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Libraries as research enablers: A content analysis of research excellence framework environment statements

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ABSTRACT

The Research Excellence Framework (REF) assesses the research quality of UK Higher Education Institutions (HEIs). One element of this assessment, the environment statement, allows discipline-specific Units of Assessment (UoAs) to detail aspects of their HEIs wider research environment. As academic libraries play a crucial role in facilitating research, it would be expected that recognition of this would be acknowledged within these environment statements. To test this, a content analysis of all 3769 environment statements submitted to REF2014 and REF2021 was conducted. It found that only 63.4 % of UoAs mentioned the library in their environment statements. Moreover, environment statements in non-STEM disciplines were approximately twice as likely to mention the library than those in STEM disciplines. Interestingly, while the acknowledgment of 'traditional' support services remained consistent over time, acknowledgement of 'non-traditional' services (e.g., open research support, and research data services) increased significantly between REF2014 and REF2021 across all disciplines. Therefore, while academic libraries are often recognised by their HEIs as contributing to the institutional research environment, this is by no means universal. Instead, recognition depended on discipline and has shifted over time. These findings have important implications for understanding and prioritising library research support.

Introduction

A core function of Higher Education Institutions (HEIs) in the UK is to carry out research, the majority of which is publicly funded (UKRI, 2023). In order to distribute this funding to HEIs, a dual funding system is in place consisting of funding from Research Councils, which is awarded through peer-reviewed competition and is focussed on funding specific projects, and quality-related research (QR) funding awarded from the four UK higher education funding bodies (Scottish Funding Council, Research England, Higher Education Funding Council for Wales, and Department for the Economy, Northern Ireland) (Pinar & Horne, 2022). QR funding is distributed as a block to each eligible institution, and is a versatile source of financial support that can be allocated according to the research agenda of individual institutions (UKRI, 2023). The amount of funding awarded through this route is notable, amounting to £1.97 billion in England alone during 2022/23 (UKRI, 2022), and therefore the quality of research carried out by HEIs has been a significant metric by which institutions are measured (e.g.,

Hicks, 2012; Martin & Whitley, 2010).

In the UK, the quality of research produced by HEIs is assessed through the Research Excellence Framework (REF) (e.g., Arnold, 2018; Marques et al., 2017). This was first carried out in 2014, replacing the previous Research Assessment Exercise (RAE) which had taken place at regular intervals since 1986 (Shattock, 2012). The REF is a peer-review process in which research quality is assessed by experts sitting on panels of subject-based Units of Assessment (UoAs) and has been described as one of the most well-established and refined national research evaluation systems (Pinar & Unlu, 2020; Torrance, 2020), resulting in an overall improvement in both research quality and productivity (Stearn, 2016). However, in addition to the benefits it brings, the REF has also resulted in a number of unintended consequences and subjected to various criticisms including encouraging institutions to game the system in order to maximise their returns, and in the prioritisation of short-term applied research over long-term and fundamental research activity (Pinar & Horne, 2022; Stearn, 2016). Despite these criticisms, the REF has had a huge influence on the research landscape of the UK and has

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acted as a catalyst for many universities, including those that are traditionally teaching-focused, to make research a strategic priority (Marques et al., 2017; Torrance, 2020).

The aims of the most recent REF, which was conducted in 2021, were to: (a) “provide accountability for public investment in research and produce evidence of the benefits of this investment”; (b) “provide benchmarking information and establish reputational yardsticks, for use within the [higher education] sector and for public information”; and (c) “inform the selective allocation of funding for research” (REF2021, 2021). Research quality was assessed under three categories: quality of outputs (‘Outputs’); impact beyond academia (‘Impact’); and the environment that supports research (‘Environment’) (REF2021, 2021). The majority of QR funding awarded to institutions is based on the Outputs section of the REF submission, and therefore puts the focus on the producers of research (typically the authors of the outputs assessed, which can range from academic publications such as books and journal articles, to physical artefacts and exhibitions) (REF2021, 2020, pp. 48–67). The Impact element of the REF consists of a submission of case studies that demonstrate an effect beyond academia (REF2021, 2020, pp. 68–76). Finally, as part of the REF submission each UoA was also required to include an ‘environment statement’ focussing on “the structures and environment that support research and its application or impact” (REF2021, 2020, p. 17). UoAs write this statement with the aim of crafting a “compelling story” to convince reviewers that they not only have an excellent research environment, evidenced by selecting stand-out examples which illustrate how they encourage and facilitate research, but that they also provide outstanding facilities and research infrastructure (Thorpe et al., 2018). It is within the environment statement that institutions have the opportunity to highlight networks beyond the primary researcher that contribute to the research process. As academic libraries play a crucial role in the research ecosystem, it would be expected that they would be mentioned within this statement (Walker, 2020).

