What is local research? Towards a multidimensional framework linking theory and methods

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Abstract

In this research article we propose a theoretical and empirical framework of local research, a concept of growing importance due to its far-reaching implications for public policy. Our motivation stems from the lack of clarity surrounding the increasing yet uncritical use of the term in both scientific publications and policy documents, where local research is conceptualized and measured in many ways. A clear understanding of it is crucial for informed decision-making when setting research agendas, allocating funds, and evaluating and rewarding scientists. Our twofold aim is (1) to compare the existing approaches that define and measure local research, and (2) to assess the implications of applying one over another. We first review the perspectives and measures used since the 1970s. Drawing on spatial scientometrics and proximities, we then build a framework that splits the concept into several dimensions: locally informed research, locally situated research, locally relevant research, locally bound research, and locally governed research. Each dimension is composed of a definition and a methodological approach, which we test in 10 million publications from the Dimensions database. Our findings reveal that these approaches measure distinct and sometimes unaligned aspects of local research, with varying effectiveness across countries and disciplines. This study highlights the complex, multifaceted nature of local research. We provide a flexible framework that facilitates the analysis of these dimensions and their intersections, in an attempt to contribute to the understanding and assessment of local research and its role within the production, dissemination, and impact of scientific knowledge.

Keywords: local research; scientific knowledge; scientific policy; research evaluation; scientometrics.

Introduction

Local knowledge is central for the development and implementation of efficient policies which adapt and consider the conditions and needs of different communities (Stiglitz 1999). This is especially relevant in peripheral and marginal communities, where global or mainstream knowledge may inadequately adapt to local contexts (Cancino et al. 2024). Hence, scientific policy awareness is most needed in order to foster and prioritize local research, ensuring a better distribution of resources (Miguel et al. 2015). However, despite the great interest surrounding it, local research is conceptualized and measured in many ways. A clear understanding of the concept is therefore crucial for making informed decisions when setting research agendas, allocating funds, evaluating scientists, and rewarding them for their work. A lack of systematization in defining local research might leave a vacuum which can lead to the imposition of colonizing standards, universalistic criteria and ranking regimes (Ishikawa 2014; López Piñeiro & Hicks 2015). This can erode the work of local researchers, who provide "the best prospects for deriving policies which are both effective and engender broad-based support" (Stiglitz 1999 p. 3).

The importance of defining the concept of local research, both theoretically and operationally, lies in its far-reaching implications for public policy. Although recurrently used (e.g. Cancino et al. 2024; Chavarro et al. 2014; Hicks et al. 2015), there appears to be limited discussion and consensus around it within the specialized community, since definitions are scarce and only recently have partial approaches to its measuring been made. The most typical case that has been passed on over time consists of the use of toponyms as a measurement method (for instance in Chavarro et al. 2014; Ordóñez-Matamoros et al. 2010; Zhuang et al. 2020). Other approaches include the use of national or local languages, the location of journals or the lack of coverage in international databases as proxies for the local (e.g. Gupta & Dhawan 2009; Kulczycki et al. 2020; Tijssen 2007). Governments, funders and other stakeholders also express growing interest in local research, but most policy documents just mention the concept without clearly stating its meaning and scope (Delgado-López-Cózar et al. 2021; Hicks et al. 2015; United Nations Educational, Scientific and Cultural Organization 2021; Zhang & Sivertsen 2020).

In this article we explore the different approaches and definitions of local research used in the literature, providing a conceptual and empirical framework that allows for a better understanding of the consequences of using one approach over the other. To do so, we first review the notions developed around the concept since the 1970s. This facilitates a systematic examination of the different perspectives and measures used to capture local research. Based on our review, we propose a conceptual framework which helps decompose the concept of local research into distinct dimensions, each linked with a specific definition and methodological approach. We then compute each of the measures identified in the literature to a set of more than 10 million publications extracted from the Dimensions

database, allowing us to compare each perspective. We discuss the level of alignment between perspectives and revise our proposed theoretical framework. We conclude by referring to the implications of our proposal and how its adoption may help clarify and better understand different dimensions commonly associated with local research.

Approaches to identifying local research

Concern for local research dates back to the late 1970s, when scientists began to realize that working at the local level meant dealing with budget constraints and limited scope results (Willmott 1976). The availability of reliable and sufficient data was a major drawback (Hitch 1981), as were the difficulties of adjusting foreign technology to local R&D (Kumar 1987); two still pressing issues for Global South countries. Later on, the importance of the local for scientific research was reevaluated in order to "move away from theoreticism (where empirical research on specific situations was disparaged) and overgeneralization (where specific variations between places were ignored)" (Duncan 1989 p. 128). There was renewed emphasis on conducting research that acknowledged the unique features of the local to diagnose problems and to develop ad hoc solutions, while identifying commonalities across settings (Sommer 1990). Even research agendas began to incorporate references to localized characteristics and geographic contexts, although there was little certainty of what the local actually stood for (Duncan 1989). Up until today, this trend can be seen in most policy documents and research papers across fields. Fitting examples can be found in management (Angelescu & Squire 2006), public policy (Grinstead et al. 2018; Mitchell & Schmidt 2011; Phillipps 2018), education (Kuzhabekova & Lee 2017; Lee & Kuzhabekova 2019; Phipps & Shapson 2009), anthropology (Caldwell & Lozada 2008), or sociology (Fine 2010; McAllum 2018; Roudometof 2016).

The concern that evaluative measures would systematically undermine this type of research has led the field of scientometrics to explore local research from a performative perspective, looking at visibility (Tijssen et al. 2006), authorship and collaboration (Ordóñez-Matamoros et al. 2010; Tijssen 2007), interdisciplinarity (Chavarro et al. 2014), publishing dynamics (Ishikawa & Sun 2016; Kulczycki et al. 2020; Mironescu et al. 2023), and topics (Miguel et al. 2015; Zhuang et al. 2020) mostly in Global South research outputs. These studies use different approaches to identify local research, with a few approaching their methodological design from a theoretically driven perspective.

In most cases, these definitions are pragmatic and context driven, more the result of technical solutions rather than a conscious reflection of the proxy used and its capability to identify research inherently local. Next, we will review the three most common methodological approaches to identifying local research in the scientific literature. These are the following:

1) Toponym-based methods, which rely on the presence of place names to indicate a geographical focus in research outputs.

