Indigenous knowledge, traditional knowledge and local knowledge: what is the difference? An informetrics perspective

Omwoyo Bosire Onyancha
Department of Information Science, University of South Africa, Pretoria, South Africa

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Abstract

Purpose – This study aims to explore the similarities and differences between the three concepts that are commonly used to describe the knowledge of traditional and indigenous communities, namely, indigenous knowledge, traditional knowledge and local knowledge, with a view to contributing to the discourse on conceptualizing indigenous knowledge.

Design/methodology/approach – Data was extracted from the Scopus database using the main terms that are used for indigenous knowledge, namely, "indigenous knowledge" (IK), "traditional knowledge" (TK) and "local knowledge" (LK). Data were analyzed according to the themes drawn from the objectives of the study, using the VOSviewer software and the analytical tool embedded in the Scopus database.

Findings – The findings indicate that whereas IK and LK are older concepts than TK, TK has become more visible in the literature than the former; there is minimal overlap in the use of the labels in the literature; the three labels' literature is largely domiciled in the social sciences; and that there were variations in representation of the labels according to countries and geographic regions.

Practical implications – The author avers that the scatter of literature on the knowledge of traditional and indigenous peoples under the three main labels has huge implications on the accessibility and use the literature by stakeholders including researchers, students, information and knowledge managers and information service providers.

Originality/value – This study demonstrates the application of informetrics beyond is traditional use to assess trends, nature and types of research patterns and mathematical modeling of information patterns to encompass the definition of the scope of concepts as covered in the literature.

Keywords Indigenous knowledge, Traditional knowledge, Local knowledge, Bibliometrics, Research, Content analysis

Paper type Research paper

Introduction

Is indigenous knowledge (IK) traditional knowledge (TK) and/or local knowledge (LK)? Conversely, are traditional knowledge and local knowledge indigenous knowledge? An examination of the published literature indicates that the three concepts are more often than not used interchangeably in the literature (Kihwelo, 2005;

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Getha, 2010; Santha, Fraunholz and Unnithan, 2010). In some cases, one term is used in place of another, not so much because the terms are seen as different but because authors prefer the use of one term over another for various reasons. In other cases, the terms are used together to reflect their distinctive but intertwined nature (Antweiler, 1998). Boven and Morohashi (2002, p. 6) treat indigenous knowledge as local knowledge and defines the concept as "a complete body of knowledge, knowhow and practices maintained and developed by peoples, generally in rural areas, who have extended histories of interaction with the natural environment [. . .] these sets of understandings, interpretations and meanings are part of a cultural complex that encompasses language, naming and classification systems, practices for using resources, ritual, spirituality and worldview". On his part, Grenier (1989, p. 1) considers the three terms to be synonymous and defines them as "knowledge existing within and developed around the specific conditions of women and men indigenous to a particular geographic area". Odora Hoppers (2005, p. 2) define TK as the "totality of all knowledge and practices, whether explicit or implicit, used in the management of socio-economic, spiritual and ecological facts of life," while Warren and McKiernan (1995) argue that LK is IK and Janke and Sentina (2018) believe that TK is a component of IK.

It is not surprising, therefore, that the concept is said to be lacking a universally agreed definition (Kihwelo, 2005; Ngulube and Onyancha, 2011; Onyancha *et al.*, 2018). As a result, several scholars have made efforts in scoping indigenous knowledge (herein used to cover the three concepts under investigation in the study) in an attempt to find a uniform terminology for the many concepts used for indigenous knowledge (Onyancha *et al.*, 2018). The attempts to seek for a uniform terminology for indigenous knowledge is made complicated due to its diverse nature in types of knowledge, systems, and concepts and labels associated with it (Kok, 2005; Dekens, 2007; Ngulube and Onyancha, 2011; Onyancha *et al.*, 2018). The diverse nature in terms of the labels associated with indigenous knowledge is well illustrated in Ngulube and Onyancha (2011), who identified a total of 17 names for indigenous knowledge. It has also been noted that the concept is multidisciplinary (Hirwade and Hirwade, 2012, p. 240), thereby strengthening the arguments on its diverse nature. In view of the above, it is acknowledged that the concept requires continued discourse for deeper and clearer understanding of its scope and subject domain. For purposes of conducting this study, we adopt the definitions offered in Ngulube and Onyancha (2011) for the three concepts.

Related studies

Informetrics/scientometrics studies to examine IK and its associated terminologies are rare, and rarer are the studies that have sought to conceptualize indigenous knowledge using bibliometric techniques. There are equally few studies that have examined the literature to explore the trend and patterns of research in the subject domain. Although the current study is not necessarily assessing the latter and focuses more on the former, this section highlights some findings on studies regarding research outputs on IK and its related terms. Regarding research production in the subject domain, all studies (Kwanya, 2016; Ali *et al.*, 2016; Brook and McLachlan, 2008; Singh and Harish, 2016; Fung and Wong, 2017; Maluleka and Ngulube, 2019; Njiraine *et al.*, 2010; Ocholla and Onyancha, 2005; and Pathak and Bharati, 2018) that have been conducted to assess the growth of literature on indigenous knowledge, have reported similar patterns in different geographical contexts. The studies have revealed an upward trend of growth of the number of publications on indigenous knowledge. For instance, South Africa has witnessed an upward trend in the number of publications on

indigenous knowledge since 1990 (Ocholla and Onyancha, 2005; Njiraine *et al.*, 2010) but the same study and that of Kwanya (2016) found that Kenya's research productivity is low and sometimes on a downward trend. In their bibliometric analysis of indigenous knowledge research in Africa, Maluleka and Ngulube (2019) noted a steady increase in the number of publications after 2008. A bibliometric study of the global trend of research on indigenous knowledge by Ali *et al.* (2016) shows a tremendous increase in the number of papers on TK, from just 3 papers in 1989 to a total of 2465 papers in 2015. It was noted, however, that the increased interest in this otherwise marginalized knowledge (Ocholla and Onyancha, 2005) is a recent occurrence, as depicted in the above-mentioned studies. The number of papers on indigenous knowledge have had a sharp increase after mid-1990s. Besides the assessment of the trend of publication of the IK literature as indexed in various databases or as published in some journals, the aforementioned studies have also sought to determine, among others, the journals publishing IK research, citation analysis of the IK literature, contributing authors, and organizations/institutions and countries. These aspects were, however, not the subject of the current study.