Academic libraries and research support

In addition to learning and teaching, academic libraries have traditionally played a central role in supporting the research activities of their parent institutions by facilitating access to information resources and providing services for students and staff (Brophy, 2005). Here we define academic libraries broadly as “a library based in a higher education institution that supports the teaching, learning, and research needs of both staff and students” (Frandsen & Sorensen, 2020); this definition therefore avoids distinguishing between ‘academic libraries’ and ‘research libraries’ (typically considered as the part of an academic library that serves an institution’s research community; Ilesanmi, 2013), as this distinction is not made within the REF. In recent years, a combination of factors including the transformation of the higher education environment, technological advancements, and the changing scholarly landscape has transformed the needs of researchers (Corrall, 2014; Lewis, 2016). In response, academic libraries have evolved to offer an array of ‘non-traditional’ services to enhance the research environment by supporting researchers throughout the research cycle, in addition to providing ‘traditional’ services such as access to information resources (e.g., Ragon, 2019). Key examples include research data management (RDM) services (e.g., Andrikopoulou et al., 2022; Cox et al., 2017; Cox et al., 2019), the development of open access institutional repositories (e.g., Novak & Day, 2018; SCONUL, 2019) and bibliometric services (e.g., Corrall et al., 2013).

The majority of literature on the research support offered by academic libraries focuses on the services they provide (reviewed by Si et al., 2019), but fails to elucidate whether this support is actually recognised by their parent institutions. However, understanding how they are perceived is crucial since the ultimate mission of academic libraries derives entirely from their existence within their HEI (Robertson, 2015). It is therefore vital that the contributions libraries make to institutional

goals are recognised, as failure to do so can weaken their position with stakeholders with negative consequences for resourcing and prospects (Cox, 2018), the ability to influence key groups (Pinfield et al., 2017), and their position within the institutional hierarchy (Baker & Alden, 2017). It is also essential that researchers recognise the role libraries play in regard to supporting research, as the quality of research outputs can benefit from librarians’ skills (RIN & RLUK, 2011). For example, librarians can support researchers in identifying the characteristics of predatory publishing (e.g., Lancho Barrantes et al., 2023; Teixeira da Silva, 2022), perform literature searches (e.g., Desmeules et al., 2016; Spencer & Eldredge, 2018), and support writing grant applications (e.g., Edmunds Otter et al., 2017) and research data management plans (e.g., Andrikopoulou et al., 2022; Tripathi et al., 2017). Moreover, the co-authorship of publications by librarians and academics demonstrates the contribution that librarians can make to the production of research outputs, with their role ranging from the development of research questions and methodologies through to data collection, curation, and presentation (Borrego et al., 2018; Borrego & Pinfield, 2020). Academic libraries are therefore an integral part of the research ecosystem, not merely research supporters or enablers.

Recognition of academic libraries in REF environment statements

Walker (2020) reasoned that if the research support provided by academic libraries was perceived highly by their HEIs, this would be reflected in the nature and extent to which libraries and the support services they offer are cited within the REF environment statements. The rationale for this is that given that these statements are written by individual UoAs, with little, if any input from research enablers (such as libraries), it is predominantly the UoAs’ perception of the support libraries offer which is reported. However, by analysing environment statements from REF2014, Walker (2020) found that academic libraries were in fact rarely mentioned, suggesting that their contribution to research support was not perceived sufficiently highly to emphasise this to REF assessment panels. There was an indication that non-STEM subjects mentioned the library more than STEM areas. Since REF2014, libraries have continued to develop the research support they offer (e.g., Cox et al., 2019; Si et al., 2019), although there has been no contemporary assessment of the perception of academic libraries’ contribution to the research environment in the UK, if recognition has changed since REF2014, or whether this differs between disciplines.

The aim of this work is to investigate the extent to which academic libraries are recognised by their HEI as contributing to the institutional research environment, in the context of the REF. It tests the following hypotheses: (1) the extent to which libraries are recognised as contributing to the research environment increases between REF2014 and REF2021; (2) libraries are perceived as making greater contributions to the research environment in non-STEM compared to STEM subject areas; and (3) the recognition of non-traditional methods of library research support increases between REF2014 and REF2021.

Methodology

Data collection and coding

A content analysis was carried out on 3769 environment statements submitted by each UoA as part of REF2014 (1891 environment statements) and REF2021 (1878 environment statements). These are freely available online at <https://results.ref.ac.uk> (REF2014, 2015) and <https://results2021.ref.ac.uk/environment> (REF2021, 2022a), respectively. In their REF submission, UoAs were required to use a template for the environment statement which comprised a number of predefined sections. Because there was no a priori reason for assuming that mentions to the library would occur under any particular section, all sections of each environment statement were included in the data extraction. The statement itself was therefore considered the unit of analysis

(Neuendorf, 2017, pp. 20–21).

The content analysis was broken down into two constituent parts: (1) an analysis at the level of words, i.e., recording whether or not the library was mentioned within an environment statement; and (2) an analysis of concepts, i.e., recording the ways in which the library was reported as contributing to the research environment.

To identify instances where the library was mentioned in an environment statement, each document was searched using the stem 'librar', which matched the words 'library', 'libraries', 'librarian' and 'librarians' within all sections of the document. These specific mentions were then further evaluated to ensure they specifically referred to the parent institution's academic library, as some references to libraries were not necessarily to the institutional library, but to libraries outside the institution or other types of library (e.g., software libraries). Any mentions of non-academic libraries were disregarded. In some statements the name of the library was abbreviated after the first mention; for example, in REF2021 the University of Dundee used the abbreviation LLC for 'Library and Learning Centre'. If this was the case, the environment statement was subsequently searched for instances of the abbreviation. For each environment statement, whether or not the library was mentioned was recorded as either 'Yes' or 'No', respectively.