2) Language-based methods, where the use of non-English languages is taken as an indicator of a national or regional orientation in research.
3) Journal-based methods, which assume that research published in national journals and/or indexed in non-mainstream databases inherently reflects local concerns or topics.

Toponym-based methods

The starting premise for studies centered on toponyms is that "local research is site specific, in that the researcher seeks to understand or change conditions in a particular location at a particular time" (Sommer 1990 p. 205). In similar terms, it implies "research related to either local, regional or national contexts, conditions or topics, as opposed to research that is universalistic or decontextualized" (Chavarro et al. 2014 p. 2). Such studies usually reflect scientific activities where the country is either the main topic, the case studied, part of a comparison study, the social environment including national personalities and events, the territorial scope, or a referent (Miguel et al. 2015; Ordóñez-Matamoros et al. 2010).

> *In either case, relevant knowledge is derived, contributing therefore to the local stock of information necessary to increase local understanding and to produce new knowledge valuable to solve local intellectual, technical, or social issues.* (Ordóñez-Matamoros et al. 2010 p. 421)

One of the most used methods for this approach is to identify toponyms and demonyms in the titles, abstracts, keywords and other sections of publications. It has been used to analyze various aspects of local research, like the share of contributions on local issues authored by national and foreign researchers, or the effects of international collaboration on team performance and agenda setting in Global South countries (Ordóñez-Matamoros et al. 2010). Additionally, Chavarro et al. (2014) employed this method to investigate the relationship between the degree of interdisciplinarity and the local orientation of publications in Colombia (Chavarro et al. 2014). Other studies focus on the growth rate in different disciplines within Argentina's thematic domain (Miguel et al. 2015), or the interactions of global and local geography topics in China and the United States, especially regarding local responses to global issues and the global performance of local matters (Zhuang et al. 2020).

These studies have contributed to gain insights into the nature and scope of research addressing local issues (Chavarro et al. 2014; Ordóñez-Matamoros et al. 2010). Still, toponym-based methods pose a series of methodological challenges that can undermine their capacity to identify local research. First, there is an unequal use of toponyms by region in titles and abstracts (Castro Torres & Alburez-Gutierrez 2022). Authors from the Global North are less likely to include concrete geographical references in their articles than Southern authors, who end up being more exposed to the evaluation and citation disadvantages of following naming conventions (Kahalon et al. 2022; Miguel et al. 2023; Mongeon et al. 2022). This leads to the reinforcement of the belief that "evidence produced in and about the Global North is assumed to be more 'universal', whereas evidence from or produced in the Global South is

considered valid only for specific contexts (i.e., 'localized')" (Castro Torres & Alburez-Gutierrez 2022 p. 1). Second, certain disciplines and even subdisciplines, such as demography or international relations within the Social Sciences, are more geographically bounded; thus, geolocation is referenced more explicitly than in others, such as general or educational psychology (Castro Torres & Alburez-Gutierrez 2022). Behavioral sciences provide an illustrative case where findings are frequently generalized from predominantly Western, Educated, Industrialized, Rich, and Democratic (WEIRD) samples, highlighting the existence of local research that remains unlabeled as such (Henrich et al. 2010; Kahalon et al. 2022; Miguel et al. 2015). All these differences in localization habits, disciplines and data sources translate into fewer toponyms' mentions, that is to say, false negative results.

Furthermore, working with toponyms is complex on a technical level. While their isolation from natural language text might be straightforward when it comes to unique proper nouns, it produces false positive results when dealing with common place names, anthroponyms and ordinary nouns. A close example to us is Granada, which in Spanish refers to several cities in Spain, Peru, Nicaragua and the United States, a province in Spain, a department in Nicaragua, a country in The Caribbean, a fruit (pomegranate) and a weapon (hand-grenade). Similar issues can be found in the coincidence between streets and people's names (Jerônimo et al. 2018) or in the close linkages between toponyms and dermatological conditions (Radhika et al. 2021), just to mention a few cases. As the level of territorial aggregation decreases these types of scenarios multiply, which could explain the strategy of most studies working with toponyms at the country level only and hence looking more into national research rather than local. While novel methodologies using Natural Language Processing (NLP) techniques have the potential to overcome these limitations (Jerônimo et al. 2018; Mongeon et al. 2022), there is space for improvement, especially due to the presence of false positives and false negatives in the obtained results.

Language-based methods

Studies using language to identify local research usually take English language as a proxy to describe global research. This is because English has, for many decades now, been broadly considered the lingua franca of science (Garfield 1967), with mainstream databases primarily covering publications in this language (van Leeuwen et al. 2001). Added to this is the notion that by publishing in English language, research will potentially reach broader audiences and gain higher impact (Buela-Casal & Zych 2012; van Leeuwen et al. 2001). This has led many non-English-speaking countries to implement national policies that promote publishing in English as a strategy to boost internationalization and enhance their scientific impact (Robinson-Garcia & Ràfols 2020).

Fields which are especially affected by this linkage between language and internationalization are those of the Social Sciences and the Humanities. Researchers will attempt to address different audiences: global or national. Depending on their goal they will publish in their own language in order

to reach local communities (Nederhof 2006). This is evidenced by the resistance researchers in these areas pose to policies pushing them towards publishing in English language (Ishikawa & Sun 2016), highlighting the importance of national language as a means to reach local audiences (Kulczycki et al. 2020; Mironescu et al. 2023).

Another example on the use of language as a proxy for identifying local or global research is found in the CWTS Leiden Ranking (https://www.leidenranking.com/) which aims at analyzing the scientific performance of over 1,500 universities worldwide. This ranking is based purely on bibliometric data derived from Web of Science[1]. However, they exclude publications in non-English languages (CWTS 2024) and do not consider them as core publications suitable for analysis, thus reinforcing a double bias: one related to the predominance of Global North coverage within WOS, and another to the preference for English language publications. Given that languages other than English also contribute to knowledge advancement, the main problem with language-based methods is that they overshadow and underrate non-English scientific outputs (van Leeuwen et al. 2001).