In terms of conceptualizing the different IK labels using bibliometrics or informetrics techniques, studies such as Singh and Harish (2016), Brook and McLachlan (2008) have identified the fields of IK application. Although the intention of the authors was to demonstrate the dispersion of the IK literature in different research fields, they nevertheless conceptualized the concept according to fields and disciplines of study. For example, Kwanya (2016) noted that IK research is largely conducted on the themes of agriculture, health, ecology and environment, thereby implying the close link of indigenous knowledge to agriculture, health, ecology and agriculture. Similar observations have been made by Ocholla and Onyancha (2010), and Njiraine *et al.* (2010), who noted that indigenous knowledge literature is covered or indexed under the following broad subject areas: culture, health and medicine, environment, agriculture, education and law, among others. Maluleka and Ngulube (2019) observed that the bulk of indigenous knowledge research was conducted in envrinmental sciences, and medicinal and pharmaceutical sciences. According to Maluleka and Ngulube (2019), the Web of Science (WoS) subject categories within which indigenous knowledge featured prominently included Environmental sciences and Ecology, Plant sciences, Public environmental occupational health and Pharmacology/pharmacy. On their part, Ngulube and Onyancha (2011) found that indigenous knowledge research is largely located in the social sciences, and arts and humanities fields of study or research. The aforementioned studies did not however distinguish the subject areas per indigenous knowledge labels but ascribed the subject areas to the indigenous knowledge, in its broad sense. Perhaps, the closest studies to the current one are Ngulube and Onyancha (2011) and Onyancha *et al.* (2018), who used publications count and citation analysis to conceptualize the various indigenous knowledge labels. Ngulube and Onyancha's (2011) paper titled "What is in a name? Using informetric techniques to conceptualize the knowledge of traditional and indigenous communities" reported that the most common labels used in the literature are IK, LK and TK. The authors further assessed the title keywords to assess the most common terms by which the IK labels can be conceptualized. In their paper titled "Towards a uniform terminology for indigenous knowledge concepts: informetrics perspectives," Onyancha *et al.* (2018) conducted a citation analysis of the IK literature and found, similar to the findings of Ngulube and Onyancha's (2011) study, that LK, IK and TK were the most cited concepts, thereby implying that the three concepts are the most preferred to describe the knowledge of traditional and indigenous communities. While citation analysis and publications counts may reveal the popular concepts, the visualization and mapping of author-supplied keywords as well as broad subject areas may reveal

patterns that may reflect the scope and breath of a concept. Furthermore, the two studies, while comparing research outputs for different indigenous knowledge labels, fell short of assessing whether or not the patterns of publication of research was similar or different across the labels through statistical analysis techniques such as correlation analyses. The studies adopted numerical counts of publications and percentages to draw conclusions on the similarities or differences between the labels. It is within this understanding that this study was conducted with the aim of exploring the differences and similarities between IK, LK and TK in terms of the trend of publication of the literature, the number of publications, overlap of the literature and subject terms and topics covered in the literature as well as the preference of the concepts in different geographic regions and countries.

Purpose of the study

The current study seeks to explore the similarities and differences between the three concepts that are commonly used to describe the knowledge of traditional and indigenous communities, namely, IK, TK and LK, with a view to contributing to the discourse on conceptualizing indigenous knowledge. Specifically, the study sought to:

- examine number of documents published in under IK, LK and TK over time;
- determine the trend of research for IK, LK and TK;
- determine the extent of the overlap that exists between IK, LK and TK, using the number of publications;
- examine the most commonly used terms to describe the literature for IK, LK and TK through the analysis of the author-supplied keywords;
- explore the Scopus subject categories in which the literature for each label is indexed to situate IK, LK and TK in specific disciplines; and
- identify the countries from which the IK literature originates to determine country-based preferences for the IK, LK and TK terminologies.

Methodology

The study adopted an informetrics research design, domiciled within the quantitative research approach to explore the trend and conduct of research on the three labels that describe the knowledge of traditional and indigenous communities. The source of data was the Scopus database, which is one of the largest and key bibliographic sources for informetrics and scientometrics data (Onyancha and Ocholla, 2009). A search, using the three concepts as search terms, was conducted within title, abstract and keywords fields to extract bibliographic details (i.e. citation information, bibliographic information and abstract and keywords) of publications on IK, LK and TK. The search filter document type was used to limit the search to articles, books, book chapters and conference papers, so as to obtain data for research-related documents, which often supply author-supplied keywords, which formed part of the aspects for analysis in the current study. The relevant data was downloaded on 10 September 2021. The distribution of the publications, according to document type, that were obtained for analysis is shown in Table 1.

Data was analyzed to:

- assess the trend of publication for each concept over time until September 10, 2021;
- determine overlap among the concepts;
- determine the topics associated with the three concepts;

- compare the disciplinary orientation of the concepts; and
- discuss the countries' preferences for each of the concepts.

In terms of the overlap, the overlap ration was computed as follows to determine the extent to which the use of the concepts overlaps in the literature:

$$\text{Overlap } (x, y) = \frac{(x \cap y)}{(x \cup y)}$$

Where x and y denote the number of publications on a given concept.

We further measured annual growth rate (AGR) as the percentage change in the quantity of publications for each year except the year zero. We used the equation: AGR = [(Ending Value - Beginning Value)/Beginning Value] x 100. The AGR was meant to assess the annual change in each label's volume of publications so as to measure the level of growth. The average annual growth rate (AAGR) was computed to compare the performance of each label as well as determine the researchers' preference or interest in each of the labels.