A content analysis of sentences which included any reference to the library was also conducted to ascertain the ways in which libraries were recognised for supporting the research environment of their HEL, using a structured coding scheme (Bryman, 2015; Neuendorf, 2017, pp. 121–164). Individual categories were grouped under two main headings: 'traditional' support roles and newer, 'non-traditional' support roles (Table 1). The traditional categories were based on those used by Brophy (2005), who provides a comprehensive overview of the research support and services provided by libraries in the early 2000s. A report by SCONUL (2019) also distinguishes between traditional and 'newer' (or non-traditional) services. These newer services used to support research have been widely discussed, and the syntheses provided by Si et al. (2019) and Cox et al. (2019) were primarily used when devising the categories covering non-traditional support. A codebook was created which included detailed descriptions of each coding category, with each category coded based on the dichotomy of its presence (Neuendorf, 2017, pp. 136–141).

Table 1

Names and definitions of categories (including whether categories are within the traditional or non-traditional group) used to code the type of support libraries are mentioned as provided within the UoA environment statements of both REF2014 and REF2021. These terms were rarely used verbatim, and therefore coding focussed on the underlying meaning encompassed by each category.

Category	Definition
Access to information (traditional)	Provision of collections (including books, journals, ebooks, ejournals, special collections and databases); an inter-library loan or document supply service.
Study space (traditional)	Provision of study space.
Traditional advisory services (traditional)	Support with literature searching, copyright, plagiarism, referencing, reference management software, or information literacy skills.
Open research support (non-traditional)	Support for the use of and/or hosting of both output and data repositories; publishing or converting existing publications to open access.
Bibliometric, altmetric and citation services (non-traditional)	Support for the use of bibliometrics and altmetrics (including support for the responsible use of bibliometrics).
Research data services (non-traditional)	Support researchers to work with data. Includes research data management (e.g., assisting with the development of data management plans), as well as data extraction (e.g., text mining), data visualisation, data analysis, accessing data and systematic reviews.
Raising research visibility (non-traditional)	Support with research profiles (e.g., ORCID IDs), and social media.

In addition to the word-level and concept-level data, the REF that each UoA was entered into (REF2014 or REF2021) was recorded. Furthermore, which higher-level discipline each UoA belonged to (STEM or non-STEM) was also documented, using the discipline of the Main Panel it was submitted to. In both REFs there were four Main Panels, the first two (Main Panel A: Medicine, health and life sciences, and Main Panel B: Physical sciences, engineering and mathematics) encompassing STEM subjects, and the final two (Main Panel C: Social sciences; and Main Panel D: Arts and humanities) covering non-STEM subjects. These therefore provide a natural grouping for the analysis at the level of discipline without having to subjectively assign UoAs to particular subject areas.

Data processing

There were some minor differences in the makeup of UoAs between REF2014 and REF2021. In REF2014, engineering research was submitted to four separate UoAs: 'Aeronautical, Mechanical, Chemical and Manufacturing Engineering'; 'Electrical and Electronic Engineering, Metallurgy and Materials'; 'Civil and Construction Engineering'; and 'General Engineering'. In REF2021, however, these were consolidated to form a single UoA, termed 'Engineering', which encapsulated all the research previously submitted to the four separate engineering UoAs (REF2021, 2022b, p. 69). For data collection purposes, the four REF2014 engineering UoAs were therefore combined, and labelled 'Engineering' for consistency between REFs. Similarly, in REF2014 there was a single UoA entitled 'Geography, Environmental Studies and Archaeology', which in REF 2021 was split into two separate UoAs, 'Archaeology' and 'Geography and Environmental Studies' (REF2021, 2022c, pp. 52, 63), each of which was labelled 'Geography, Environmental Studies and Archaeology' for consistency between REFs. Finally, one UoA changed its name between REFs: the UoA entitled 'Music, Drama, Dance and Performing Arts' in REF2014 was changed to 'Music, Drama, Dance, Performing Arts, Film and Screen Studies' in REF2021 to better reflect the subject makeup of the UoA. Although not encapsulated in the title, research within both film and screen studies was submitted under that UoA in REF2014 (REF2021, 2022d, p. 192); they can therefore be considered identical in terms of subject make-up, and for data collection purposes this UoA was labelled 'Music, Drama, Dance, Performing Arts, Film and Screen Studies'.

