

Professional competencies and jurisdictional claims in evaluative bibliometrics: The educational mandate of academic librarians

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Quantitative metrics in research assessment are proliferating all over the world. The demand has led to an increase in bibliometric practitioners and service providers. Their professional roles and competencies have not yet been subject to systematic study. This paper focuses on one important service provider in evaluative bibliometrics – academic librarians – and analyzes their professional competencies from a sociology of professions perspective. To this end, expert interviews with 25 British and German information professionals and several documents have been analyzed qualitatively. Academic librarians compete with other occupations for professional jurisdiction in quantitative research assessment. The main currency in this competition is their expert knowledge. Our results show that academic librarians rely strongly on the know-how gained in their academic Library and Information Science (LIS) training and develop a specific jurisdictional claim towards research assessment, consisting primarily in training, informing and empowering users to proficiently manage the task of evaluating scientific quality themselves. Based on these findings, and informed by the theoretical framework of Andrew Abbott, our conceptual proposal is to adapt formal training in bibliometrics to the various specific professional approaches prevalent in the jurisdictional competition surrounding quantitative research assessment.

Keywords: Professional jurisdiction, evaluative bibliometrics, academic libraries, Andrew Abbott, sociology of professions, academic knowledge base, professional knowledge base, bibliometrics education, claiming vacant jurisdiction

1. Introduction

Since the early 1970s, the field of evaluative bibliometrics has been developing indicators and tools for the purpose of research evaluation. It is one of the most important research areas within bibliometrics, which is a sub-discipline of Library and Information Science (LIS) [4,22,60,64,65,67]. The field's knowledge has become adopted rapidly by evaluation practices worldwide, and is increasingly employed to complement peer review procedures to satisfy the growing demand for accountability as part of a new governance of science [32,59]. In Europe, the UK and the Netherlands were among the forerunners in the use of citation analyses for evaluative purposes at a national level [35,45]. A recent study shows that quantitative metrics – ranging from simple paper counts up to complex citation analyses in national research evaluation systems – are widespread and are now employed by

several countries worldwide [26]. At the level of research organizations, bibliometrics is becoming part of managerial and administrative procedures in the course of institutional evaluations on an even larger – but as yet unmeasured – scale.

The proliferation of metrics in research evaluation has given rise to increasing concerns about the misuse and uninformed use of metrics [21,51]. While critical perspectives on unchecked bibliometric systems [18] and “mandarinates of measurement” [13] abound, one aspect has remained neglected: To date, there is no systematic empirical evidence either regarding who the external producers, clients, or users of bibliometrics outside of the research field are, or regarding how they relate to and interact with the academic field of scientometrics. The need for knowledge about the professional roles of these practitioners (be they producer, client, expert or amateur users), as well as their skills and competencies has been aptly demonstrated during the recent debates about standardization of bibliometric indicators at the recent International Conference on Scientometrics and Informetrics (ISSI) and Science and Technology Indicator (STI) conference [55,63].

Alongside the well-established bibliometric services and consultancies developed by the commercial data base providers Thomson Reuters and Elsevier, and the contract research and services provided by the Dutch Center for Science and Technology (CWTS) [8], a diverse group of analysts at government departments or organizations specializing at the study of science and technology, university research managers, and companies is establishing itself [73,74].

In this “crowded marketplace” [51], academic librarians have started to emerge as a professional group that actively engages and promotes evaluative bibliometric analyses as a new service for their clients, namely the researchers and management of their research organization [6,23,34,36]. However, this new service area is not covered adequately in LIS education [10,66].

A salient question to be addressed is therefore: Which professional competencies are required for bibliometrics in research evaluation, and how can they be obtained?

We propose a conceptual answer which is informed by a sociology of professions perspective. The sociologist Andrew Abbott defines professions broadly as exclusive occupational groups “applying somewhat abstract knowledge to particular cases” [1], thereby establishing an exclusive link between the professional and his work which Abbott calls “jurisdiction” [1]. According to Abbott, this jurisdictional link does not remain uncontested, because multiple professions and occupational groups striving for professional status exist in an interrelated system and compete for the provision of exclusive expert services in a professional work area [1]. Due to social and technological change, or to changing conceptions of societal relevance, professional problems amenable to expert services arise and disappear. In line with the need to account for public expenses in science, quantitative research evaluation can be treated as a professional field of responsibility. No professional jurisdiction has yet been claimed by competing professionals and professionalizing groups for this field.

The currency in this competition is the abstract academic knowledge on which any professional problem diagnosis and treatment is based. A central assumption we

make is that bibliometrics as a research field serves as the academic knowledge base needed for a process of professionalization. Although bibliometricians have their stakes in the competition for this vacant jurisdiction if they are not primarily engaged in producing and validating new scientific knowledge, we focus on one competing professional group, namely the academic librarians who are claiming bibliometric services as a new field of responsibility.

Drawing on several documents and expert interviews, we analyze how academic librarians obtain bibliometric knowledge and the skills needed for service provision, and what kind of professional diagnosis and treatment is offered on the basis of this knowledge.

Our paper is structured as follows: First, we introduce the main theoretical concepts of Andrew Abbott's sociology of professions and then provide a brief overview of the relevant literature, showing that the various approaches taken in the literature still lack an actor-centered perspective on the professionalization of research evaluation. After having presented the methods and data of our empirical investigation of bibliometrics in academic libraries, we present our findings on the following aspects of bibliometric practices in libraries: knowledge bases, learning strategies and needs, and the types of professional services offered based on the previous training and education. We conclude with the conceptual implications arising from this sociology of professions perspective on bibliometrics education.

2. Identifying professional competencies with Abbott's framework

Metrics-based research evaluation constitutes a societally relevant professional sphere of work [47]. This field of responsibility contains professional problems which are amenable to expert services based on abstract knowledge.

According to Abbott, professional problems have objective features such as being grounded in natural, technical or organizational facts, and subjective features that are open to interpretation by professions [1]. It is through exclusive approaches to problem-solving that professions establish a link between themselves and a task which is called jurisdiction.

In the case of metrics-based research evaluation, the professional problem consists in the assignment of value to and measuring the quality of scientific research. At the core of this problem of finding a quantitative proxy for the qualitative notion of scientific quality [30] lies the question of what citations actually mean. What kind of inferences can we draw from citation behavior? These subjective properties of the problem are re-interpreted by a profession. Social and cultural categories of relevance and value may be attached in different ways, the construction of statistical indicators being one of them.

A jurisdictional link between this sphere of work and a specific profession is maintained by identifying a professional problem for a client, called diagnosis, then reducing the problem to its component parts and subjecting it to processes of inference,

and lastly establishing a solution via treatment. Via these three professional mechanisms of diagnosis, inference, and treatment the subjective features of the problem are re-interpreted individually by each profession.

A significant objective feature of the problem of measuring scientific quality is the representation of citation behavior in citation indices. These databases as sources for citation analysis are both technological and organizational in nature, since the most important ones, Web of Science and Scopus, are owned by the companies Thomson Reuters and Elsevier. These features are not amenable to interpretation by professions.