The Pearson correlation test was used to gauge relationships among the three concepts by examining the publications that had been published on each of the concepts. The following relationships were examined through correlation tests: trend of publication; distribution of publications according to the broad subject areas or disciplines; and preference of the concepts by geographical territories. Finally, the VOSviewer software was used to analyze the data by author-supplied keywords to identify and visualize the common terms associated with the IK, LK and TK (see Figure 2).

Results and discussion

Trend of publication of indigenous knowledge, local knowledge and traditional knowledge literature

Table 2 and Figure 1 illustrate the trend of publication of IK, LK and TK literature. Table 2 shows that earliest document that mentioned any of the three concepts was published in 1889. The document mentioned local knowledge within its abstract. Thereafter, there were 11 papers on LK, scattered between 1927 to 1970. The IK and TK concepts were first mentioned in the literature's titles, abstracts, or keywords in 1979 and 1974, respectively. The concepts IK and TK are therefore late entrants into the literature when compared to LK. This finding is in concurrence with Ali, Ambika and Chikkamanju (2016) who found, in their article titled Bibliometric Analysis of the Global Traditional Knowledge during 1989–2015, that TK was first published in 1989. In terms of growth of literature on the concepts, Table 2 reveals that the trend can be divided into three main periods of growth and therefore development in IK, LK and TK. In the first period, from 1971 to 1989, the publication of the literature was slow and almost constant from one year to another but picked up rather

	IK (N = 6025)		LK (N = 7129)		TK (N = 8089)	
Document type	n	(%)	n	(%)	n	(%)
Article	4,965	82.41	5521	77.44	6,842	84.58
Book chapter	645	10.71	440	6.17	635	7.85
Conference paper	315	5.23	1076	15.09	512	6.33
Book	100	1.66	92	1.29	100	1.24
TOTAL	6025	100.00	7129	100.00	8089	100.00

Table 1. Publication outputs in IK, LK and TK by document types

PY	LK *n*	LK AGR	IK *n*	IK AGR	TK *n*	TK AGR	PY	LK *n*	LK AGR	IK *n*	IK AGR	TK *n*	TK AGR
1889	3		0		0		1992	27	12.5	13	−13.3	13	−7,1
1892	1	−66.7	0	0.0	0	0.0	1993	44	63.0	28	115.4	14	7,7
1927	1	0.0	0	0.0	0	0.0	1994	43	−2.3	29	3.6	23	64,3
1954	1	0.0	0	0.0	0	0.0	1995	43	0.0	33	13.8	28	21.7
1958	1	0.0	0	0.0	0	0.0	1996	49	14.0	37	12.1	20	−28.6
1959	1	0.0	0	0.0	0	0.0	1997	57	16.3	41	10.8	28	40.0
1962	2	100.0	0	0.0	0	0.0	1998	49	−14,0	35	−14.6	42	50.0
1967	1	−50.0	0	0.0	0	0.0	1999	60	22.4	41	17.1	66	57.1
1968	1	0.0	0	0.0	0	0.0	2000	86	43.3	57	39.0	73	10.6
1969	1	0.0	0	0.0	0	0.0	2001	69	−19.8	50	−12.3	54	−26.0
1970	1	0.0	0	0.0	0	0.0	2002	87	26.1	88	76.0	60	11.1
1973	1	0.0	0	0.0	0	0.0	2003	131	50.6	115	30.7	109	81.7
1974	1	0.0	0	0.0	1	0.0	2004	111	−15.3	74	−35.7	80	−26.6
1975	3	200.0	0	0.0	1	0.0	2005	155	39.6	124	67.6	129	61.3
1976	0	−100.0	0	0.0	2	100.0	2006	181	16.8	117	−5.6	165	27.9
1977	3	0.0	0	0.0	0	−100,0	2007	234	29.3	153	30.8	185	12.1
1978	4	33.3	0	0.0	2	0.0	2008	224	−4.3	185	20.9	265	43.2
1979	2	−50.0	1	0.0	1	−50.0	2009	267	19.2	274	48.1	365	37.7
1980	6	200.0	5	400.0	3	200.0	2010	293	9.7	239	−12.8	374	2.5
1981	1	−83,3	0	−100.0	1	−66,7	2011	323	10.2	263	10.0	400	7.0
1982	4	300.0	0	0.0	4	300.0	2012	299	−7.4	314	19.4	444	11.0
1983	6	50.0	0	0.0	2	−50.0	2013	356	19.1	289	−8.0	473	6.5
1984	5	−16.7	2	0.0	0	−100.0	2014	375	5.3	320	10.7	455	−3.8
1985	9	80.0	2	0.0	5	0.0	2015	421	12.3	336	5.0	490	7.7
1986	10	11.1	2	0.0	6	20.0	2016	455	8.1	416	23.8	579	18.2
1987	10	0.0	2	0.0	6	0.0	2017	450	−1,1	324	−22.1	537	−7,3
1988	10	0.0	6	200.0	10	66.7	2018	509	13.1	433	33.6	608	13.2
1989	7	−30.0	6	0.0	6	−40.0	2019	542	6.5	471	8.8	681	12.0
1990	12	71.4	7	16.7	15	150.0	2020	575	6.1	606	28.7	748	9.8
1991	24	100.0	15	114.3	14	−6.7	2021	482	−16.2	472	−22.1	502	−32.9