Coder reliability

Following data collection, intra- and inter-coder reliability were assessed in order to ensure the replicability and consistency of the measures used (Lacy et al., 2015). Specifically, a random sample of 200 environment statements were re-coded approximately 2 months after the initial data collection, and the same 200 environment statements were coded by an independent coder (who was unfamiliar with topic and naïve to the research question) using the word-level definitions provided herein. Both intra- and inter-coder reliability were tested using Krippendorff's alpha (Neuendorf, 2017, pp. 172–187), a statistical measure of coder agreement which is appropriate for the binary data arising from the word-level analysis of mention scores (Krippendorff, 2019, p. 284), using the 'kripp.alpha' function in the 'irr' package (Gamer & Lemon, 2019) for R version 4.2.1 (R Core Team, 2022). Franklin et al. (2010) suggest that an agreement level of 80 % is considered sufficient to establish reliability. Here, Krippendorff's alpha was 100 % for both the intra-coder reliability and the inter-coder reliability, indicating perfect levels of within- and between coder agreement and hence excellent reliability.

Statistical analysis

All data were analysed using R version 4.2.1 (R Core Team, 2022). Analysis of the word-level data considered library mentions in relation

to REF and discipline using a binomial generalised linear mixed-effects model (GLMM). Similarly, binomial GLMMs were also used for the concept-level analysis, considering which factors affected the extent to which libraries were acknowledged as providing traditional and non-traditional research services. All these models were fitted using the 'glmer' function in the 'lme4' package for R (Bates et al., 2015). The nominal (binary) dependent variable was either whether the library was mentioned or not (for the word-level analysis) or whether a research service was acknowledged or not (for the concept-level analysis), and the independent variables were REF (a factor with two levels, 2014 or 2021) and discipline (a factor with two levels, STEM and non-STEM), and their two-way interaction. Models also included random effect terms of UoA (to allow for a paired analysis over the two REFs; i.e., the models could test for changes in mention score *within* a UoA over time) and institution (to control for the potential non-independence in mention scores from UoAs within a particular HEI). Significance was determined by comparing the full models to null models lacking the independent variable(s) of interest using likelihood ratio tests (Crawley, 2012). In all cases, a p-value <0.05 was considered to be statistically significant.

Results

Library mentions

Considering both REFs combined, 63.4 % of UoAs mentioned the library in their environment statements, meaning that the remaining 36.6 % of UoAs made no mention of the library at all. The percentage of UoAs that mentioned the library in their REF environment statements was significantly predicted by the two-way interaction between REF (2014 or 2021) and discipline (STEM or non-STEM) ($\chi^2(1) = 6.57$, $p = 0.010$; Fig. 1). Specifically, REF environment statements in non-STEM disciplines were significantly more likely to mention the library than those in STEM disciplines, in both REF2014 (STEM: 35.4 %, non-STEM: 75.3 %; $\chi^2(1) = 318.39$, $p < 0.001$) and REF2021 (STEM: 46.8 %, non-STEM: 77.1 %; $\chi^2(1) = 191.87$, $p < 0.001$). However, while the percentage of environment statements mentioning the library increased slightly, but significantly, between REF2014 and REF2021 in STEM disciplines (REF2014: 35.4 %, REF2021: 46.8 %; $\chi^2(1) = 20.53$, $p <$

0.001), there was no significant change in non-STEM disciplines (REF2014: 75.3 %, REF2021: 77.1 %; $\chi^2(1) = 2.00$, $p = 0.628$).

Research support services

When considering combined data from both REFs, 47.1 % of UoAs acknowledged traditional methods of library support, while only 15.3 % acknowledged non-traditional methods of support. The percentage of UoAs that acknowledged a traditional research support service was not predicted by the two-way interaction between REF and discipline ($\chi^2(1) = 0.0004$, $p = 0.992$) and there was no significant overall difference between the two REFs ($\chi^2(1) = 0.98$, $p = 0.322$); however, there was a significantly greater level of acknowledgment overall in non-STEM compared to STEM disciplines ($\chi^2(1) = 481.66$, $p < 0.001$) (Fig. 2a). Of the three traditional categories of support considered here, there was significantly greater acknowledgment in non-STEM disciplines for access to information and study space (Table 2).

The percentage of UoAs that acknowledged a non-traditional research support service was significantly predicted by the two-way interaction between REF and discipline ($\chi^2(1) = 8.04$, $p = 0.005$; Fig. 2b). Not only were there significant increases between REF2014 and REF2021 in both STEM ($\chi^2(1) = 159.08$, $p < 0.001$) and non-STEM ($\chi^2(1) = 188.93$, $p < 0.001$) disciplines, there were also significantly greater overall levels of acknowledgement in non-STEM compared to STEM disciplines in both REF2014 ($\chi^2(1) = 15.05$, $p = 0.047$) and REF2021 ($\chi^2(1) = 4.24$, $p = 0.039$). When considering specific categories of non-traditional support, acknowledgement was slightly, but significantly higher in non-STEM disciplines for open research support, bibliometric, altmetric and citation services, and raising research visibility. Moreover, levels of acknowledgement during REF2021 were significantly higher for open research support, bibliometric, altmetric and citation services, and research data services (Table 2).