A prototypical professional problem solution in metrics-based research evaluation may proceed along the following lines: The clients that need expert services in bibliometrics are collective and individual actors ranging from universities and national governments and their sub-units to individual researchers. Diagnosis consists in identifying the client's needs, such as which unit is to be evaluated to which aims, and in which frame of reference.

From the data gathered in citation indices and specialized databases, it must then be inferred what the citations mean. For example:

“How do we know that certain citations belong to biology, to chemistry, to computer science? The answer could be that the metadata or word frequency or co-association or documentary relationships may tell us this.” [16].

The citations are symbols and thus representations of the scientific domains and the positional relationships between them.

The treatment consists in assigning value to these respective positions, captured in numerical and comparative statements in the form of indicators or rankings [16].

These three professional mechanisms – diagnosis, inference and treatment – are based on abstract academic knowledge which formalizes the skills upon which professional work is based [1]. The abstract academic knowledge base of a profession can be located in specific worksites such as universities, research institutes, and scientific journals, and is not connected to practice but rather committed to rational and logical theorizing. While it plays a role in providing professions with new professional practices based on research, and is also fundamental in instructing both neophytes and working professionals, the abstract academic knowledge base's main function lies in the provision of a legitimate foundation for a particular professional jurisdiction [1].

The research field of evaluative bibliometrics is considered to be the main academic knowledge base for the provision of bibliometric services. The field has spawned a number of bibliometric indicators designed to measure research impact and quality. A recent study [29] has identified more than 60 indicators representing unique innovations belonging to six broad methodological groups: journal impact indicators [19], field normalized indicators [39,54], source normalized indicators [40,68], Eigenfactors [7,46], percentile indices [20], and h-type-indices [27]. Alongside science indicators, science mapping is also considered to be a valuable

tool in science policy [24], and forms a growing part of the research activity within evaluative bibliometrics. Science maps are used to display the structures and dynamics of science, and can complement and validate performance analyses based on bibliometric indicators [41].

Abstract knowledge is the basis for jurisdictional contests and thus successful professionalization [1]. However, it is the degree of abstractness that matters: Not all theories and methods taught in university matter in successful professional practice. In this paper, we make use of the fact that specific professional practices – in the form of diagnoses and treatments – point, on the one hand, to the knowledge bases obtained [75] and, on the other hand, to the amount of jurisdictional control achieved, helping us to assess whether training programs should be focused more on academic objectives, or whether education should focus more on developing problem-solving skills based on standardized techniques and situations encountered in practice [76].

Professions strive for comprehensive and full claims to jurisdiction based on their ability to define and solve a set of problems, and on the social recognition of this function in the public and legal arenas. On the road to full jurisdictional claims, several jurisdictional settlements occur. Among the several forms of settlement are, for example, the case of subordination, where routine duties are delegated to a subordinate profession (a prominent example are the nursing professions, which are subordinate to medicine), or the final division of labor, which splits a jurisdiction into two equal but interdependent parts (for example, architects share the work of designing and constructing buildings with engineers) [1].

To achieve a full claim over jurisdiction or jurisdictional settlements, a rhetorical device called “reduction” is often employed. This argument states that a new task is, in principle, reducible to an already existing and secure jurisdiction held by the profession [1].

Abbott [1] proposes three analytical steps which will be broadly adhered to in this paper: The literature sections presents some disturbances in the professional system of librarianship which then evoke a shift in jurisdictional claims from access to, for example, information literacy or, in our case, bibliometric literacy. The empirical section of the paper will then trace the modifications in the professional system of knowledge that are needed to balance the professional work performed in bibliometric service provision and jurisdictional claims based on this work.

3. Literature on the professionalization of research evaluation and academic librarians

A general perspective on the professionalization of evaluation as a development inherent in modern societies has been developed by House [28], and more recently by Dahler-Larsen [14], with a specific focus on organizations. The literature on research policy, higher education management, and the sociology of organization and science

abounds with studies on research evaluation that explore, for instance, the characteristics of national evaluation systems (see for example [61]) and the intended and unintended consequences of research assessment on the system of science and its organizations (see for example [9]). However, an actor-centred perspective seems to be lacking. Wouters [62] maintains that existing research on the use of citation indicators in research evaluation would be enhanced by the notion of the “citation as an infrastructure” [62]. This infrastructure comprises a network of databases, publishers, consultancies, bibliometric centers, and users of citation indexes, interacting with regimes of accountability. We intend to contribute to the concept of citation infrastructure by focusing on academic librarians as selected users of citation databases.

Lindgren [33] and De Rijcke and Rushforth [51] put forward the idea of a professionalization of bibliometrics as a regulatory science. As we have stated before, we prefer to conceive of the field of evaluative bibliometrics primarily as the knowledge base for a professionalizing practice for different professional and occupational groups, rather than viewing it as an actor in the process itself. The scientific field has very permeable and open boundaries, and contributions to its main publication channels stem from scholars from a variety of disciplines [30]. A clear-cut definition of the “bibliometrician” thus remains problematic. However, evaluative bibliometrics plays a central role.

Abbott regards the knowledge base as key in the process of professionalization:

“Many occupations fight for turf, but only professions expand their cognitive dominion by using abstract knowledge to annex new areas, to define them as their proper work.” [1].

The body of literature applying Abbott’s perspective to professional and professionalizing groups is large, and includes professions as diverse as archivists [31], environmental scientists [38], parish diaconal workers [48], and higher education professionals [52], as well as the traditional profession of doctors [44].

It has also been frequently applied to study professional developments in librarianship [57]. Abbott himself [1,3], as well as Danner [15] and Burnett and Bonnici [72], have studied librarianship as a profession competing for jurisdiction with other information professionals such as computer scientists.

The historical forms of library jurisdiction were influenced by the fact that the library as an organization preceded librarianship. The conception of the professional task thus centered on “maintaining physical custody of cultural capital” [1]. Librarians approached this task by focusing on access, thus providing efficient tools (cataloging, referencing etc.) for information retrieval for the user. Alongside this traditionally strong access jurisdiction, they also established and managed the library’s collection to serve the users’ educational and entertainment needs [1]. The access jurisdiction, especially, has come under severe threat by changes in library environments such as budget cuts, the rise of computers, the Internet, and other technological advances, as well as changes in scholarly communication and user needs.

These challenges force academic libraries to engage in measures such as strengthening their educational jurisdiction by building up competency in the field of information literacy [42,43]. They have also led to academic libraries reaching out for new jurisdictions: Verbaan and Cox [58] have identified research data management as being among the new fields of responsibility to which academic librarians lay claim. They conclude that the dynamics of competition inherent in the new field of research data management can be captured very well through the lens of Abbott's theory. Librarians have a more pro-active approach than their potential competitors – e.g. IT specialists and research managers – because they have been extending their jurisdiction in a more IT-oriented direction for some time. This is also maintained by Corral and Cox [12] in their overview of the development of academic librarianship specialties. In their interpretation based on Abbott, the access jurisdiction of academic librarians is bound to be reinvented and extended in response to digitization. Specifically, librarians will become more firmly embedded in the scholarly research process by taking on the management and preservation of research data.