Table 2.
Trend of publication of IK, LK and TK literature, 1989–September 2021

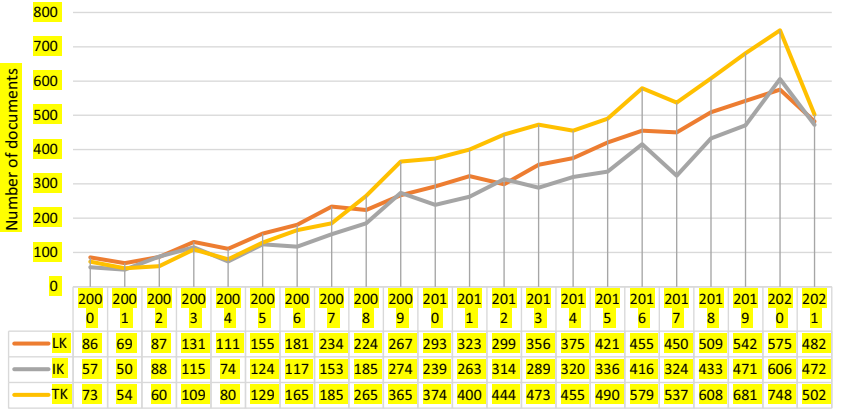

Figure 1.
Trend of publication of IK, LK and TK literature, 2000–September 2021

quickly in the second period between 1991 and 2004, after which there has been a rapid growth in the final third period. Similar patterns of growth of the literature, touching on different labels associated with indigenous knowledge, have been reported in Ngulube and Onyancha (2011) and Kwanya (2016), among others. Another observation that can be made from both Table 2 and Figure 1 is that the literature on TK has surpassed the IK and LK literature in the recent past (post-2007). Although TK overtook IK and LK at different time periods, it was not until 2008 that TK showed dominance over the other two concepts as shown in Figure 1. We think that the prominence or preference of TK to the other two labels and more particularly the IK has much to do with the reference of indigenous as primitive (Medeiros, 2021), which has connotations of inferiority (MacDonald, 2011). This explanation may also apply when assessing the preference of LK to IK, whereby the former has shown stronger presence in the literature than the latter, particularly since 1985, safe for a few instances where IK publications were more than LK publications.

Although the line graph for each concept shows that TK has overtaken IK and LK, the computation of the AAGR reveals that, in fact, the TK (AAGR = 18.86%) is growing at a slow pace when compared to IK (AAGR = 23.13%) and LK (AAGR = 23.52%). The other aspect that is worth noting is that the data fitted better when we plotted an exponential trendline than when the linear trendline was plotted, thereby implying that the growth of publications is exponential as opposed to linear, with the concepts posting the R-squared values as follows: TK ($R^2 = 0.8184$), LK ($R^2 = 0.8876$) and IK ($R^2 = 0.8822$). A correlation test to gauge relationships among the concepts in terms of their literature's growth trends yielded high Pearson correlation coefficients at $p < 0.05$, that is IK vs LK ($r = 0.9865$), IK vs TK ($r = 0.9854$) and LK vs TK ($r = 0.9900$), thereby confirming a general growth pattern that was closely similar, despite the AAGR revealing some differences in the AGR patterns.

Extent of overlap of the literature on indigenous knowledge, local knowledge and traditional knowledge

The assessment of the overlap between two finite sets of variables is meant to gauge their similarities or distinctiveness. Firstly, the current study examined the number of papers that mentioned one or more of the concepts under investigation and expressed that number as a percentage of the total number of papers for each label, as shown in Table 3. To start with, the number of papers in which one label appeared AND NOT the other was very high, accounting for more than 85% of the total number of publications for each label, while those

Label	Combination operator	IK		TK		LK		TOTAL
		n	(%)	*n*	(%)	*n*	(%)	(*N*)
IK								6,025
	AND NOT			5,295	87.88	5,711	94.79	
	AND			730	12.12	314	5.21	
	OR			13384		12,840		
TK	AND NOT	7,359	90.98			7,011	86.67	8,089
	AND	730	9.02			1,078	13.33	
	OR	13,384				14,140		
LK	AND NOT	6,815	95.60	6,051	84.88			7,129
	AND	314	4.40	1,078	15.12			
	OR	12,840		14,140				

Table 3. Overlap of IK, LK and TK papers in the Scopus database

papers that mentioned at least two of the labels constituted between 4% and 15% of the total number of publications for each label.

In the second phase of the analysis of the overlap of papers in the IK, LK and TK literature, the formula that was used to compute the level of overlap yielded the following coefficients:

$$\text{Overlap (IK, TK)} = \frac{730}{(6025 + 8089) - 730} = 0.055$$

$$\text{Overlap (IK, LK)} = \frac{314}{(6025 + 7129) - 314} = 0.024$$

$$\text{Overlap (TK, LK)} = \frac{1078}{(8089 + 7129) - 1078} = 0.076$$

The data presented in Table 3 and the coefficients computed above show that whereas there were overlaps of papers that discussed a pair of the labels, the said overlap was almost negligible. The overlap between TK and LK was the largest (n = 1078; overlap = 0.076), while IK and LK (n = 314; overlap = 0.024) registered the lowest coefficient. The overlap between IK and TK was n = 730; overlap coefficient = 0.055. The results may be interpreted in several ways. One, although the labels refer to the same knowledge, the concepts are understood and considered as distinct. Two, the labels are considered to be synonymous and as such the authors do not find it necessary to mention more than one label in the title, abstract or keywords. However, whereas using two synonyms in a title sounds far-fetched and seldom, there are high chances of abstracts and keywords listing synonyms and as such one would have expected more concept co-occurrences in the IK, LK and TK literature and therefore more overlaps found in the current study. Three, the labels might be synonymous but are used interchangeably in the literature, perhaps with geographical preferences for one label over another dictating their usage.

Subject content of the indigenous knowledge, local knowledge and traditional knowledge literature

This section compares the subject coverage or focus areas of the IK, LK and TK literature. Table 4 provides the broad subject areas, which reveals that the three labels are found in most subject categories, implying that the knowledge of indigenous communities is spread in many disciplines and therefore is multidisciplinary, as has been observed by various scholars. For instance, Hirwade and Hirwade (2012, p. 240) has observed thus:

> The traditional knowledge or indigenous knowledge can be found in multitude fields such as nutrition, agriculture and fisheries, human health, veterinary care, handicrafts, performing arts, folk songs, religion and astrology, and many other day-to-day customs and practices.