From a technical perspective, language can be a problematic variable to identify local research on a large scale. Many of them, like English, Arabic or Spanish, are official or co-official in several countries, which means they cannot be indicative of a single place. Even if this approach is controlled for geographical affiliation, working at lower levels of territorial aggregation would generally not be possible, since most regions and cities share a national language. Especially difficult is to extrapolate the method to Anglophone countries, as it would not be possible to distinguish between local and global scientific publications.

Journal-based methods

Studies on the origin of journals often assume that research published in nationally oriented sources inherently reflects local concerns (e.g. López Piñeiro & Hicks 2015; Miguel et al. 2015; Navas-Fernández et al. 2018; Tijssen 2007). In contrast, international journals are typically defined by criteria such as being produced by large editorial conglomerates, affiliated with renowned institutions, edited by internationally diverse committees, selected by authors worldwide, published in English, or indexed in mainstream databases (Buela-Casal et al. 2006). Empirically, we identify four different approaches for defining local journals, as summarized in Table 1.

One common approach focuses on the geographical affiliations of key actors involved in the journals' production, including publishers, editors, reviewers and authors. This method has been applied in studies on African journals, where their relevance and performance are investigated within the global research landscape still being considered local (Tijssen 2007; Tijssen et al. 2006). However, these methods face challenges, as the mere geographical location of a journal or its contributors does not

[1] Although since 2024 it also includes an open version based on OpenAlex data.

necessarily indicate that the knowledge produced is related to the place in which it is generated. Mainstream journals, often owned by large academic publishing companies in the United Kingdom, the Netherlands or the United States, publish research internationally. This understanding of locality reflects the assumption that Western, Anglophone journals are largely deemed global, while those edited in peripheral countries must meet several criteria to gain the same recognition (Navas-Fernández et al. 2018).

As an alternative, Moed et al. (2021) suggest looking also into the geographical location of citations to define international or national journals. In this way they add an additional perspective into locality: that which is consumed or used by individuals geographically located in a single place. The last journal-based method is followed by López Piñeiro and Hicks (2015), who focus on the field of Sociology in Spain and combine the citation approach with database journal indexing. In this case, they look into two sets of highly cited papers according to two databases: an international one (Web of Science) and a national one (In-RECS). They then investigate citation differences by language to note that "different topics are cited in the English language and Spanish language" (p. 86), pointing towards a relation between journal, citation impact, language and local research.

The use of database indexing as a criterion to identify local/national journals, is based on the notion that WOS (and Scopus by extension) index only those journals which constitute the core of each specialty. This premise dates back to Bradford's Law of Scattering and its application by Garfield to abstracting services (Bensman 2012). Garfield based the inclusion of journals in WOS on universalistic criteria, such as editorial standards and scientific impact. But over time, the selection procedure[2] has been modified as other products and citation indexes have been added, revealing a disciplinary and geographical bias in its coverage (Chavarro et al. 2018; van Leeuwen et al. 2001).

Journal indexing is used in many countries, enforcing scholars to publish in journals included in mainstream databases as a strategy to internationalize their research. We find examples of such approach in countries such as Spain, Colombia or Brazil (Chavarro et al. 2018). In the case of the former, we even find categorizations of journals based on a combination of indexing and journal impact metrics (Torres-Salinas et al. 2010).

By presenting mainstream database content as universally representative, the presence of local research in the Global North is obscured. More broadly, the dangers of using these biased and incomplete sources as proxies for global science are significant. They provide a distorted view of the volume and nature of research agendas worldwide, reinforce the notion that only science from the Global North constitutes international mainstream research, and risk informing policy decisions that undervalue local contributions. This is particularly problematic when assessing researchers' performance, as it can lead to the marginalization of local research efforts (Torres-Salinas et al. 2010).

[2] More information on the journal selection process available at https://clarivate.com/products/scientific-and-academic-research/research-discovery-and-workflow-solutions/webofscience-platform/web-of-science-core-collection/editorial-selection-process/editorial-selection-process/.

237 Table 1. Methodological approaches to identify local/national journals.

Method	Explanation	References
Geographical affiliation of publishers or editors	National origin of key actors involved in journal production to classify a journal as local or international.	Navas-Fernández et al. (2018)
Index of National Orientation of Publications (INO-P)	Share of articles published by authors affiliated with institutions in the country contributing the largest number of articles.	Grančay et al. (2017), Hladchenko and Moed (2021), Pajić (2015)
Index of National Orientation of Citations (INO-C)	Share of citations to a journal from authors affiliated with institutions in the country contributing the largest number of citations.	Grančay et al. (2017), Hladchenko and Moed (2021), Pajić (2015)
Foreign participation in editorial boards, authorship, or international collaborations	Degree of international involvement in a journal, based on the presence of members from different countries in editorial teams, authorship, or international collaborations.	Buela-Casal et al. (2006), Navas-Fernández et al. (2018)
Non-indexed journals	Journals not indexed in international mainstream databases like Scopus or Web of Science.	López Piñeiro and Hicks (2015), Moed et al. (2021), Tijssen et al. (2006)

238 Towards a conceptual framework of local research

239 As we have seen, different proxies are used to measure or identify local research. From
240 searching for toponyms in titles and abstracts, to more sophisticated methods exploring the affiliation
241 of authors or even citing authors. These methods are often used for pragmatic reasons, while on other
242 occasions they are justified by the methodological design of the study in question. But they implicitly
243 reflect very different understandings of what local research means. Beyond the technical limitations
244 each approach may conceal, broader conceptual questions arise: to what extent are they measuring the
245 same phenomenon? And if not, are they capturing partial proxies of it?

246 In order to respond to these questions, we propose a conceptual framework that gives room to
247 the different perspectives or dimensions of local research, establishing a direct link between
248 conceptualization and measurement that can help better clarify what we are actually discussing when
249 referring to local research. We build upon the literature on spatial scientometrics (Frenken et al. 2009),
250 which refers to scientometric studies which consider geographical aspects in their analyses on citation
251 impact and collaboration. This framework explores the geographic traces author affiliations leave to
252 study aspects such as citation, collaboration or mobility, among others (Hoekman et al. 2010).

253 So far, spatial scientometrics tends to focus on the performativity of countries and regions
254 (Waltman et al. 2011), the mobility of authors (Nicolás Robinson-Garcia et al. 2019) or the geographical
255 concentration of citation impact (Wuestman et al. 2019), but does not consider geographically
256 constrained knowledge. Frenken et al. (2009) adapted the proximities framework developed by

Boschma (2005) who defines five forms of proximity: geographical[3], cognitive, social, organisational and institutional (Table 2).