Discussion

The aim of this study was to investigate the extent to which academic libraries in the UK are recognised by their HEI as contributing to the institutional research environment, by analysing environment statements submitted to the REF exercises in 2014 and 2021. The most

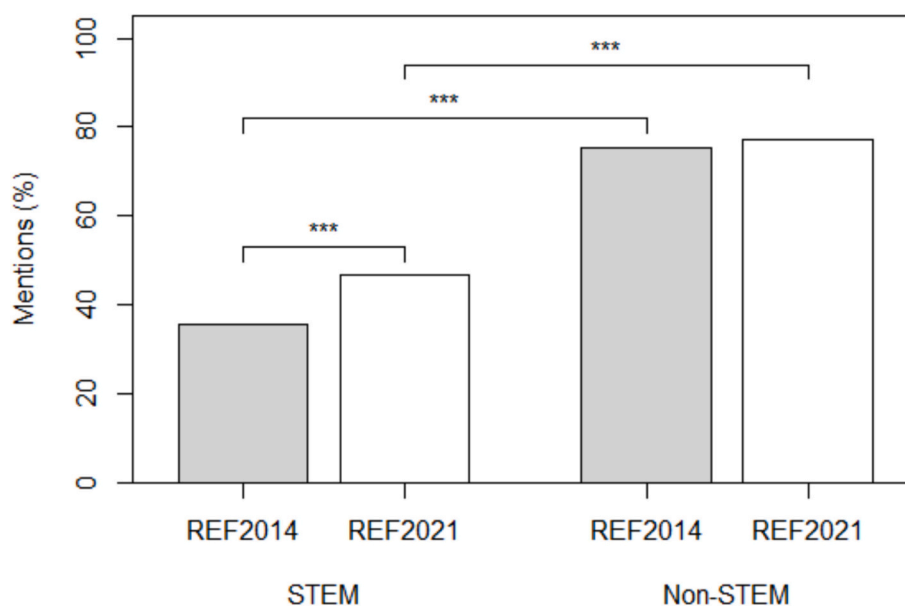


Fig. 1. The percentage of UoAs which mentioned the library in their REF environment statement, as a function of which REF they were entered into (grey bars, REF2014; white bars, REF2021) and which discipline they represented (STEM or Non-STEM). The brackets indicate significant differences between pairs of categories: ***, $p < 0.001$.

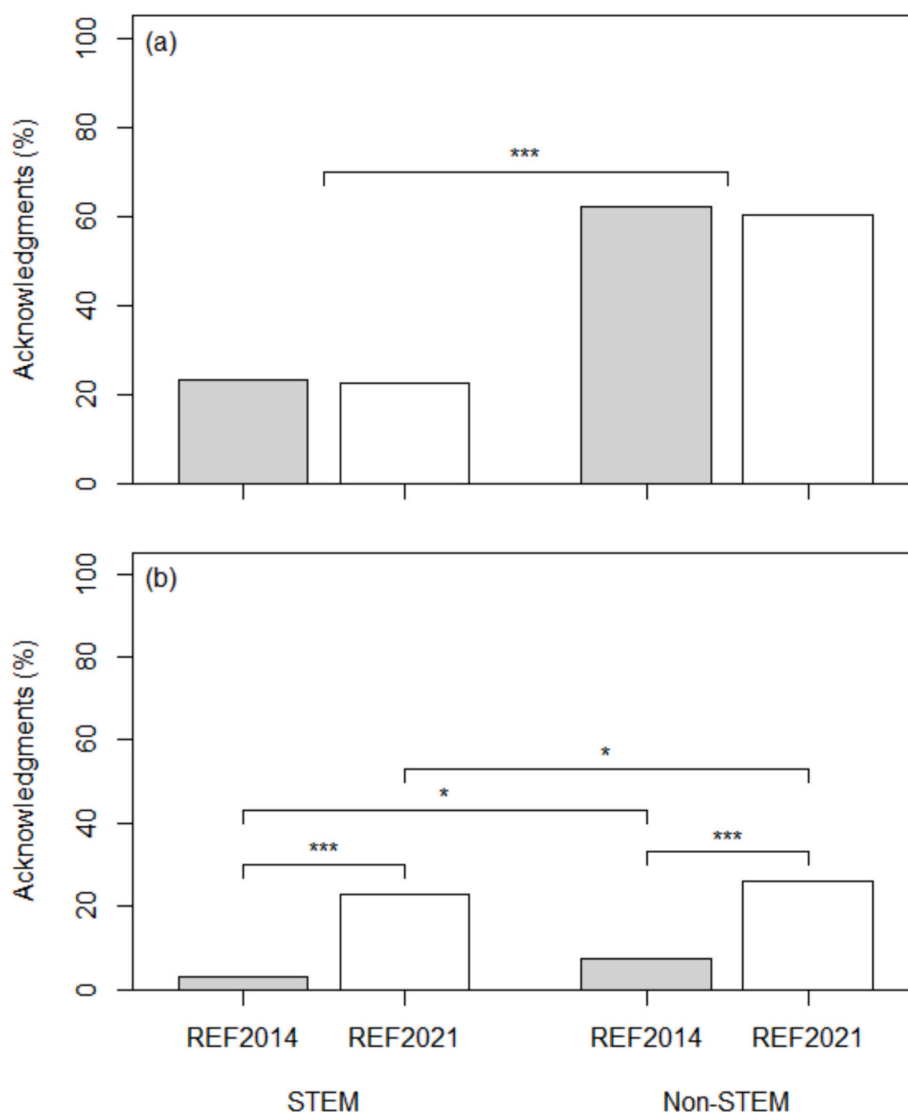


Fig. 2. The percentage of UoAs acknowledging (a) traditional and (b) non-traditional methods of library support as a function of which REF they were entered into (grey bars, REF2014; white bars, REF2021) and whether they represented a STEM or non-STEM discipline. The brackets indicate significant differences between pairs of categories: *, $p < 0.05$; ***, $p < 0.001$.