Table 4 further reveals that there was only one exception, namely that there was no IK paper that was indexed under the broad subject area of Dentistry. Regarding the discipline or subject area that indexed the highest number of papers, the ranking of the subject categories according to the number of papers for each label shows that Social Sciences was ranked position one for all labels and subsequent overall ranking. The subject area yielded 54% of IK, 41% of LK and 39% of TK literature. In the second position is Environmental Sciences, followed by Agricultural and Biological Sciences; Medicine; and Arts and Humanities, to

Table 4. Representation of IK, LK and TK literature in Scopus' subject areas

Subject area	IK ($N = 6025$) n	(%)	R	LK ($N = 7125$) n	(%)	R	TK ($N = 8089$) n	(%)	R	Overall rank
Social Sciences	3,276	54.37	1	2,933	41.16	1	3,153	38.98	1	1
Environmental Sciences	1,531	25.41	2	2,036	28.58	2	2,635	32.58	2	2
Agricultural and Biological Sciences	1,360	22.57	3	1,403	19.69	3	2,538	31.38	3	3
Medicine	569	9.44	5	621	8.72	7	1,152	14.24	4	4
Arts and Humanities	881	14.62	4	586	8.22	8	713	8.81	5	5
Earth and Planetary Sciences	498	8.27	6	753	10.57	5	671	8.30	6	5
Computer Science	283	4.70	7	963	13.52	4	455	5.62	9	7
Engineering	253	4.20	8	712	9.99	6	488	6.03	8	8
Business, Management and Accounting	248	4,12	9	561	7.87	9	290	3.59	13	9
Economics, Econometrics and Finance	216	3.59	11	419	5.88	10	310	3.83	11	10
Pharmacology, Toxicology and Pharmaceutics	223	3.70	10	96	1.35	16	586	7.24	7	11
Biochemistry, Genetics and Molecular Biology	151	2.51	14	163	2.29	13	371	4.59	10	12
Energy	153	2.54	13	196	2.75	12	262	3.24	14	13
Mathematics	70	1.16	16	317	4.45	11	110	1.36	16	14
Health Professions	168	2.79	12	41	0.58	22	295	3.65	12	15
Multidisciplinary	67	1.11	17	76	1.07	18	118	1.46	15	16
Decision Sciences	54	0.90	19	150	2.11	14	82	1.01	18	17
Psychology	99	1.64	15	120	1.68	15	62	0.77	22	18
Physics and Astronomy	58	0.96	18	87	1.22	17	57	0.70	23	19
Nursing	46	0.76	21	66	0.93	19	68	0.84	19	20
Chemistry	28	0.46	22	20	0.28	25	84	1.04	17	21
Immunology and Microbiology	27	0.45	23	52	0.73	21	65	0.80	20	21
Veterinary	51	0.85	20	36	0.51	23	50	0.62	24	23
Chemical Engineering	16	0.27	24	25	0.35	24	64	0.79	21	24
Materials Science	8	0.13	25	53	0.74	20	45	0.56	25	25
Neuroscience	6	0.10	26	16	0.22	26	14	0.17	26	26
Dentistry	0	0.00	27	2	0.03	27	2	0.02	27	27
Undefined	0	0.00	27	1	0.01	28	0	0.00	28	28

name just the top five ranked subject areas. The percentage representation in Table 4 may also be indicative of the preference of the labels according to the subject fields and disciplines. For instance, in Computer Science, the label local knowledge accounts for 13% of the total number of papers on LK when compared to IK's 5% and TK's 6%.

The indexing of three concepts in the broad Scopus subject areas was similar across only three disciplines, namely Social Sciences, Environmental Sciences and Agricultural and Biological Sciences, whereby the concepts were ranked 1st, 2nd and 3rd respectively. The ranking of each label's representation in terms of papers indexed in the other subject areas produced mixed patterns with minor variations in many subject areas. The ranking ranges (i.e. R_1-R^2) varied from 1 to 10, with most ranges being below 5, thereby indicating patterns of representation that are very close across the three labels. This pattern was further evidenced in the Pearson correlation test, which showed that the representation of the labels in Scopus' broad subject areas was high and significantly correlated, with the following correlation coefficients: IK vs LK (r = 0.9487); IK vs TK (r = 0.9343); and LK vs TK (r = 0.9367).

In addition to assessing representation of the labels in different subject areas, the study compared the labels using the author-supplied keywords in their respective papers and found that the provision of author keywords in papers was similar across the three labels, with each label yielding 2 keywords per paper. It should be noted, however, that a substantive number of papers do not often provide author keywords, partly because some journals do not require authors to supply keywords (Onyancha, 2020). This may explain the low average keywords per paper in Table 5. Be that as it may, if the average number of keywords per label was to be used as an indicator of the content and complexity associated with a topic, then there is very little that separates the three labels, as they are treated the same by the authors.

The visualization of the author-supplied keywords, as reflected in a sample of papers that had five or more keywords, yielded additional information with which to compare the three labels, as shown in the second part of Table 5. There were 644, 711 and 888 keywords that appeared five or more times in the IK, LK and TK papers, respectively. The keywords formed several clusters, with the 888 TK-associated keywords forming the highest number of clusters, i.e. 21. The number of clusters, links and the total link strength (TLS) reflect the relationships between and among the keywords. While the number of clusters, links and link strength may be dependent on the number of keywords that are mapped and analyzed, in situations where the number of keywords are almost the same across several sets of variables as is the case in this study, the results in the lower part of Table 5 reveals similarities in terms of the links and total links strength per keyword, which implies that IK, LK and TK share similar characteristics, even in terms of the provision of author-supplied

Table 5. Comparison of IK, LK and TK using author-supplied keywords' characteristics

		IK	LK	TK
All papers and keywords per paper	Papers	6,025	7,129	8,089
	Author keywords	12,752	15,726	18,100
	Author keywords/paper	2.12	2.21	2.24
Terms appearing 5 or more times in a paper	No. of keywords	644	711	888
	Clusters	14	17	21
	Links	8,249	7,419	11217
	Total link strength (TLS)	13,348	10,431	17,825
	Links per keyword	12.81	10.43	12.63
	TLS/keyword	20.73	14.67	20.07

keywords. This aspect is well illustrated in the number of author keywords that were found to be common in the sampled IK, LK and TK papers. Some of these keywords are reflected in Table 6 and Figure 2.