Table 2. Linking Boschma's proximities (2005) to measures and dimensions of local research.

Proximity	Definition	Measure for local research	Linkage strength	Local dimension
Cognitive	Refers to the similarity in knowledge bases	Geographic concentration of references	Strong	Locally informed research
Physical	Refers to geographical proximity	Use of toponyms	Strong	Locally situated research
Social	Refers to trust and social networks	Geographic concentration of citations / authors	Moderate	Locally relevant research
Organizational	Refers to common institutional control	Journal indexing in mainstream databases / language of publication	Weak	Locally bound research
Institutional	Refers to shared incentive structures and governance	Journal indexing / language of publication	Weak	Locally governed research

Here we propose adding an extra layer to some of these distances to capture different dimensions of local research. Hence, we can define these dimensions when any of these different types of proximities are geographically constrained. In Table 2 we examine the measures for identifying local research and link them with different proximities. Furthermore, we add our own assessment of the potential strength of such measures to capture the local dimension for each type of proximity. For instance, we point at a strong linkage in the measuring of cognitive proximity, which is geographically constrained or locally informed when identifying articles based on literature from authors affiliated to a given geographic region. The same goes for the locally situated dimension, which refers to research whose object of study is set in a specific geographic location one would expect to found mentioned in the paper.

On the opposite side Table 2 shows what we have named locally bound and locally governed research. These refer to research strongly shaped by local organizations such as universities, research centers or government bodies, which control or influence the agenda. The difference between these two comes from the leverage directionality. In the former case, it is local organizations who influence research, shaping it according to their focus on local needs without coordinated alliances with others. In the latter case, the research agenda is formally governed by regional or national policies, regulations or funding incentives, often tied to public policy goals that require cooperation between organizations.

[3] Renamed into physical by Frenken et al. (2009).

In these two scenarios, we find that the link with measures for local research is less clear. In an effort to establish some similarities, one would expect these types of research to be published in local venues, written in local language and directed at broader audiences, not necessarily prioritizing its scientific visibility and impact.

Lastly, we define locally relevant research in connection to the social proximity as that which has a geographically constrained impact. While here we examine the location of citations to build the measure, we must note that we actually consider a broader location of attention, whatever form that takes. It could be citations, but also downloads, viewers, users, policy mentions, news media coverage or other proxies of attention. Another proxy for the locally relevant could be the geographic concentration of authors given the origin of their institutional affiliations.

Methodology

Next, we examine the relationship between the different measures used to identify local research, computing and comparing them. To allow for a global comparison across measures we make two concessions. First, we focus on the national level but also acknowledge that this approach could be adapted at smaller geographic units, such as regions or cities. Second, we modify some of the methods and compute them at the journal level. This affects specially the toponym-based method, where we compute the locality of papers directly based on the presence of toponyms in their titles, but then aggregate them at the journal level. This means that we will consider a publication to be local as long as it is published in a journal that presents a high share of papers with toponyms in their titles. We do this for two reasons: 1) to use a comparable methodology with approaches that work at the journal level, and 2) to minimize Global North-South differences in the use of toponyms (Mongeon et al. 2022).

We work with Dimensions data for the 2017-2019 period. We identified a total of 36,482 journals publishing 10,338,372 publications. We established a minimum threshold of 30 articles published within the 3-year period and obtained a total of 25,220 journals which had published 10,205,767 articles. For each journal we computed 6 different measures of locality. These are reported in Table 3. The variables related to language, and journal indexing were computed after combining the information extracted from Dimensions with Web of Science master journal list, Scopus list of journals and the Directory of Open Access Journals (DOAJ). For non-binary variables we would compute the share of papers identified as local in a given journal. For practical purposes, we set a cut-off threshold at the third quartile of each journals' distribution to label them as local. Dichotomous variables were used for journal indexing and publication language.

309 Table 3. Definition of variables.

Operational approaches	Variables	Definitions
Toponyms	Toponyms proportion	Proportion of appearance of country level toponyms mentioned in paper titles per journal and selected in the most preponderant languages of the dataset: English, Japanese, Portuguese, German, Spanish, Indonesian, French and Russian
Languages	Non-English publishing	Whether the journal publishes in languages other than English according to WOS, Scopus and DOAJ data, and to paper titles language recognition
Journals	Publishing proportion	Proportion of appearance of the maximum publishing country per journal according to the geographical affiliation of authors
Databases	Non-mainstream indexing	Whether the journal is indexed in databases other than WOS or Scopus
References	Referenced proportion	Proportion of appearance of the maximum referenced country per journal according to the geographical origin of references
Citations	Citing proportion	Proportion of appearance of the maximum citing country per journal according to the geographical origin of citations

310

311 Table 4 summarizes the construction of variables and subsets of data per operational approach.
312 The full R code developed to compute the calculations and visualizations is freely available in Di Césare
313 (2024). Next, we present the results of this analysis and compare how all operationalizations perform
314 in local journals at disciplinary category[4] and country levels.

315 Table 4. Summary of variables and subsets construction.

Variables	Units of analysis	Thresholds	Subsets
Toponyms proportion	Country names in papers titles	3ºQ	6572 local journals
Non-English publishing	Languages of publication other than English	English	1514 local journals
Publishing proportion	Maximum publishing country	3ºQ	5571 local journals
Non-mainstream indexing	Indexing databases other than WOS or Scopus	WOS or Scopus	9517 local journals
Referenced proportion	Maximum referenced country	3ºQ	5811 local journals
Citing proportion	Maximum citing country	3ºQ	5923 local journals

[4] The assignment of journals by field is based on the Fields of Research subject classification followed by Dimensions. These are shown in Table A1 (Appendix).

Results

Identification of local journals

Table 5 shows descriptive values of the six variables computed, each one of them corresponding to an operational approach. The average values vary significantly from one variable to the other. While Toponyms proportion barely exceeds 10% of papers titles with country names per journal, Publishing proportion identifies more than half the papers per journal as produced by authors affiliated with a single country. In between, we find similar averages in Referenced proportion and Citing proportion, where 34% of the references and 37% of the citations per journal are made to and received by sources from the same geographical origin. In other words, more than a third of the information sources and audiences per journal are concentrated in a single country. In Non-English publishing we see that only 0.06% of the journals publish in languages other than English, whereas in Non-mainstream indexing almost 40% of the journals are covered by databases other than WOS or Scopus.