prominent finding was that over a third of all environment statements (746 out of 1891 UoAs in REF2014, and 632 out of 1878 in REF2021) made no acknowledgement whatsoever of the research support their library offers, highlighting that library recognition for research support in UK HEIs is far from universal. Since it is highly unlikely that any academic libraries offer no research support services at all, this strongly suggests that there is a disconnect between the support libraries do offer and their recognition by UoAs, insofar as this is reflected within their REF environment statements. This may indicate either that some researchers are unaware of the role libraries play in supporting research, at least within certain disciplines or institutions, or they are unwilling to acknowledge this. Indeed, [Searing and Greenlee \(2011\)](#) suggest that when academics are less aware of what the library can offer them, they tend to have a weaker relationship with the librarians and a lower expectation that the library can meet their needs.

Lack of awareness of the support libraries provide is also in agreement with literature suggesting that although libraries offer a variety of services to support researchers (e.g., [Awan et al., 2022](#); [Haddow & Mamtora, 2017](#); [Howie & Hinerangi, 2022](#); [SCONUL, 2019](#)), the researchers themselves are not always aware that these services exist ([Ithaka S+R, 2018](#)) or choose not to engage with them, preferring, for

example, to rely on their own knowledge or use that of colleagues rather than seek guidance from a librarian ([Akeroyd et al., 2022](#)). It has also been well documented that the library and its services are often overlooked or undervalued by researchers and managers, as is the case for many services that perform well ([Murray & Ireland, 2018](#); [RLUK, 2021](#); [Walker, 2020](#)), and it has been identified that libraries struggle to effectively communicate their value to stakeholders ([Connaway et al., 2017](#); [Lynch et al., 2007](#); [Pinfield et al., 2017](#); [Wolff-Eisenberg, 2017](#)). This is despite many libraries changing their staffing models from a subject to functional arrangement, with research support teams and research librarians becoming increasingly common ([Bains, 2014](#); [Hoodless & Pinfield, 2018](#)); changes which should have made the research support offered considerably more visible. This could, at least in part, explain why this study found that so many libraries appear to be ‘forgotten’ in the REF. It should, however, be noted that the REF environment statements were typically written by a small group of (usually senior) academics within each UoA and therefore may not fully represent the views of all the researchers involved.

The finding that just over a third of environment statements did not mention libraries is consistent with that of [Walker \(2020\)](#), who recorded mentions of library support in the environment statements of REF2014.

Table 2

Categories of traditional and non-traditional research support services acknowledged within the UoA environment statements of both REF2014 and REF2021, and how the percentage of UoAs acknowledging these methods of library support differed as a function of which REF they were entered into, and whether they represented a STEM or non-STEM discipline. Where there are significant differences (following a Bonferroni correction for multiple testing), these are given in bold.

Category	REF	Discipline
Access to information	REF2014: 45.4 %, REF2021: 42.4 %; $\chi^2(1) = 6.23$, $p = 0.088$	STEM: 20.5 %, non-STEM: 57.2 %; $\chi^2(1) = 455.36$, $p < 0.001$
Study space	REF2014: 9.2 %, REF2021: 8.2 %; $\chi^2(1) = 1.62$, $p = 0.204$	STEM: 3.1 %, non-STEM: 11.9 %; $\chi^2(1) = 92.61$, $p < 0.001$
Traditional advisory services	REF2014: 3.5 %, REF2021: 6.2 %; $\chi^2(1) = 35.6$, $p < 0.001$	STEM: 3.3 %, non-STEM: 5.8 %; $\chi^2(1) = 3.13$, $p = 0.077$
Open research support	REF2014: 4.8 %, REF2021: 22.3 %; $\chi^2(1) = 310.00$, $p < 0.001$	STEM: 10.9 %, non-STEM: 14.9 %; $\chi^2(1) = 12.61$, $p = 0.003$
Bibliometric, altmetric and citation services	REF2014: 0.7 %, REF2021: 1.6 %; $\chi^2(1) = 131.6$, $p < 0.001$	STEM: 0.7 %, non-STEM: 1.4 %; $\chi^2(1) = 111.1$, $p < 0.001$
Research data services	REF2014: 1.4 %, REF2021: 7.9 %; $\chi^2(1) = 115.15$, $p < 0.001$	STEM: 4.8 %, non-STEM: 4.5 %; $\chi^2(1) = 0.04$, $p = 0.838$
Raising research visibility	REF2014: 0.6 %, REF2021: 1.0 %; $\chi^2(1) = 0.69$, $p = 0.406$	STEM: 0.4 %, non-STEM: 1.0 %; $\chi^2(1) = 0.69$, $p = 0.017$