In a similar vein, bibliometric services in academic libraries may broaden the research support role of librarians. Such services are proliferating in academic libraries worldwide, as a recent survey indicates [5,10], and are being promoted as a promising new service area by information professionals and academic librarians alike [6,23,34]. Nevertheless, an understanding of the factors enabling and constraining bibliometric service delivery, and especially the competencies needed to provide it, is still lacking [12].

4. Bibliometrics in libraries: Investigation of the knowledge base and the professional services

4.1. Data and method

This empirical study draws on several data sources which give an insight into the bibliometric practices in academic libraries and the knowledge bases for these services. To account for different educational systems in librarianship as well as differing national research evaluation practices British and German information professionals and academic librarians are the focus of this study.

Publicly available data on bibliometric practices in British and German academic libraries comprise 15 conference and workshop presentations, eight opinion articles and case studies in scholarly and practitioner journals, 26 institutional library websites covering bibliometric content and promoting bibliometric services, 54 entries of the British JISC Bibliometrics mailing list, and 60 blog posts about bibliometrics and libraries. Since one of the main service areas is bibliometric training, we collected nine course presentations for scholars and university management and 16 factsheets containing information about bibliometrics. The documents were collected between October 2013 and October 2014.

The main data source is 25 semi-structured expert interviews we conducted with librarians and information professionals on bibliometric practices, training, and professional development in academic libraries. The interviews were recorded between December 2013 and April 2014, and transcribed with the aid of F4 transcription software. Transcripts were sent to the interviewees for authorization of use of selected interview passages.

The variety, richness and volume of the qualitative data – 188 documents and 25 interviews – call for systematization and reduction.

Qualitative content analysis is especially suited to data of mixed types [37,53]. It permits a theory-guided cross-section of diverse material, structured according to Abbott's theoretical framework. The categories deduced from this framework are first enhanced by inductive categories to assure a significant degree of openness, and then compiled in a category system. This category system is the main analytical tool, and serves as a basis for interpretation. The analysis is preceded by computer-assisted coding of the relevant data after the category system is imported into MaxQDA software. This procedure is systematic and rule-guided; all the material is treated consistently. The extracted text-bundles are then analyzed – partly manually and partly by MaxQDA – for patterns and co-occurrences of professional competencies and related jurisdictional claims according to Abbott's framework.

Three qualifications should be taken into account when assessing the validity of our qualitative research results: Firstly, although the main data material consists of expert interviews with information professionals in 24 libraries, our results should not be interpreted on the institutional level. The blog entries, mailing list posts and articles or websites contain numerous references to other libraries that are out of the national scope chosen for this study. The main focus of our analysis is an Abbottonian approach to professional work, i.e. the actual and planned bibliometric practices which are tied to the profession of librarianship, but not to the library as an organization.

Secondly, we partly quantify our qualitative data in order to facilitate pattern recognition, and document our analysis [69,70]. This does not imply that the data are one-to-one models of reality or actual distributions. The number of codes assigned to text passages can also be influenced by interview techniques, types of material, or other selective effects. Nevertheless, we maintain that we can extract more meaning from our data if we make use of numerical descriptions.

4.2. The main analytical categories

Before reporting our results, we will briefly explain how Abbott's conceptual framework is brought to bear on the empirical data in showing selected aspects of the main analytical tool, the category system.

Tables 1 and 2 show the most salient categories for bibliometrics education. As a basis for bibliometric services, academic librarians need not only abstract academic knowledge (as would be expected, according to Abbott) but, as the data shows also

Table 1
Knowledge bases for bibliometric practices in academic libraries

Knowledge base (KB): Refers to the knowledge obtained by information professionals in academic settings and practical work contexts, and put to use in bibliometric practices in academic libraries			
Academic KB: Refers to knowledge gained directly from the research field of evaluative bibliometrics or indirectly through the following carriers		Professional KB: Refers to knowledge gained in LIS education which is applied in librarianship as a professional practice, know-how embedded in routines and objects	
<i>Closely related to Bibliometrics</i>	<i>Widely related to bibliometrics</i>	<i>Closely related to bibliometrics</i>	<i>Widely related to bibliometrics</i>
Bibliometric conferences (conferences ISSI; STI, courses CWTS, summer-school ess)	Wider bibliometrics literature (outside the field of evaluative bibliometrics, e.g. journals in fields such as medicine, biology)	Conferences, workshops (Referring to events that deal with bibliometrics in a library context such as Bibliometrics in Libraries meetings, UK or vendor workshops on commercial database products)	Scholarly communication and publishing (knowledge of the process of scholarly communication and the types and venues used for publication, publishing industry)
Bibliometric core journals (Scientometrics, JASIST, Journal of Informetrics)	General background in mathematics/statistics	Journal articles (practitioner or scholarly journals in librarianship that thematize bibliometrics, f.e. Journal of Documentation, Journal of Academic Librarianship, Library Review, Library Quarterly, College & Research Libraries, Library Trends)	Data handling (accuracy, dealing with ambiguity, handling with care, handling large amounts, data collection, cleaning, indexing)
Own bibliometric research		Personal networks (exchange with other librarians and information practitioners about present and planned use of bibliometrics)	Metadata (structure and content of data to facilitate retrieval)
Personal networks with bibliometricians		Library/Librarians' blogs, institutional and thematic websites	Information retrieval (handling large amounts of information, obtaining information sources relevant for information needs, assessing information quality)
Books (f.e. Moed)		Mailing lists (f.e. JISC Bibliometrics in the UK, Inetbib in Germany)	Handling databases (know-how concerning database structures and function, information retrieval in these data sources)

the professional know-how acquired in LIS education. Both knowledge bases are related to the specialty of bibliometrics in differing ways. The academic knowledge base is tightly coupled to knowledge from the research area of evaluative bibliometrics, whereas the professional knowledge base develops practical know-how of bibliometrics in the application context of the library itself. Table 2 displays categories showing what kind of knowledge was acquired and which learning strategies and needs were identified. It is not possible to directly link the knowledge content to the knowledge base it was acquired from, yet some cues can be derived from the material. The specific diagnostic approach of academic librarians, as opposed to other professionals engaged in bibliometrics, is shown in Table 3. The treatment of the professional problem as visible in Table 4 follows three approaches which were inductively identified. These knowledge-based professional services then lead academic librarians to jurisdictional claims, which are operationalized in Table 5. These claims are very closely related to the bibliometric knowledge obtained, and thus provide important cues for improving bibliometrics education in librarianship.