Table 5. Descriptive measures of the variables at journal level.

Measures	Continuous variables			
	Toponyms proportion	**Publishing proportion**	**Referenced proportion**	**Citing proportion**
Mean	0.11	0.54	0.34	0.37
Median	0.05	0.53	0.31	0.27
Minimum	0	0.06	0.04	0.04
Maximum	0.99	1	1	1
1º quartile	0.01	0.28	0.24	0.18
3º quartile	0.14	0.82	0.40	0.50
Standard deviation	0.14	0.29	0.16	0.25
	Dichotomous variables			
	Non-English publishing		**Non-mainstream indexing**	
Frequency	1,503		9,517	
Relative frequency	0.06		0.38	

From here on, we present results focused only on the journals identified as local according to each operational approach and their specific thresholds. Figure 1 shows the resulting subsets of local journals and how they overlap. On the left-hand horizontal bars we see the total set sizes per approach, with Databases being the largest (9,517 local journals not indexed in WOS or Scopus) and Languages being the smallest (1,514 local journals not published in English). The orange vertical bars and dots denote that half the operational approaches nearly do not intersect, but rather keep most local journals from their subsets disconnected from the rest. In Toponyms, References and Databases, 3,056 (47%), 2,158 (37%) and 1,964 (21%) of their respective subsetted journals are not identified as local by any other approach. The opposite happens in Journals (233), Citations (233) and Languages (52), whose

values without overlap barely range from 3% to 4%. The first coincidence between approaches is found in fourth place, where Databases, Citations and Journals possess 1,548 local journals in common.

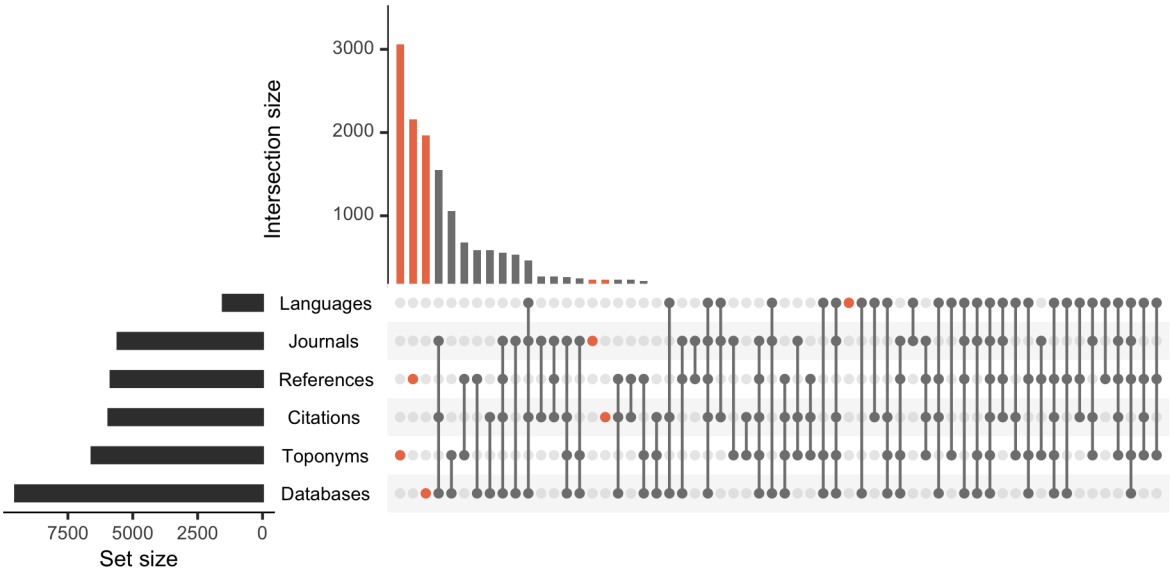

Figure 1. Local journals overlap between operational approaches.

Figure 2 delves into field differences within the subsets of local journals according to each operational approach. The grey dots in the plot represent the proportion of local journals that belong to each Dimensions disciplinary category, whereas the orange triangles indicate the mean value per field. Health Sciences show the highest average proportions in all operational approaches, most especially in Journals (0.15) and Databases (0.13). It is followed by Social Sciences, which in Citations (0.06) and Databases (0.05) coincide with Humanities. Life and Physical Sciences have very similar mean values in all cases but in the Toponyms approach (0.06 and 0.01 respectively). As for the categories, those of Humanities concentrate in the lowest values with Language, Communication and Culture (0.9) achieving the highest proportion in both References and Citations. Social Sciences spread quite similarly along the x axis, with a few highlights in Toponyms and References for Human Society (0.18 and 0.13), and in Languages and Citations for Education (0.13 and 0.12). Health Sciences informs some of the most pronounced differences between categories, especially in Journals and Databases where Biomedical and Clinical Sciences reach the highest values of all (0.22 and 0.20). Both Physical and Life Sciences report some of the lowest proportions, although Engineering (0.08) stands out in Journals, Databases and Citations, and all Life Sciences categories are notably prominent in Toponyms.

Figure 2. Average share of local journals according to each operational approach by disciplinary category and aggregated by five major fields.

Local research at country level

Figure 3 presents the variables considered in the study at country level. It reveals that Toponyms proportion and Referenced proportion do not correlate with the rest of the approaches. On the contrary, Non-English publishing, Publishing proportion, Non-mainstream indexing and Citing proportion are correlated with each other. The strongest link of all is identified between Publishing and Citing proportions (0.77), while Non-English publishing and Non-mainstream indexing correlate moderately (0.56).