Table 6, which provides the top 30 author-supplied keywords in IK, LK and TK papers, reveals some similarities and differences in terms of ranking of the common keywords found in three labels' papers. All the top 30 keywords listed in Table 6 were common in the three labels' literature. However, the analysis of the keywords that appeared five or more times in the papers revealed the following: 148 author-supplied keywords were common in the three labels' papers; 156 co-occurred in LK and TK; and 197 were common in IK and TK; while 156 author-supplied keywords were common in IK and LK. Table 6 further shows that the three labels featured prominently in each other's list of top author keywords. Among the most prominent and common keywords were climate change, ethnobotany, conservation, traditional ecological knowledge, medicinal plants, sustainability, sustainable development, adaptation, knowledge, and biodiversity, among others. The top keywords explain the ranking witnessed in Table 4, where Environmental Sciences, Agricultural and Biological Sciences and Medicine produced the greatest number of IK, LK and TK papers.

The network map of the most common author-supplied keywords depicted in Figure 2 produced six clusters, with the main three clusters revolving around the three labels. In cluster one, where local knowledge was mapped, were other author-supplied keywords including traditional ecological knowledge, which appeared 488 times in the IK, LK and TK papers. The other keywords, which featured prominently alongside LK in cluster one, are local ecological knowledge (198), ecosystem services (131), agroforestry (118), indigenous people (106), and GIS (103). The author-supplied keywords that formed the second cluster, together with the label indigenous knowledge, included the following in descending order of frequency of occurrence: indigenous (319), sustainability (278), knowledge (231), sustainable development (188), culture (179), indigenous knowledge systems (126), innovation (119), governance (111), knowledge management (108), and education (101). TK was mapped in cluster three together with ethnobotany (812), medicinal plants (689), conservation (456), traditional medicine (229), ethnomedicine (173), and ethnopharmacology (102), to just name the keywords that appeared more than 100 times in the literature. The fourth cluster revolved around climate change, which appeared 594 times, together with adaptation (262), resilience (215), agriculture (136), and vulnerability (125). Although Climate change was grouped in a different cluster from IK, LK and TK, it had links to all the three concepts, with the highest link strength being with IK (ls = 93), followed by LK (ls = 85) and TK (ls = 64).

It can be argued that whereas TK is mostly associated with medicinal plants/traditional medicine and botany, IK is largely linked to cultural issues and sustainable development, while LK is closely linked to environmental issues, including agroforestry, the study of ecosystems and ecological conservation. Nevertheless, it should be noted that each of the labels under investigation in this study are intertwined and therefore overlap in many cases, as demonstrated in Table 6. The VOSviewer that was used to map the author keywords in Figure 2 allocates keywords to a single cluster and as such no keyword would belong to more than one cluster, and therefore the relationship between keywords that appeared in the literature of the three labels (see Table 6) and the labels themselves is not apparent in Figure 2. Instead, Figure 2 shows the keywords that were the most associated with each of the labels, thereby indicating the specific areas in which each label is mostly applied. The results are concurrent with the analysis of the literature according to the Scopus' broad subject areas in Table 4, which shows variations of representation of IK, LK and TK in the different subject areas.

Table 6.
Top 30 author-supplied keywords in IK, LK and TK papers

	Indigenous knowledge ($N = 6,025$)			Local knowledge ($N = 7,129$)			Traditional knowledge ($N = 8,089$)		
No.	Author keyword	*F*	(%)	Author keyword	*F*	(%)	Author keyword	*F*	(%)
1	Indigenous knowledge	1,757	29.2	Local knowledge	1065	14.9	Traditional knowledge	1,445	17.9
2	Medicinal plants	206	3.4	Climate change	199	2.8	Ethnobotany	506	6.3
3	Indigenous	191	3.2	Ethnobotany	148	2.1	Medicinal plants	416	5.1
4	Climate change	176	2.9	Indigenous knowledge	111	1.6	Local knowledge	323	4.0
5	Traditional knowledge	175	2.9	Adaptation	110	1.5	Traditional ecological knowledge	318	3.9
6	Ethnobotany	158	2.6	Conservation	110	1.5	Indigenous knowledge	223	2.8
7	Conservation	127	2.1	Knowledge	89	1.2	Climate change	219	2.7
8	Traditional ecological knowledge	115	1.9	Participation	76	1.1	Conservation	219	2.7
9	Indigenous knowledge systems	109	1.8	Sustainability	76	1.1	Biodiversity	169	2.1
10	Biodiversity	106	1.8	Traditional knowledge	75	1.1	Traditional medicine	138	1.7
11	Sustainability	97	1.6	Resilience	73	1.0	Local ecological knowledge	129	1.6
12	Indigenous peoples	86	1.4	Medicinal plants	67	0.9	Ethnomedicine	108	1.3
13	Sustainable development	77	1.3	Innovation	64	0.9	Sustainability	105	1.3
14	Culture	75	1.2	Biodiversity	63	0.9	Indigenous	102	1.3
15	Local knowledge	70	1.2	Local ecological knowledge	59	0.8	Adaptation	95	1.2
16	Knowledge	68	1.1	Vulnerability	58	0.8	Indigenous peoples	78	1.0
17	Resilience	66	1.1	Participatory research	56	0.8	Resilience	76	0.9
18	Traditional medicine	66	1.1	Traditional ecological knowledge	55	0.8	Intellectual property	75	0.9
19	Adaptation	57	0.9	Ecosystem services	51	0.7	Knowledge	74	0.9
20	Agriculture	52	0.9	Governance	51	0.7	Culture	73	0.9
21	Development	51	0.8	GIS	48	0.7	Food security	69	0.9
22	Ethnomedicine	49	0.8	Sustainable development	48	0.7	Ethnopharmacology	66	0.8
23	Education	46	0.8	Agriculture	46	0.6	Sustainable development	63	0.8
24	Food security	45	0.7	Gender	44	0.6	Ecosystem services	62	0.8
25	Indigenous people	43	0.7	Agroforestry	42	0.6	Ethnobiology	50	0.6
26	Decolonization	40	0.7	Community	42	0.6	Genetic resources	49	0.6
27	Indigenous ecological knowledge	38	0.6	Remote sensing	42	0.6	Knowledge management	48	0.6
28	Arctic	35	0.6	Knowledge management	37	0.5	Indigenous people	46	0.6
29	Natural resource management	35	0.6	Collaboration	35	0.5	Agroforestry	45	0.6
30	Gender	34	0.6	Food security	35	0.5	Ethnoecology	45	0.6