Table 2
Bibliometric knowledge and skills and learning environment

Knowledge and skills							
Conception of bibliometrics	Types of bibliometric analyses	Databases	Indicators	Field specific publication and citation behavior	Citations: Definition and motivation	Meaning of impact/Scientific quality	Applicability and ethical use, caveats
Refers to the personal "working-hypotheses" – type conception of bibliometrics that a librarian has which is implicitly or explicitly mentioned, such as e.g. "a technical term" or "an instrument of science policy" or "statistical analysis of research output"	Refers to varying types of citation analyses (trend, performance, collaboration etc.) and network analyses	Technical and practical knowledge, e.g. covering aspects such as coverage of databases, document types included, transparency of selection procedure of journals to be included, caveats such as name disambiguation, field specific coverage rates	Technical and practical knowledge, e.g. coverage aspects such as limitations of indicators, their scope and meaning, uses, contexts, interpretation	Refers to commercial or free software packages used, technical capacities, how to solve bibliometric problems with these tools and their limitations	Refers to the notion of citation, its function in the process of scientific communication and varying motivations to cite	Conceptual notions of quality and impact, e.g. breakthrough research or number of citations	Limitations and ethical use of bibliometrics with considerations for limitations, general "health warnings"
		Web of Science Scopus Google Scholar others	Journal Impact Factor H-index Almetrics others	Thomson Reuter's InCites Elsevier's SciVal Strata others			
Learning environment							
Learning strategies	Learning needs	Learning motivation	Self-assessment	bibliometric	Estimated level of abstraction of bibliometric knowledge		
Self-study proactive Self-study reactive Commodity-aided learning Professional networks Conferences and workshops	Bibliometric tools and techniques Bibliometric indicators General bibliometric knowledge Best practices in other libraries	high low undetermined	proficient medium low		high medium low		

Table 3
Diagnosis of the professional problem

Diagnosis	
Refers to the professional problem that academic librarians identify exclusively which is solved using bibliometrics, part of the cognitive claim and one of the three major professional mechanisms	
Objective aspects of problem definition	Subjective aspects of problem definition
Refers to the aspects of the professional problem that cannot be altered, that are present because they are organizational or fundamental facts	Refers to the aspects of the professional problem (user needs) that are redefined by academic librarians in an exclusive way compared to other professional diagnoses
<ul style="list-style-type: none"> – Library hosts institutional repository – Library licenses citation databases – Library as a neutral institution Library as an independent, traditional, neutral service institution – Library as a custodian of knowledge/ collection management with the aid of bibliometric analysis 	<ul style="list-style-type: none"> – Bibliometrics as a management tool Management tool for strategic organizational development, staff management, performance assessment – Publication strategy Researcher-oriented, which publication venue is best, improving visibility/citations – Scientific career Pro-active use of bibliometrics to improve career perspectives such as tenure and hiring, demonstrate capacities – Bibliometric literacy Improving general knowledge about bibliometrics and its limitations and uses – Benchmarking Performance measurements for institutional rankings and national comparisons – Funding bids Bibliometrics supporting bidding for grants from a management and researcher perspective

5. Results

5.1. Knowledge bases, learning needs and strategies

According to Zhao [66] and Corral, Kennan and Afzal [10] the potential for acquiring knowledge in the field of bibliometrics is limited in LIS education worldwide, due to a poor representation of bibliometrics in course modules and textbooks.

Specifically for the German case, Richter [50] reports that bibliometric modules exist in most library schools and LIS university departments, although coverage varies in depth and is not especially adapted to evaluative bibliometrics as a library service. The data collected in the present study, ranging from blog entries to interview passages, also indicate that formal training in bibliometrics is virtually non-existent: “(...) and then I did an MA in Information and Library Management which didn't cover bibliometrics at all I think.” (UK B9).

The education for academic librarianship differs in Germany and the UK. Germany has a dedicated educational path towards academic librarianship, which involves either taking a BA or MA degree in librarianship at a general university or a

Table 4
Treatment of the professional problem

Treatment				
Refers to the solution the librarian has found for the problems identified. These imply the use of bibliometrics of some sort. Part of the cognitive claim and one of the three professional mechanisms				
Information		Training		Consultancy
Information about bibliometrics in general and provision of bibliometric information without detailed analysis or interpretation to researchers and management		Holding training sessions, workshops or providing training material such as factsheets, e-courses to researchers and management, interactive setting		Activities and services with the aim of giving advice and support to researchers and management, value-added information in that data analysis and interpretation are provided
Databases		Definition and history of bibliometrics		Reports
Informing on meaning, use and limitations of Web of Science, Scopus, Google Scholar		Databases Web of Science, Scopus, Google Scholar, uses and limitations		Regular or one-off provision of bibliometric reports for assessment and benchmarking containing analyses on citedness, output
Indicators		Indicators		Analysis
Informing on meaning, use, and limitations of H-index and variants, JIF, SciMago, Eigenfactor, publication/citation counts		H-index and variants, JIF, SciMago, Eigenfactor, publication/citation counts, uses and limitations		Citation analysis, network analysis, trend analysis, perception analysis, benchmarking, not part of a report
Citation reports		Caveats		Support
Provision of information on citations of the own/other institutions, research groups or individual researchers which can take the form of regular citation reports, without interpretation or further analysis		Limitations and responsible application of bibliometric methods		Unspecified advice, consultancy and support of researchers or management
Compilation publication output/indicators				
Drawing on citation databases to compile publication lists or compile impact indicators				
Treatment technicality				
How abstract are the services in terms of technicality and formalism of the knowledge conveyed				
High	Medium	Low		Indeterminate
Treatment exclusivity				
Indicating degree of professionalization, this category captures degree of professional control that librarians exercise over the bibliometric services they offer				
Information for self-empowerment	Commodity	Consultancy without strategic implications	Consultancy with strategic implications	Commissioned service
Providing information about bibliometric methods, tools, and indicators with a view to improving the user's bibliometric literacy (educational approach), which would eventually make the library's bibliometric services obsolete in the future	Commercial or non-commercial tools such as databases, software products and algorithms that are needed for bibliometric services and that partly embody expertise, the librarian needs to master these commodities	Providing advice on bibliometric methods, tools, and their capabilities as well as preparing publication lists, reports, analyses with an disinterested, neutral approach and refraining from taking strategic decisions based on these services	Providing advice on bibliometric methods, tools, and their capabilities as well as preparing publication lists, reports, analyses with engaged, strategic approach and making strategic decisions based on these services	Providing advice on bibliometric methods, tools and their capabilities as well as preparing publication lists, reports, analyses with a consultancy-oriented approach and the desire to provide value-added service packages that are delivered to facilitate decision-making and interpretation, the library takes responsibility, sometimes the services are fee-based