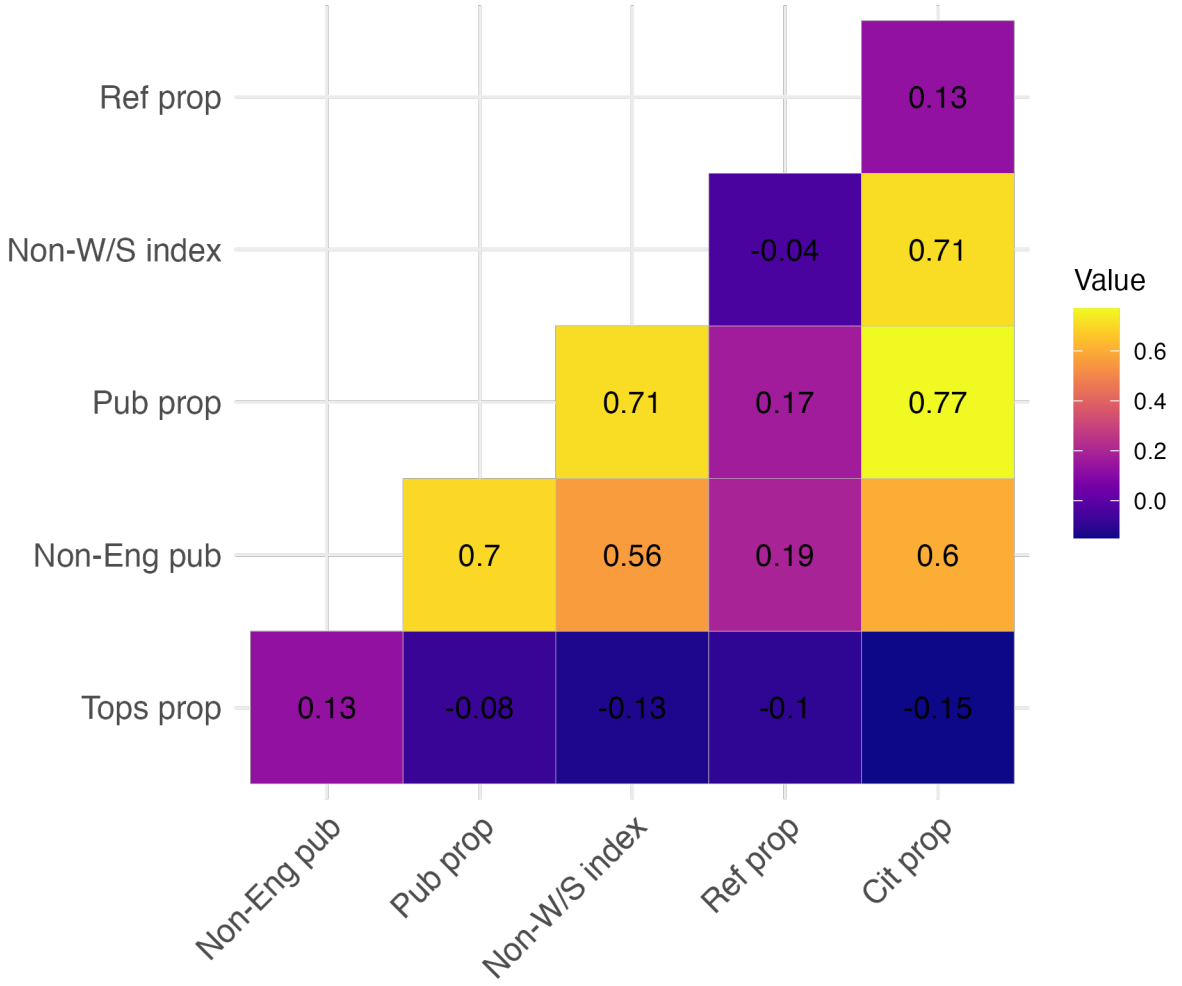

Figure 3. Country level correlations of variables from all operational approaches.

In Figure 4 we show six different world maps, each one of them corresponding to an operational approach. The color scale represents each country's proportion of papers published in local journals with respect to their total number of publications during the period of study. The darker hues indicate a low share of publications in local journals, whereas the lighter shades reveal higher proportions. On the whole, Toponyms stands out because it presents the highest proportions. Approximately 50% to 80% of the papers produced in parts of Africa, Southeast Asia, and Central and South America are published in local journals according to this approach. Databases also presents medium to high proportions particularly in Southeast Asia, Eastern Europe, and Central and South America. Indonesia stands out because 85% of its papers are not indexed in mainstream databases. Most parts of the Citations map show low shares of local research except for countries like Indonesia (0.52), Ukraine (0.50), Russia (0.40) and Brazil (0.30). From an audience point of view, these countries publish around 30% to 50% of their papers in local journals. These same countries stand out in Journals with 30% to 45% of their papers being published in sources that mostly disseminate articles by authors located in the same country. The References approach, in contrast, highlights cases like the United States (0.30) and Canada (0.18). From an information source perspective, around 20% to 30% of their output is published in

journals referencing papers which are geographically constrained. Finally, Languages reports that almost all countries worldwide publish in journals operating in English.