Not only did this study find very similar patterns during REF2014 but also, concerning, for REF2021. It could be suggested that because increasing the visibility of research enablers, such as libraries, is not an intrinsic aim of the REF (in fact, in REF2021 the contribution of environment statements to the total weighting outputs dropped from 20 % to 15 %; REF2021, 2020, p. 88), acknowledging them become less of a priority. This comparative lack of emphasis on the environment statements (in comparison to outputs and impact) could also mean that researchers are unaware that libraries (along with other research enablers) can be acknowledged within them. It is indeed concerning to see this pattern continue into REF2021, as it is vital that libraries are recognised by their stakeholders in order to strengthen their position within the institutional hierarchy (Baker & Allden, 2017) and allow them to be placed favourably in terms of resource allocation and prospects (Cox, 2018). The change in weightings for the three sections of the upcoming REF2029 ('People, Culture, and Environment', formerly 'Environment', increased from 15 % to 25 % and 'Contribution to Knowledge and Understanding', formerly 'Outputs', decreased from 60 % to 50 %) indicate a shift in emphasis from producers of research to overall research culture, which include research enablers (REF2029, 2025a). Libraries need to seize this opportunity to ensure they receive the recognition they deserve, for example by actively promoting the services they offer to relevant stakeholders or by lobbying for the inclusion of a specific narrative within the environment statements detailing the support the library provides.

When considering the various factors underpinning whether libraries were mentioned or not in an environment statement, the starkest difference was between STEM and non-STEM disciplines. The majority of STEM UoAs made no mention whatsoever of the library, while the overwhelming majority of non-STEM UoAs did mention – and therefore acknowledge – the research support their library offers (again, consistent with Walker's (2020) analysis of REF2014 data). It is somewhat surprising that recognition by STEM UoAs was so much less than that of non-STEM UoAs, as the STEM category includes UoAs that cover medicine and other health-related subjects (the primary subject focus of Main Panel A, one of the two panels which comprises the STEM UoAs; REF2014, 2010, p. 8; REF2021, 2017, p. 17), which commonly have dedicated health librarians who support research, often through non-

traditional methods such as systematic reviews (e.g., Amelia & Rosie, 2023; Bullers et al., 2018). However, it may be that researchers in non-STEM disciplines are more reliant on traditional methods of research support, such as access to physical resources (Scoulas & De Groot, 2023), meaning that they visit the library more frequently than those within STEM disciplines (Bridges, 2008) which, in turn, positively influences their perceptions and awareness of the library and the services on offer.

Although STEM researchers also use the library to support their research, predominantly by accessing information through databases and library subscriptions, as many of these (including e-books and most academic journals) are now accessible online (Carroll et al., 2016) they may often be using the library without realising they are doing so. Many STEM researchers begin their research outside their institution's library (Gordon et al., 2020). This loss of direct connection with the library may impact their recognition of the role it plays in supporting their research and explain the comparatively low percentage of mentions given by UoAs in STEM disciplines. It is also likely that different disciplines have differing needs which could be challenging for libraries to meet. For example, managing bespoke services across disciplines can be very demanding on resources, as highlighted by Kennan et al. (2014) for bibliometric and research data management services. This in turn may contribute to the observed differences in the percentage of mentions, particularly the low percentage seen in STEM UoAs, which may be more reliant on bespoke and non-traditional services (Tchangalova et al., 2021).

The current study also revealed that recognition of non-traditional methods of library research support increased between REF2014 and REF2021 and for all discipline types. It is possible that between the two REFs these relatively new services were incorporated and/or developed into the programme of research support that libraries offer, and as it can take time for researchers to become aware of and use new services (Nel & Fourie, 2016), this was not fully realised until REF2021. Indeed, the literature suggests that in addition to traditional methods of research support, newer 'non-traditional' methods are now an important part of an academic library's offering (e.g., Atkinson, 2016; Jubb, 2016; SCOUNUL, 2019). If these non-traditional methods are aligned with researcher needs and requirements throughout the entire research cycle, as reported in the literature (e.g., Ashiq & Warraich, 2023; Brown et al., 2015; Si et al., 2019; Tang & Zhang, 2019), this may explain the increased acknowledgement of non-traditional support in REF2021 compared to REF2014 across all disciplines. However, it is impossible to infer from the data collected here whether this change was purely perceptual or whether there was in fact a change in the services offered between REFs. The literature does, however, suggest that changes have occurred over the past decade in the provision of services to support research; for example, Cox et al. (2019) report that traditional library services have often been extended to incorporate research data services, which they conclude are now widespread across libraries.

Notably, this study found that the two non-traditional research support methods that saw the largest increase in acknowledgements were open research and research data services. This could be because these two areas of research support are high on the agenda of researchers, not least because most outputs submitted to REF2021 were required to be open access, and libraries have been successful in recognising the need to support researchers in these areas. Indeed, the literature suggests that libraries have been key players in running, managing and encouraging the use of these open-access repositories (Novak & Day, 2018; SCOUNUL, 2019), promoting the open access agenda (Bower et al., 2017; Muir, 2016; Tate, 2016) and supporting researchers in writing of research data management plans which are now mandatory for a number of major funders (ACRL, 2020, 2022; Ashiq & Warraich, 2023; Corral et al., 2013; Cox et al., 2019; Safdar et al., 2022). This significant rise in acknowledgement between REFs indicates that both open research and research data services support is recognised as an important contributor to the research environment.