Table 5

Jurisdictional claim on bibliometric expertise in academic libraries

Jurisdictional claim on bibliometric expertise					
Refers to jurisdictional claim on bibliometric services made in the social arena, i.e. the public sphere or the workplace, which for librarians is the university					
Bibliometrics purely a library role	Library roles shared with others (library lead)	Library roles shared with others (equal share)	Library roles shared with others (library subordinated)	Bibliometrics not a library role	Limited claim
Library claims full jurisdiction in bibliometric service provision based on its abstract knowledge and professional mechanisms of problem solution	Library takes advisory control or intellectual jurisdiction but accepts a shared practical jurisdiction	The bibliometric services are divided equally between library and another organizational unit in the university or profession. The work is divided according to content and into functionally interdependent but structurally equal parts	Library divides the labor with another organizational unit or profession and acknowledges that another profession/organizational unit is more knowledgeable and skilled in bibliometrics and therefore takes the lead, library delivers data or other resources, intellectual jurisdiction is retained by dominant profession	Library does not claim a full or partial jurisdiction	Bibliometrics is the library's responsibility, but time, funding and insufficient demand might pose restrictions for fully claiming this role
Other legitimate claimants					
Librarians perceive another profession/occupational group to be an equally legitimate potential claimant to bibliometric expertise					
Research manager	Academics	Statistician/ Mathematician	Bibliometrician	IT or computer specialist	Other
Perception of other libraries' bibliometric engagement					
High		Low		Changing	
			Undetermined		

university of applied sciences, or by combining a Master's in a different subject with a two-year traineeship in a national or state library, or another post-graduate course in librarianship [49]. The UK provides no specific education for academic librarianship, most common instead being a Bachelor's degree in a potentially related subject; followed by postgraduate qualifications. There is also the option of taking a Bachelor's or Master's degree in Library and Information science (or a related subject) that is accredited by the Chartered Institute of Library and Information Professionals (CILIP) [49].

Yet although German academic librarians might formally benefit from a better coverage of bibliometrics in their LIS curricula, librarians from both countries maintain that their predominant learning strategy is training on the job (see Fig. 1). A statement from a British librarian thus summarizes current learning strategies in bibliometrics quite well:

"(...) we're sort of trained generally as librarians but the actual things, the actual specific specialties that we arrive to do at the time we take up the role we don't necessarily have formal training or we don't... we haven't previously received formal training in that particular... those particular specialist aspects we thought of as part of doing the job, and sort of pick up what we can from reading around and any training courses, which do exist – but often the sort of

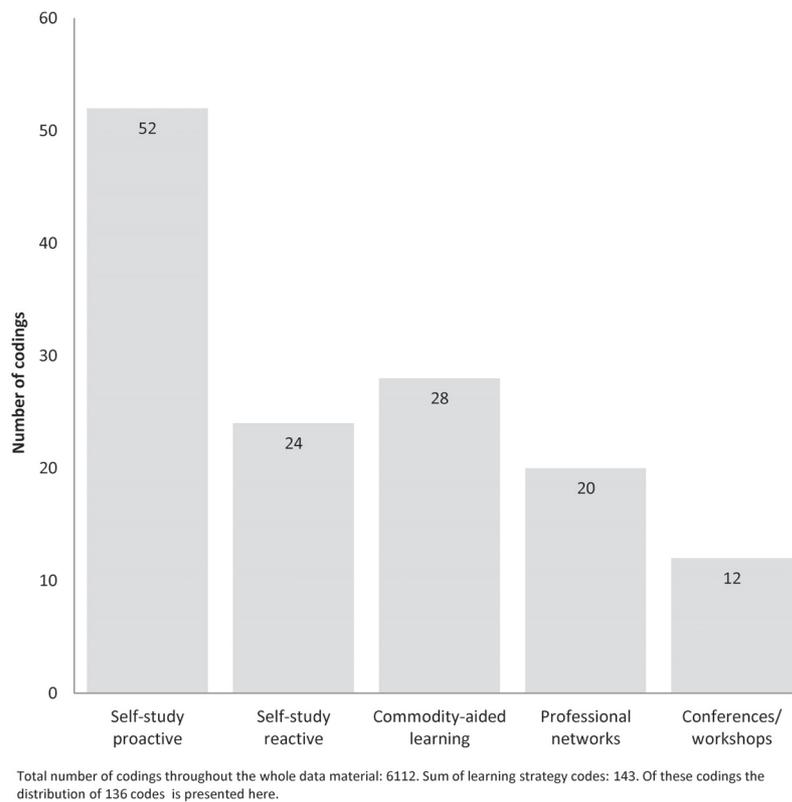


Fig. 1. Learning strategies of academic librarians in bibliometric training on the job.

job comes first, or the role comes first, and then as we take on the role and as we go on through it, we sort of learn how to do the role as we are actually doing it.” (UK B3).

Librarians proactively immerse themselves in a primarily literature-based self-study:

“(…) Just taking a look at things, reading definitions in JCR and of course also reading critical and technical discussions of JCR in the specialist literature (…).” (GER B8, author’s translation).

A second important role is played by so-called commodity-aided learning, which refers to experimenting with software tools and databases, and consulting help files which often serve to acquaint librarians with bibliometric knowledge:

“You know, we are looking at these tools and it’s only through looking at those during the last months or so that we are learning exactly what’s possible and

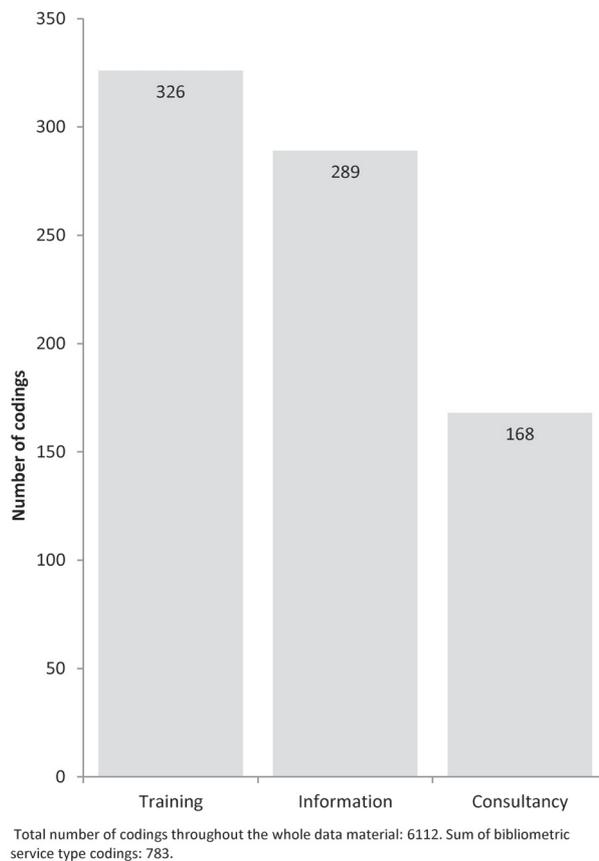


Fig. 2. The three elements of bibliometric services in academic libraries.

what kind of metrics we could use and what, you know, what the pros and cons of different metrics are.” (UK B7).

A reactive self-study takes place when library clients demand a service and the necessary knowledge is then obtained to serve these information needs:

“It’s more sort of just trying to read journals, although I don’t do as much of it as I ideally would do, so it’s more of a case of, if I find that I need to know something for a particular task at work then I will look online to find out more about it.” (UK B3).

Visiting conferences or workshops and making use of professional networks are additional learning strategies.