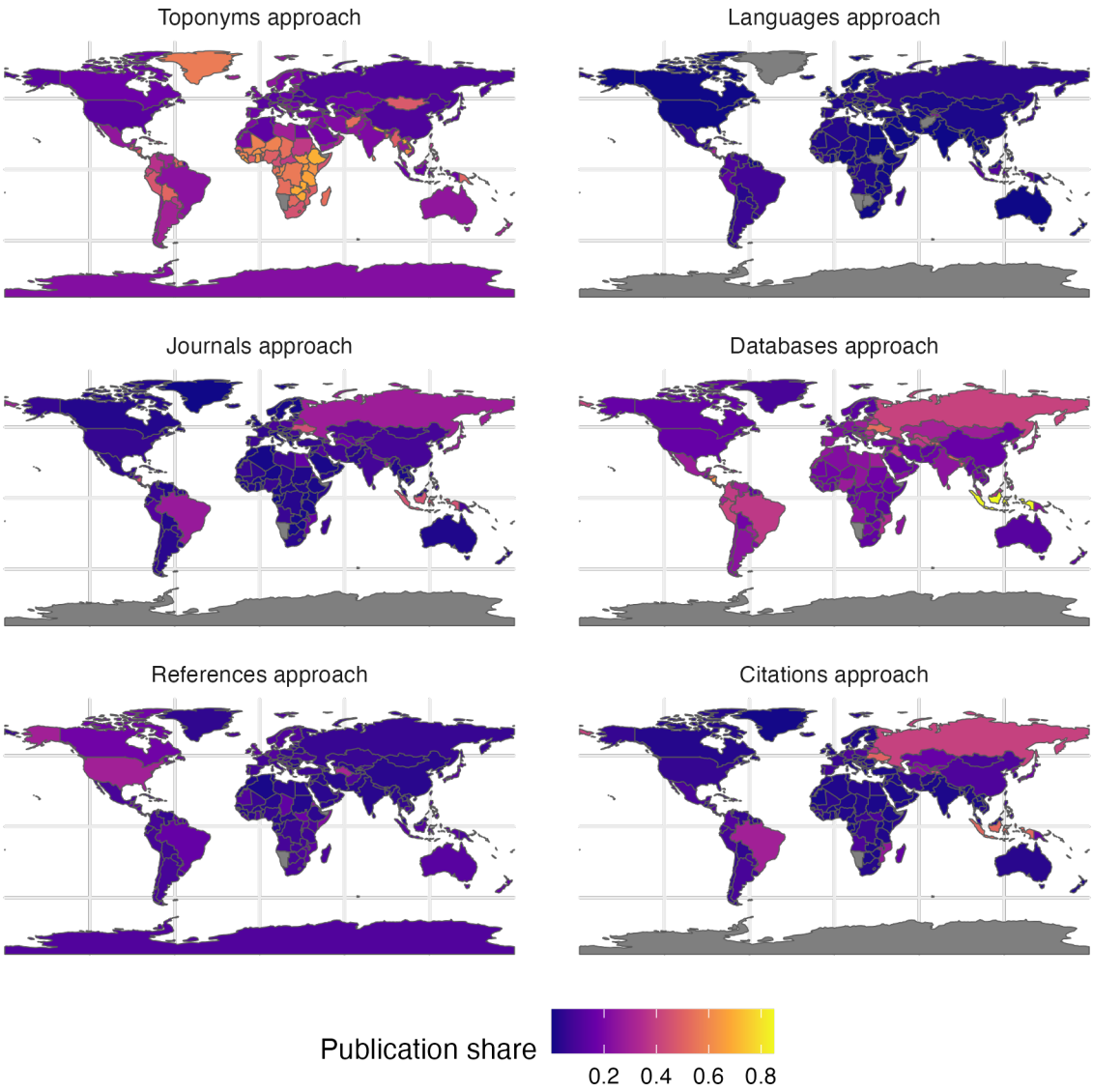

Figure 4. Countries publication share in local journals per operational approach.

Figure 5 delves into category differences per operational approach of six countries taken here as case studies: Brazil, China, Germany, Spain, United States and South Africa. Again, the color scale represents the proportion of papers published in local journals with respect to each country's total number of publications. The lighter the shade, the higher the proportion, which allows us to observe that Brazil has the most local-oriented scientific production of all countries and with respect to all approaches. China and South Africa report their higher proportional values in Toponyms, whereas the United States' most noticeable column is References. Germany and Spain display a similar pattern of moderate to low values in Toponyms and Databases. Despite their differences per approach, all countries share two lighter-colored sections that spread across the Social Sciences and Humanities, including a few disciplinary categories from Life Sciences.

Considering the operational approaches, Toponyms shows medium to high proportions in most categories from the Humanities, Social and Life Sciences. They are particularly evident in South Africa (Law and Legal Studies = 0.94) and China (History, Heritage and Archaeology = 0.95). On the contrary, Languages is just moderately present in Brazil (Education = 0.37) and Germany (History, Heritage and Archaeology = 0.37). Journals appears quite muted in most countries but Brazil (Language, Communication and Culture = 0.72), with a couple of categories also accumulating high publication shares in South Africa and Germany. Next to it, Databases has some of the brightest areas in Brazil around Social Sciences (Law and Legal Studies = 0.88) and Humanities (Creative Arts and Writing = 0.91). The References approach informs considerable shares in the United States across the Social Sciences (Education = 0.81), Humanities (Philosophy and Religious Studies = 0.72) and even part of the Health Sciences. Several Humanities categories are also quite noticeable in China, South Africa and Germany. Lastly, Citations is almost only highlighted in Brazil's Social Sciences (Education = 0.83) and Humanities (Language, Communication and Culture = 0.84), along with a couple of light-colored areas in Physical and Health Sciences.

