University library work	5
科技信息	Technology Information	4
江西图书馆学刊	Jiangxi Library Journal	4
才智	Talent	4
图书馆建设	Library construction	4

农业图书情报学刊	Journal of Agricultural Library and Information Science	4
图书馆	Library	3
图书馆理论与实践	Library Theory and Practice	3
佳木斯职业学院学报	Journal of Jiamusi Vocational College	3
现代经济信息	Modern Economic Information	3
图书馆学研究	Library Science Research	3
文教资料	Cultural and educational information	3
河北科技图苑	Hebei Science and Technology Garden	3
图书馆工作与研究	Library work and research	3
现代交际	Modern communication	3
改革与开放	Reform and opening	2
湖北经济学院学报(人文社会科学版)	Journal of Hubei University of Economics (Humanities and Social Sciences Edition)	2
情报探索	Intelligence exploration	2
中华医学图书情报杂志	Chinese Medical Library and Information Journal	2
中外企业家	Chinese and foreign entrepreneurs	2
文化创新比较研究	Comparative Research on Cultural Innovation	2
新世纪图书馆	New Century Library	2
产业与科技论坛	Industry and Technology Forum	2
图书馆研究	Library research	2
黑河学刊	Heihe Academic Journal	2
农村经济与科技	Rural Economy and Technology	2
现代情报	Modern intelligence	2
贵图学苑	Guitu Academy	2
科技视界	Technology Vision	2
中国科技信息	China Science and Technology Information	2

情报资料工作	Intelligence work	2

As shown in the following Table 10, 39.46% of articles are published in LIS professional journals, 60.54% of articles are published in other discipline journals. It is indicated that more research outputs regarding professional competency skills are centred in non-LIS professional journals in Mainland China.

Table 10: Classification of periodicals

Category of journal	LIS	Other disciplines
No. of paper	88	135
Percentage	39.46%	60.54%

4.Conclusion

This paper made a bibliometric analysis on the professional competency skills of library professionals in Mainland China from the following five aspects: the trend of quantity of published literature, keywords of published literature, authors of published literature, institutions of published literature and publications of published literature. The results showed that the number of articles in this field has been increasing slowly in the last ten years. In addition, these eight combinations of keywords: "图书馆员 (Library professional) & 职业能力(Professional competency)"; "图书馆员(Library professional) & 高校图书馆(University library)"; "图书馆员(Library professional) & 能力(Ability)"; "图书馆员(Library professional) & 服务能力(Service capabilities)"; "图书馆员(Library professional) & 专业能力(Special competence)"; "图书馆员(Library professional) & 素质(Quality)"; "职业能力(Library professional) & 高校图书馆(University library)"; along with "能力(Library professional) & 素质(Quality)" are more frequent than others. Further, it can be seen that there is a serious lack of cooperation between authors and institutions in this research area of Mainland China. Moreover, the cited degree of the main authors' cooperative groups is relatively low. Lastly, the proportion of authors affiliated to the library is far greater than that of the teaching department and the published literature is more concentrated in the general research journals or non-LIS journals instead of LIS professional journals. The author firmly believed that with the development of competency skills of library professionals in Mainland China, more and more attention will be paid by academia of Mainland China. In future, it is expected that more institutions and authors will be drawn to the research field, and the research output related to library professionals' competency skills will be more visible and more fruitful in Mainland China.

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