The latter two learning strategies, in particular, are tied to two different knowledge bases that inform academic librarians’ bibliometric services and their claims to

jurisdiction in quantitative research assessment: the academic knowledge base and the professional knowledge base. The two differ in that the former derives its knowledge from evaluative bibliometrics as a research specialty, whereas the latter derives its knowledge from a LIS education and the day-to-day practices of academic librarianship [11]. While practical knowledge allows librarians to deal with specific situations in particular cases, scientific knowledge allows them to see specific situations as instances of general cases and to thereby explain, for example, larger mechanisms or structures. The two constitute separate and yet complementary forms of knowledge which are united in the academically trained professional [56]. The learning strategies of academic librarians are mainly tied to knowledge sources from the professional knowledge base, developed especially by networking and attending conferences.

Bibliometric practices in academic libraries are predominantly informed by the professional knowledge base. In the context of increasing demand by library users, practical bibliometric know-how is developed in practitioner conferences and workshops (such as the *Bibliometrics in Libraries* meetings in the UK), training by commercial vendors, and professional networks. “That workshop was just a stepping stone, I think to find out what everybody else is doing, what services were available, what were issues people were looking at.” (UK B8).

Other important sources are library blogs and websites, mailing lists – such as the bibliometrics-specific *JISC* list in the UK – as well as articles in practitioner and academic journals in librarianship that deal with bibliometrics.

Next to the bibliometric knowledge developed in the application context, librarians emphasize the advantages of general LIS competencies for the delivery of bibliometric services: The skills stressed particularly include being able to handle databases as complex sources of information, and knowing about specific publication types and discipline-specific behaviors in scholarly communication. Information retrieval skills are also considered necessary:

“Librarians have skills and experience in evaluating the quality of information resources and these are very relevant to researchers whose work is to be evaluated, as well as to those proposing to evaluate research.” [17].

Other skills considered important are accurate and careful data cleaning and handling, as well as knowing how to correctly interpret and attribute metadata:

“We know exactly what descriptors are, we can distinguish them immediately from keywords, we know how to collect material in a standardized way, for instance we know the difference between a series and a journal, a normal person wouldn’t know this. That’s why we get questions such as: Why do these conference proceedings not have an Impact Factor?” (GER B6, author’s translation).

The academic knowledge base plays a smaller role in educating academic librarians in bibliometrics. The most important source consists in maintaining an awareness

of topics covered in bibliometric core journals such as *Scientometrics*, *Journal of Informetrics* or *Journal of the Association for Information Science and Technology (JASIST)*. Librarians have also discovered that topics may be covered in subject-specific journals:

“I noticed during my research concerning bibliometrics and the Impact Factor and all those critical considerations that many articles and contributions appear in scientific journals of the respective scientific disciplines. For instance in a psychology journal I read an article about the critical aspects of the Impact Factor.” (GER B13, author’s translation).

Some librarians also get the opportunity to visit bibliometrics conferences such as the bi-annual conference of the *International Society for Scientometrics and Informetrics (ISSI)*, or to attend bibliometric workshops for professionals such as those offered at the Center for Science and Technology Studies (CWTS) in Leiden, the Netherlands.

The reasons for librarians’ limited application of their academic knowledge in evaluative bibliometrics are, on the one hand, of a structural nature, resulting from such difficulties as time restrictions or limited funding for attending conferences. On the other hand, limitations are rooted in the perceived high abstractness of bibliometrics, for which they lack the necessary statistical and mathematical background, and the problem of transferring this knowledge from theory into practice: “I know there is the *Journal of Scientometrics* but I wouldn’t have gone there because I know a lot of their material is so theoretical.” (UK B11).

Nevertheless, academic librarians exhibit high learning motivations: “I am soaking it up like a sponge.” (GER B6, author’s translation).

Through their bibliometric practices and from their knowledge bases, librarians accumulate multifaceted know-how that can be broadly categorized in the following topical areas: bibliometrics as a research specialty and practical field of work; notions of what scientific quality and impact mean; knowledge of bibliometric indicators, citation databases, and commercial software tools; the ethics of bibliometrics; and caveats as to its uses.

The most well-known indicators are the h-index (and variants such as g-index and A-, AR-, and e-index in Google Scholar or Publish or Perish metrics) and the Journal Impact Factor in the Thomson Reuters’ Journal Citation Reports. Sometimes, field-normalized indicators such as the crown indicator, SciMago Journal Rank, Eigenfactor, and Source Normalized per Paper (SNIP) are also mentioned on blogs and websites and in interviews. Most of the knowledge accumulated on citation databases refers to Web of Science, with Scopus in second place.

Librarians are aware that single performance measures are unable to capture complex concepts such as scientific impact or quality, that context information is always necessary, and that publication and citation practices – which vary over disciplines – need to be normalized when counting citations. Problems regarding name disambiguation, different citation motivations, and field-specific database coverage are also well known.

Academic librarians are also familiar with using commodities, such as commercial software products:

“I’ve successfully used Thomson’s InCites to perform publication/subject analysis for my previous employer, such as subject area strengths and citation impact against national and international benchmarks.” (JISC Mailing 49).

The main learning needs identified are improving knowledge of software, tools, techniques and indicators, and keeping track of best practices of other academic libraries with bibliometric services.

5.2. Professional problem diagnosis

The know-how acquired from academic and professional knowledge bases enables academic librarians to develop an exclusive professional approach to solving the problem of measuring scientific quality, which differs from the approaches of other professional groups competing for this vacant jurisdiction.

Certain aspects of this problem cannot be exclusively re-defined because they are objective, i.e. shaped by organizational or technical facts [1]. The measurement of scientific quality as represented by citations requires data sources such as citation databases. The library as an organization hosts institutional repositories and licenses citation databases, and is thereby well-positioned to derive some claims to bibliometric expertise from these organizational and technological problem properties: “I think there is a natural place for expertise in bibliometrics in the library if they have a repository which may be displaying these bibliometrics scores.” (UK B11).

However, jurisdictional claims to expertise for solving the problem of quality measurement are mainly derived from the re-definition of the subjective problem properties. Academic librarians frame this quality measurement problem primarily as a problem of information: The application of bibliometric methods and tools by libraries or library clients can solve these information needs. Evaluative bibliometrics thereby becomes an essential information skill for library users, be they academics or members of university management and administration.

Primarily based on the academics’ demands, librarians are able to detect a need to support scientific careers and successful publication strategies by making use of bibliometric information:

“I’ve been asked if there are metrics or methodologies appropriate for measuring the impact of publications in applications for promotion, particularly at professional level.” (JISC Mailing 39).

A deficiency regarding “bibliometric literacy” is diagnosed among academics and managers alike:

“(…) So it’s just sort of providing training sessions for academics and administrators just to understand about bibliometrics, because I think up until recently

when the university senior leadership team sort of told departments what their sort of performance is in terms of citations that hasn't... the numbers haven't necessarily meant very much to the schools or departments (...)." (UK B3).

Academic librarians also diagnose a pronounced managerial demand for bibliometrics to help to allocate institutional funding, select new scientific staff, or strategically position the research organization in the competition for funds (category *bibliometrics as a management tool*) or in university rankings (category *benchmarking*): "I am supporting senior management with analyses on the overall position of the university and its broad citation impact." (UK B2).