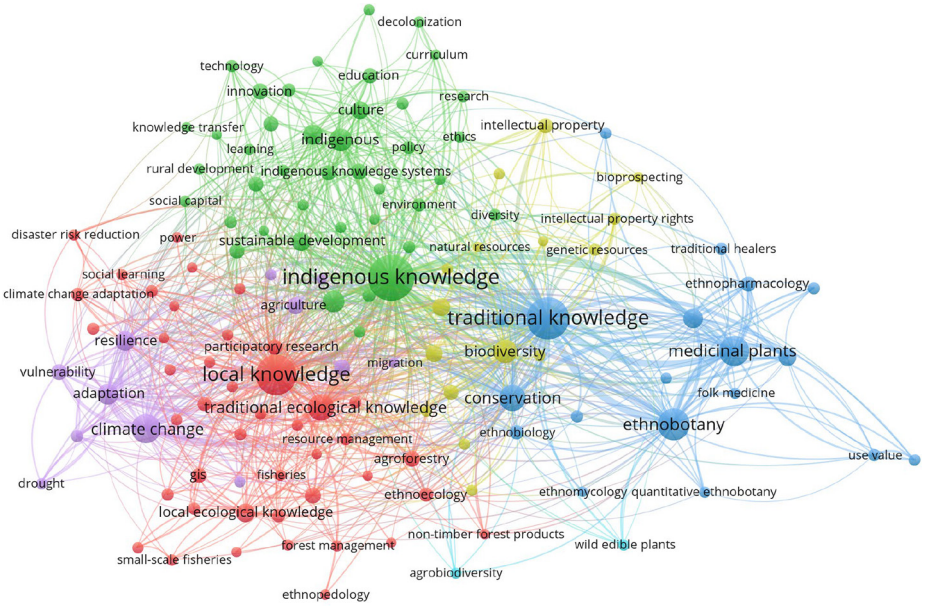

Figure 2.
Network map of most common author-supplied keywords in IK, LK and TK literature

Preferences for the labels across countries or geographic regions

Appendix provides the contribution of each country in each label under investigation in the current study. The analysis was meant to assess the preference of labels across the countries and territories, with the assumption being a country's number of papers for each label as a percentage of papers produced on each label may indicate the country's label of preference. The results in Appendix indicate that, with the exception of the USA, which was ranked in position one in terms of the number of papers across the three labels, all the other countries' ranking varied from one label to another, with some countries posting a ranking variation (range) of as high as 92 in Tunisia ($LK_r = 68$; $IK_r = 160$) and Eswatini (formerly known as Swaziland) ($TK_r = 159$; $IK_r = 67$). In addition, an examination of the percentage contribution to each label reveals variations for each country. For example, the USA's contribution to IK, LK and TK literature stood at 18.01%, 23.14% and 19.33%, respectively, while Canada and the UK, which were placed in positions 2 and 3, respectively, contributed 11.15% and 6.97% (IK), 6.34% and 13.55% (LK) and 9.71 and 8.29% (TK). This pattern was similar across all the countries, whereby variations were witnessed in terms of the countries' percentage contributions for each label and subsequent overall ranking. The percentage variations, calculated as a country percentage contribution in one label minus its percentage contribution in another label, were highest in India's share of the LK (i.e. 2.62%) and TK (i.e. 16.05%) literature, where the range in percentage was 13.43. The second highest range was recorded between TK and IK in South Africa (i.e. 7.81%), while the range between LK and IK in the same country recorded the third-highest percentage difference (i.e. 7.57%). There were several countries that yielded the same percentage contributions across two labels, as shown in Appendix. These are the countries that did not publish any papers across two labels. However, there was no single instance in which a country registered the same percentage contribution across the three labels. Although there were variations in the number of papers and percentage contribution as well as the rankings for each label in each

country, a Pearson correlation based on the number of papers revealed a closely similar pattern across the countries. The coefficients yielded from a Pearson correlation test on the number of papers produced in each country for each label were as follows: IK vs LK (r = 0.8321), IK vs TK (r = 0.8635) and LK vs TK (r = 0.8482). These coefficients are said to be moderately high and therefore depicts moderately strong relationships among the labels.