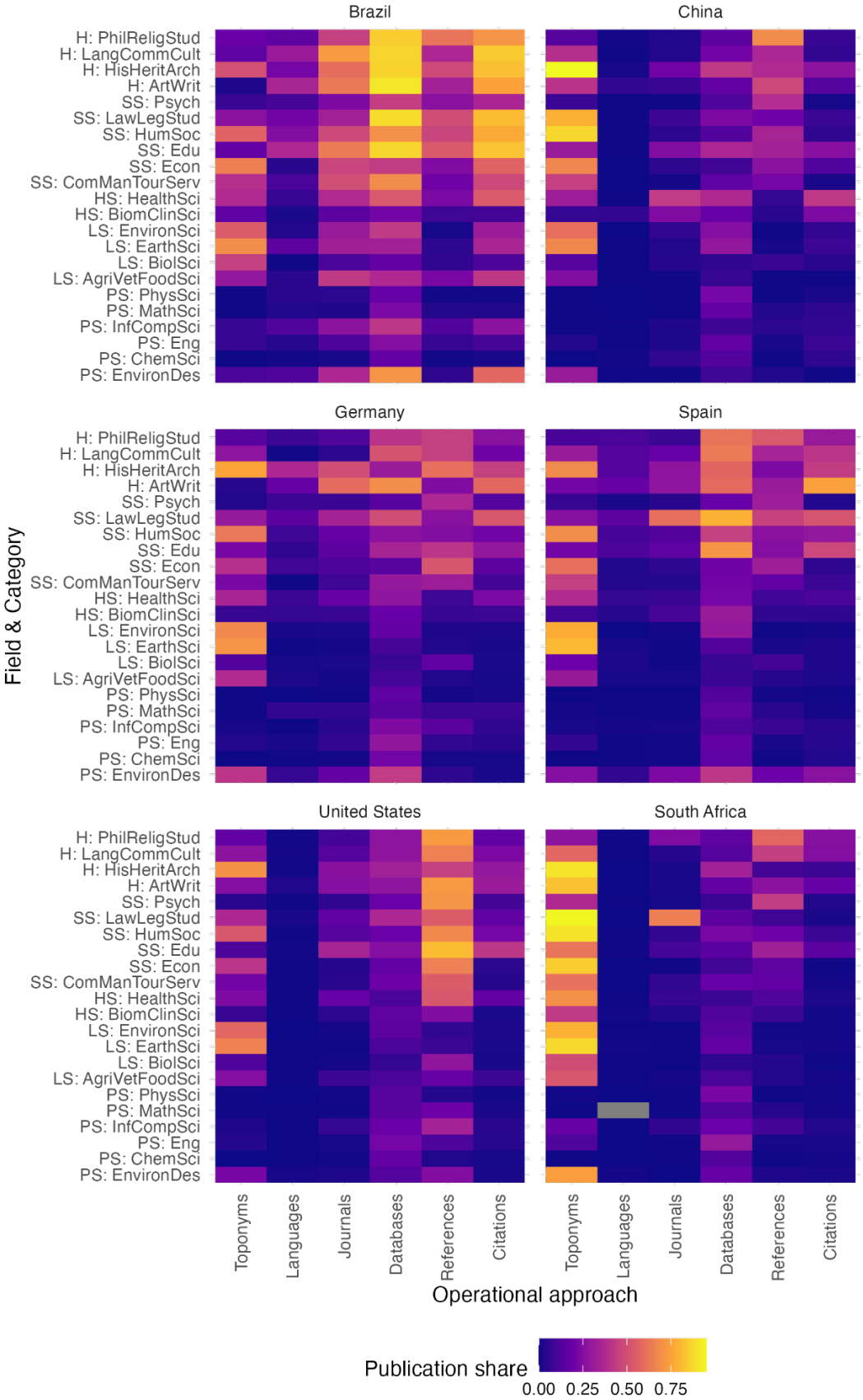

Figure 5. Case studies' publication share in local journals per disciplinary category and operational approach.

Discussion and concluding remarks

In this article we propose a conceptual and empirical framework of local research. Our goal is twofold. First, to compare the different approaches used in the literature to define and measure the concept to date. Second, to better understand the implications of applying one approach over the other. The starting point is the lack of clarity we observed in the increasingly frequent and rather uncritical usage of the concept in both scientific publications and policy documents. With this theoretical and operational contribution to the matter, we intend to systematize the knowledge and practice surrounding local research and, ultimately, help place value on the work of local researchers.

Based on the spatial scientometrics program (Frenken et al. 2009) which feeds from Boschma's proximities framework (Boschma 2005), we conceptually link six approaches for identifying local research to the dimensions of analysis we have called: locally informed research, locally situated research, locally relevant research, locally bound research, and locally governed research. Each dimension is supported on a geographically constrained proximity and, as our results suggest, not all of them establish an exclusive, significant tie to a measure.

Our main findings indicate that the six operational approaches tested here not only measure various, and sometimes disconnected, aspects of local research, but do so with contrasting degrees of effectiveness in the outcome across countries and disciplines. Toponyms and Databases work best in peripheral regions but start from problematic assumptions that give a heightened impression of locality in certain places while hiding this quality in others. Therefore, caution should be exercised when applying these proxies to the operationalization of the locally situated, bounded, and governed dimensions. Languages yields almost no information other than emphasizing English as the lingua franca of science, although we acknowledge that Dimensions' skewed coverage could be interfering with the result. The use of larger and more comprehensive databases such as OpenAlex could potentially unveil language differences and their link to local research (Céspedes et al. 2024). Journals and Citations display similar world and disciplinary patterns that could be indicative of proximity between authors and audiences around common interests on issues of local relevance. Lastly, the References approach appears to have potential for identifying locality features linked to a shared cognitive base, particularly in countries that might go undetected by other methods.

This study draws attention to the complex, multifaceted nature of local research. The different methodological approaches used to identify local research represent partial proxies, contributing with distinct notions that could be complemented to achieve a fuller picture of the phenomenon. Our framework integrates those which can be more theoretically attuned with different aspects of locality. With this, we aim at contributing on the design and assessment of local research in order to better understand its functions on the production, dissemination and impact of scientific knowledge (Hicks et al. 2015; López Piñeiro & Hicks 2015). By introducing multiple perspectives from which local research

451 can be analyzed, we provide a flexible framework which gives room not only to the study of each of
452 the dimensions identified, but also to the analysis of the intersection between perspectives. We see great
453 potential for their combination within this framework to analyze, for instance, the role of local journals
454 as communicating vessels between global and local scientific circles (Chavarro et al. 2017), or the
455 evolution of research fronts that emerge to respond to localized problems but then expand when the
456 issue acquires a global scale (i.e. the spread of vector-borne diseases, Simon et al. 2008). Not all
457 perspectives are addressed empirically, as is the case with bounded and governed dimensions, nor are
458 they are free of limitations, as seen in locally situated research. Still, we believe this contribution can
459 serve as a starting point for integrating empirical approaches with theoretically informed conceptions
460 of local research, potentially helping to mitigate many of the barriers current research evaluation
461 systems, particularly those based on metrics, face when supporting local research.

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Appendix

Table A1. Dimensions category names and acronyms grouped by fields.

Fields	Category names	Acronyms
Humanities	Creative Arts and Writing	ArtWrit
	History, Heritage and Archaeology	HisHeritArch
	Language, Communication and Culture	LangCommCult
	Philosophy and Religious Studies	PhilReligStud
Social Sciences	Commerce, Management, Tourism and Services	ComManTourServ
	Economics	Econ
	Education	Edu
	Human Society	HumSoc
	Law and Legal Studies	LawLegStud
	Psychology	Psych
Health Sciences	Biomedical and Clinical Sciences	BiomClinSci
	Health Sciences	HealthSci
Life Sciences	Agricultural, Veterinary and Food Sciences	AgriVetFoodSci
	Biological Sciences	BiolSci
	Earth Sciences	EarthSci
	Environmental Sciences	EnvironSci
Physical Sciences	Built Environment and Design	EnvironDes
	Chemical Sciences	ChemSci
	Engineering	Eng
	Information and Computing Sciences	InfCompSci
	Mathematical Sciences	MathSci
	Physical Sciences	PhysSci