These diagnoses are centered on the observation that research assessment practices are changing and becoming increasingly metrics-based. Accordingly, research support by the library as a service institution should adapt to these changes: "The research environment reconfigures the library" [34]. The differences between the decentralized, institutionally focused research evaluation practices in Germany and the regular national evaluation exercise (Research Excellence Framework, REF) in the UK [71] might suggest that German libraries are not faced with the same pressure towards establishing bibliometric services. Our data show that the REF and subsequent needs for evaluation support in universities pose a clear rationale for British librarians to engage in this service area. However, the same applies to German librarians, especially if their library is situated in a technical university or an independent research organization with a subject focus on the natural sciences. Universities with a comprehensive spectrum of subjects and social science or humanities research organizations, as well as universities of applied science who engage in less research, mainly employ librarians who offer only a limited range of bibliometric services, if at all.

5.3. Professional problem treatment

Treatment of the information problem of academics and university managers rests on three pillars: training, information and consultancy (see Fig. 2).

Training is the dominant method. It consists of bibliometric courses offered to academics at all career stages, as well as to administrative and management staff. These courses aim to convey knowledge on the uses, meanings, and limitations of bibliometric indicators, specifically the Journal Impact Factor and the Immediacy Index from Thomson Reuters' Journal Citation Reports; citation counts as indicators; the h-index and some of its variants such as the m-quotient or g-index; and the SciMago Journal Rank. Other central themes are the main citation databases Web of Science, Scopus, and Google Scholar, discussing their uses and limitations. Raising awareness of caveats and limitations of bibliometric methods and tools is also an important aspect of training sessions.

The courses are generally characterized by a low level of technicality and formalism in their teaching style. For instance, bibliometric webinars often contain guided

“walk-throughs” through citation databases to assist in finding JIFs or determining an h-index,¹ and indicators are presented largely without formulas.

The second treatment mechanism – academic librarians’ information services – centers around the provision of definitions and assistance regarding the uses and limitations of bibliometric indicators² and the main citation databases. Furthermore, librarians engage in informational activities such as “Compiling a list of the Journal Citation Reports, journals and their impact factors into one consolidated list” (UK B2). Librarians may sometimes determine – on demand – academic staff members’ h-indices or provide indicators using software such as Publish or Perish, InCites, or SciVal: “Currently we look at our impact relative to subject area compared with a selection of UK and international institutions using InCites.” (JISC Mailing 24).

These information activities are followed by the third treatment option, bibliometric consultancy, which represents information with prescriptive and advisory elements. The main consulting activities consist in generating reports – for example:

“A member of Library staff had provided a series of reports, the most recent of which was a ranking of researchers. Others have been ranking research areas by normalised citations, research strengths and collaborators.” (JISC Mailing 27).

Academic librarians also analyze various types of output, trends, and cooperations, applying network and citation analyses of differing levels of complexity. On a simple level:

“We are dealing primarily with simple citation analyses, for example comparing output with productivity and input, or providing the average citation rate. For journal-based indicators we look at the JIF, of course, and then the h-index when it comes to indicators concerning the individual”. (GER B11, author’s translation).

On a more complex level:

“The term ‘perception analysis’ is used to describe a direct comparison of scientific institutions. For this direct comparison, institutes must be involved in the same scientific field. If the institutes work in different disciplines then field normalization is required to relate the different fields to each other. The main subject of perception analysis is a ranking in accordance with the perception of the scientific articles.” [6].

The category *exclusivity of treatment* designates the extent to which control over bibliometric work is maintained exclusively by academic librarians (see Fig. 3). The

¹For example the participants GER B3, GER B4 and UK B5 make use of webinars with step-by-step instructions.

²Information was mainly conveyed about the following indicator types (listed in descending order): Journal Impact Factor, h-index, SciMago Rank, Altmetrics, Eigenfactor, and citation counts.

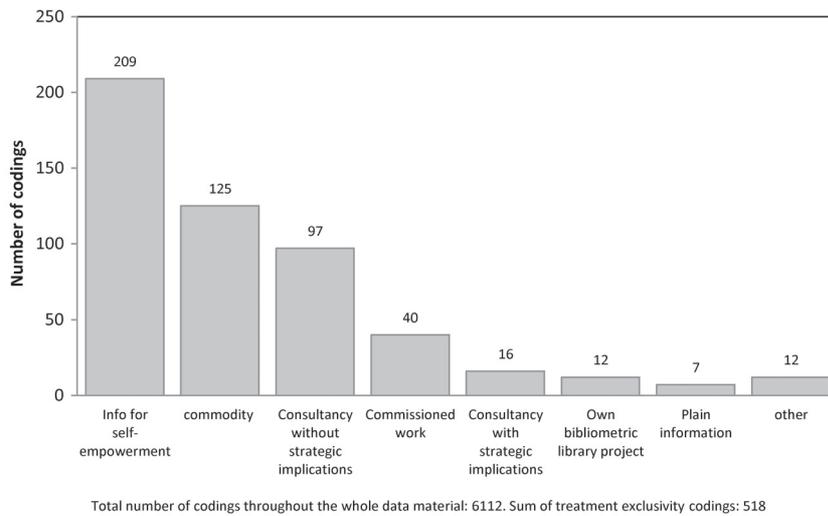


Fig. 3. Exclusive professional approaches of academic librarians towards bibliometric services.

highest level of professional control is displayed by libraries that conduct bibliometric research and pursue bibliometric projects. For example, one librarian wrote, “What I am hoping to achieve at <university> is the creation of a research impacts repository.” (JISC Mailing 28). This highest form of professional control is experienced only in a minority of cases.

Nevertheless, strong library engagement is also evident in providing *commissioned work* or *consultancy with strategic implications*. This happens when bibliometric services are delivered on demand, especially to university management, with librarians given discretion to decide on the methods, indicators, and scope of analysis, and there is also desire to influence relevant stakeholders on the basis of insights gained:

“We often find that demands from the client, be they academics or administrators, are attached to very different expectations; usually they completely underestimate the effort involved and overestimate the results’ informative value. It has always been important for us to put these expectations back into perspective. (...)” (GER B5, author’s translation).

Smaller tasks may also be demanded, sometimes with less discretion in their implementation: “Can you repeat that twenty times? I labor through it twenty times and do whatever it is.” (UK B2). Mostly though, commissioned work is tied to a strong cognitive claim on delivering comprehensive services or making an impact:

“There is much more interest to go and influence these people. Talk to them and see what their perspective is. Correct their misapprehensions and guess strate-

gies that will be helpful because in the end I want the <university> to win. I can help them to win and I'll be delighted to do it.” (UK B 2).

However, more common is the professional approach of *consultancy without strategic implications*. Academic librarians position themselves as competent and yet neutral advisors who use their knowledge to serve users at the users' discretion.

“It is not our task to evaluate, we see ourselves rather as being in the role of the mediator and teacher of the topic. The scientists themselves need to decide how they deal with this. We can't take this responsibility from them, that's not our job.” (GER B9, author's translation).