There was also a statistically significant increase in acknowledgment of two other non-traditional research support services, raising research visibility and bibliometric, altmetric and citation services; however, compared to other services the overall proportion of UoAs acknowledging them was extremely small. This is surprising as bibliometric support is commonly associated with library services (Corrall et al., 2013), although there is a distinct lack of literature on the current service levels offered by libraries in the UK. Moreover, contention surrounds the use of certain bibliometrics as measures of research impact (e.g., Belter, 2015; Waltman, 2016), which is at least in part why the REF primarily uses peer-review to quantify research excellence – although it should be noted that there is still limited use of bibliometrics, for instance quantitative data such as citation counts can be requested by evaluation panels (Grove, 2022). The use of altmetrics, which try to overcome some of the failings of traditional bibliometrics measures (Karanatsiou et al., 2017; Mech et al., 2020), are a relatively new phenomenon which may have not had enough time to become firmly established both within the research landscape and the library itself (Tattersall, 2017). A combination of both these factors may have contributed to the very small proportion of UoAs acknowledging this service. As already stated, the data collected within this study do not necessarily reflect whether a service is offered by a library, but only the recognition of that service. It is also important to emphasise that not all institutions will offer all services, especially some of the newer non-traditional services, and therefore it is difficult to disentangle whether the general increase in the acknowledgement of non-traditional services really reflects an increase in recognition. At the very least, however, the services actually offered by a library place a lower bound on the services that can be acknowledged (i.e., services cannot be acknowledged if they are not offered).

Although this study found that acknowledgement of non-traditional measures of support increased between REF2014 and REF2021, the results show that traditional methods of support still predominate, with access to information (for example, through books, journals, databases, and so on) being acknowledged by almost half of all UoAs across both REFs. This indicates that libraries are still well recognised for the traditional research support they offer, which is not surprising as libraries are historically known for supporting researchers through traditional methods such as the collections they hold (Brophy, 2005), a finding supported by a number of recent studies (Ashiq & Warraich, 2023; Awan et al., 2022; Cox et al., 2019; Tenopir et al., 2017).

For the forthcoming REF2029, the environment statement has been broadened into a section covering ‘People, Culture, and Environment’ (REF2029, 2025b). This may provide an invaluable opportunity to explicitly incorporate information on precisely how academic libraries contribute to creating a supportive research culture, provide essential resources, and foster an environment conducive to high-quality research; thereby illustrating the integral role they play in the research ecosystem. However, for this to be realised close collaboration between researchers, REF document authors and library staff is essential for ensuring that the role libraries play in facilitating research is appropriately recognised.

Conclusions

The overall aim of this study was to investigate the extent to which academic libraries are recognised as contributing to the research environment of their parent HEIs, by evaluating environment statements submitted to REF2014 and REF2021. Approximately two thirds of environment statements referred to the research support offered by the library, meaning that the remaining third made no acknowledgement of library support at all. Moreover, it is evident that the factors underpinning the extent to which library support was mentioned were complex and affected by the interplay between which REF the submission was made to, and which discipline (STEM or non-STEM) the UoA belonged to. Therefore, while there were changes in the extent to which

libraries were perceived as contributing to their institutional research environment between REF2014 and REF2021 (hypothesis 1), as well as differences between STEM and non-STEM disciplines (hypothesis 2), the complex nature of the interaction between these factors meant that trends and patterns in any given factor were not universal and could only be interpreted in light of the other factor. Indeed, the only hypothesis that received consistent support was hypothesis 3, which postulated that the recognition of non-traditional methods of library research support would increase between REF2014 and REF2021; this was exactly what was observed, irrespective of discipline.

These findings are important as, assuming that library mentions can be considered a proxy for recognition, they highlight that the research support offered by libraries is not always recognised by its stakeholders. It is vital that the support libraries provide to researchers, from provision of information resources through to the delivery of specialised support (such as systematic review guidance) is adequately recognised, as it can enable institutions to achieve research excellence (e.g., Bower et al., 2017; cOAlition S, 2018; Finch, 2012). Libraries must ensure their position within their institution is strong, especially in the current economic climate (e.g., Cox, 2018; Kett et al., 2024; Leeming, 2024) and so it is imperative that the contributions they make are recognised in order to benefit themselves and the institution as a whole (RIN & RLUK, 2011). For these reasons, libraries must consider how they can become more visible to their stakeholders, especially to specific populations, such as STEM disciplines, for which there was only limited evidence of recognition. Nevertheless, the forthcoming REF2029 presents a promising opportunity for libraries to gain recognition for their invaluable role as research enablers.

CRediT authorship contribution statement

Claire Pike: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Barbara S. Lancho Barrantes:** Conceptualization, Methodology, Writing – review & editing.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data supporting this study are openly available at <https://doi.org/10.17605/osf.io/bkdwy>.

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