The degree of exclusive professional control decreases in *information for self-empowerment*. The code describes a librarians' options for informing academics about the possible advantages – but also limitations – of bibliometrics, thus enabling the users to apply bibliometric methods competently themselves:

“This is connected quite closely to the fact that that I want to develop the capacity for self-help and, as a matter of fact, deliver fewer concrete numbers myself.” (GER B15, author's translation) or “You know, we could get their level of expertise up, they could do it themselves and tailor the questions to answer precisely the questions they want to answer.” (UK B2).

This educational approach, with the librarian as a vital partner in the learning process, is the dominant one found in the material.

Treatment exclusivity is also strongly affected by commodities such as software products. Databases and software tools are indispensable for bibliometric work:

“I mean, in order to be able to achieve anything normalized I need to use Scopus, and in fact it's not just Scopus, it's Elsevier's advanced package, which you may well know about, SciVal.” (UK B3).

However, librarians' claims to bibliometric expertise can be weakened when they are mediated via the use commodities:

“I am sort of managing my own expectations', in the sense that I want to be able to do what I know that the tools will allow us to do, and if I happen to know that there is something we can't do because the tools don't allow that capability then I (–) then I tend not to look for being able to do that.” (UK B3).

Bibliometric expertise is also embodied in commodities [2] which interact with the knowledge of professionals:

“I use both Web of Science and Scopus, and the more you use these things the more you realize, not they are limited, but they are controlling the amount of information that they want to give to you.” (UK B2).

However, this need not be to the detriment of librarians jurisdictional claims to bibliometric expertise. They frequently combine the main professional approach of

empowering library users with the use of commodified bibliometric knowledge by training library users to use databases properly.

5.4. Jurisdictional claims to bibliometric expertise

The three main aspects of treatment exclusivity – empowering users, consulting without strategic implications, and, especially, the use of commodities – point to the type of jurisdictional claims that academic librarians make in the public sphere, for example at conferences, on their websites or at their workplace, the university. The claim to jurisdiction is particularly dependent on a strong professional knowledge base.

It is most frequently maintained that bibliometrics is solely the domain of librarians:

“Well, I think certainly I am seen to be and I am officially the university expert on bibliometrics, and not just the bibliometrics person in the library but the library is seen and in fact is the source of bibliometric expertise.” (UK B3).

However, this claim to expertise is not an attempt to take on a new professional jurisdiction in research evaluation at academic libraries. Rather, the stakes that academic librarians have in providing bibliometric expertise are rooted in the professional jurisdictions they have already secured, namely the access- and information literacy jurisdiction. Citation and publication impact can be treated as information that needs to be collected and processed professionally in the manner of the traditional jurisdiction of access:

“Increasingly, assessment of research requires comprehensive information on citedness and contribution – something that no individual tool can provide today. Given the nature of such a global search – for citations or mentions in published works, acknowledgements and other potential indicators of quality – finding information has become very complex. This, however, provides a unique opportunity for librarians in these evaluation processes.” [25].

Librarians reduce the professional problem of measuring scientific quality to a problem already within their professional jurisdiction. They conceive of it as an information problem that can be solved by improving bibliometric literacy, as a variation of information literacy, and by empowering library users.

Often, the claim to bibliometric expertise is limited based on the extent of user demand, the present knowledge and skills of librarians, and potentially negative effects on the library's neutral standing at the research organization.

The reductionist professional approach also results in shared claims to bibliometric expertise. From the point of view of the library, other legitimate claimants to this professional jurisdiction are especially research managers and the academics themselves.

6. Discussion

Academic librarians in the UK and Germany pursue a distinct professional approach concerned with the provision of bibliometric literacy and user empowerment, designed to solve the problem of quality measurement in science and evaluation. This jurisdictional claim represents an extension of the professional expertise developed in academic libraries for other service areas:

“My own personal view is that it’s one of a number of different areas that, to do with information management, that librarians are moving into. I don’t think we are reducing our work in any particular area. We still have very strong library-faculty relationships, so we have our specialist librarians that deal with information literacy and materials and the usual kind of cataloging and acquisition and inter-library-loans and all that, normal library services. They are not diminishing so much but we are finding new areas that the university is interested in, because they overlap with what we are already doing, they become kind of an extension of the services that we are offering already and so research analytics or bibliometrics is one area, another is copyright.” (UK B8).

The knowledge base for bibliometric practices in libraries is predominantly professional. This means it is composed of practical knowledge derived from an academic LIS education and made relevant in the application context of the provision of bibliometric services. More importantly, there is know-how being exclusively developed with relation to evaluative bibliometrics applications in the library context, via professional exchange and learning strategies.

The specific, knowledge-based, jurisdictional approach of librarians calls for a specific educational approach in bibliometrics. Although some librarians do perform complex analyses and even engage in bibliometric research, this type of professional treatment of the problem of quantitative research assessment is not the common type of professional work that librarians perform when offering bibliometric services.

Educational elements to be strengthened should not be primarily of a technical or highly mathematical – that is, they should not aim to intensify knowledge about advanced citation analyses or bibliometric mapping techniques, models, and distributions – but should rather be of a more general and problem-solving, practical nature.

Librarians need a firm educational background in bibliometrics to be able to fulfill their educational mandate to empower their users properly. Knowledge regarding bibliometric indicators and tools should be deepened with a view to describing not only the applications, but also the limitations and caveats as well as the subject-specific citation and publication behavior and the effects of open access publishing and altmetrics on citation impact.

The vacant jurisdiction of quantitative research assessment will most likely be shared by several different professional groups, because librarians are neither extensively developing data-intensive analyses nor are they making strategic decisions

in their provision of bibliometric services. Their educational and informational approach will be complemented by the more strategic and mathematically grounded approach of research managers, statisticians or IT professionals because “they have a better handle on the sort of research strategy side of things, the institutional strategy.” (UK B7).

Consequently, bibliometrics education should thus be adapted to the distinct jurisdictional claims and varying types of professional work performed by each of these groups.

7. Conclusion

An Abbotonian perspective on bibliometric services in academic libraries has shown what kind of professional role librarians take in the jurisdiction of quantitative research evaluation and what skills and competencies they bring to bear in claiming this jurisdiction: “I think it’s capitalizing on this position that they already have, it’s because they have this position that makes them valuable in the bibliometrics role.” (UK B11).

Librarians extend their access and literacy jurisdiction to the bibliometric services they offer. This approach is specific to librarianship as a profession: It is based on a specific knowledge base derived from LIS education and practical bibliometric know-how developed in the course of service provision.

Other professions or occupational groups aspiring to professional status in bibliometrics may pursue other jurisdictional claims that are more strategically and analytically oriented and more data-intensive.

Based on these findings, our proposal for improving bibliometric education for research assessment is that it should be adapted to the specific jurisdictional claims made and the professional work performed that underpins these claims. This would imply that more empirical studies on professional and occupational groups and organizations working in the area of quantitative research assessment are needed, in order to gain a better picture of the interrelated professional system of quantitative research evaluation.

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