Conclusion

The three competing labels that are used to describe the knowledge of traditional and indigenous communities have enjoyed a growing and almost similar interest among scholars and across countries, as exhibited in their number of papers indexed in the Scopus database. The interest in each of the labels, dating as far back as 1889 in the case of local knowledge, has continued to grow as shown in Table 1 and Figure 1, with TK overtaking IK and LK, which were previously the leading in terms of the number of papers. The label traditional knowledge yielded the most papers in the database, thereby implying that it is the most preferred or most researched concept among the three labels. The concepts are rarely mentioned together in the publications' titles, abstracts and/or as keywords, as reflected in the small overlap ratios. This implies that although the labels are used to refer to the same type of knowledge, their usage in the literature may be different or synonymous to warrant the use of one of the labels. Subject-wise, the three labels exhibited several differences as well as similarities in their coverage and indexation in the database. However, it was noted that the concepts are largely domiciled in and therefore belong to the broad subject area of Social Sciences. Nevertheless, the knowledge is applied across the 27 Scopus subject areas or disciplines. Despite the countries' percentage share of the total number of publications for each label revealing variations, the Pearson correlation test shows that the pattern was similar across the countries. The variations, however, show that the authors in some of the countries preferred one label to another. Whereas the top ranked countries' preferences for one or another of the labels was not very clear, an examination of the percentage contributions of each of the countries shows that LK was the most preferred in the USA, while South African authors seem to prefer IK to LK and TK, just to mention two examples. These variations may be attributed to high school and/or university curriculum content which may emphasize one label over another, a situation that may influence the use of the labels when conducting research related to the said knowledge.

Recommendations for further research

The study was limited to the data obtained from Scopus, and therefore, a study that examines the coverage of the IK literature in other bibliographic databases is recommended to validate the results of the current study. Furthermore, regional studies may help to understand the usage of the labels in various contexts, in an endeavor to contribute to the understanding of the different labels used to describe the knowledge of the traditional and indigenous communities around the world. Finally, it is well acknowledged that the quantitative data expressed in this paper may not provide adequate explanations on the publication patterns of and preferences for IK, LK or TK, and therefore, this study recommends a qualitative study to explain the results presented herein.

Implications of the study

The usage of the three concepts as synonyms, on the one hand, as well as their usage as separate and distinct concepts, poses challenges for different stakeholders who include

subject librarians, reference librarians, knowledge organizers (indexers, abstracters, and cataloguers) and knowledge users. The implications for organizing and accessing the literature on indigenous knowledge are therefore substantial. In terms of knowledge organization, Cherry and Mukunda (2015) have underscored the challenges associated with classifying indigenous knowledge using conventional library classification systems. The findings of this study may present scholars and indexers with an additional tool to use in refining the existing classification systems for the indigenous knowledge literature.

Although the study's findings yielded small overlap ratios between the concepts, there were many publications that were common among the three concepts' literature, and as such, we believe that information users will require to use all the labels, including those identified in Ngulube and Onyancha (2011) to organize and/or obtain maximum benefits, using Boolean operators, to yield maximum search results. This is particularly important in informetrics studies, which rely on the extraction of representative samples of research outputs to yield desired results. For example, while Ali *et al.* (2016) used the term traditional knowledge alone to conduct a bibliometric analysis of the global traditional knowledge research between 1989 and 2015, Kwanya (2016) used the search terms indigenous knowledge, traditional knowledge and local knowledge to examine indigenous knowledge research in Kenya through bibliometric techniques. An examination of the other bibliometric studies reviewed in this study reveals discrepancies in the use of search terms to extract data from databases.

On matters of policy, stakeholders such as government agencies and educational institutions may use the study's findings to develop thesauri for use within their jurisdictions. The variations witnessed when comparing the use of the concepts in different countries should be considered in policy formulation on various matters such as curriculum development. We believe that the preference of one concept to another, depending on geographic regions, may have implications on the teaching and learning of indigenous knowledge. Nevertheless, we note that the three concepts are used in most countries listed in Appendix. In addition to the theoretical implications of the study, this paper compliments the efforts and attempts of several scholars who have examined the need for a universally accepted concept to represent all the concepts used to describe the knowledge of traditional and indigenous communities. Despite their usage as synonyms, the concepts have some differences in their usage in the literature, which may imply their uniqueness.

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Appendix

Country/territory	IK ($N = 6025$) n	(%)	R	LK ($N = 7129$) n	(%)	R	TK ($N = 8089$) n	(%)	R	Overall rank
USA	1085	18.01	1	1650	23.14	1	1378	19.33	1	1
Canada	672	11.15	2	452	6.34	4	692	9.71	3	2
UK	420	6.97	6	966	13.55	2	591	8.29	4	3
Australia	601	9.98	4	538	7.55	3	457	6.41	7	4
India	562	9.33	5	187	2.62	13	1144	16.05	2	5
Germany	144	2.39	9	399	5.60	5	294	4.12	8	6
China	127	2.11	11	293	4.11	9	490	6.87	6	7
South Africa	634	10.52	3	210	2.95	12	193	2.71	13	8
Brazil	85	1.41	17	294	4.12	8	551	7.73	5	9
France	75	1.24	19	311	4.36	6	217	3.04	12	10
The Netherlands	119	1.98	13	255	3.58	11	168	2.36	14	11
Indonesia	108	1.79	15	268	3.76	10	148	2.08	15	12
New Zealand	232	3.85	7	98	1.37	21	135	1.89	17	13
Italy	53	0.88	36	301	4.22	7	282	3.96	9	14
Mexico	63	1.05	27	154	2.16	15	234	3.28	11	16
Norway	94	1.56	16	130	1.82	18	129	1.81	18	14
Spain	54	0.90	34	187	2.62	13	281	3.94	10	17
Sweden	55	0.91	31	152	2.13	16	119	1.67	20	18
Kenya	122	2.02	12	78	1.09	24	73	1.02	32	19
Thailand	72	1.20	22	93	1.30	22	83	1.16	26	20
Ethiopia	161	2.67	8	57	0.80	29	60	0.84	36	21
Switzerland	49	0.81	37	131	1.84	17	117	1.64	21	22
Malaysia	60	1.00	28	68	0.95	26	104	1.46	22	23
Belgium	64	1.06	25	77	1.08	25	78	1.09	28	24
Finland	49	0.81	37	103	1.44	20	94	1.32	24	25
Denmark	39	0.65	40	122	1.71	19	96	1.35	23	26
Pakistan	119	1.98	13	27	0.38	53	120	1.68	19	27
Nigeria	143	2.37	10	39	0.55	41	43	0.60	43	28
Colombia	35	0.58	41	65	0.91	28	80	1.12	27	29
Nepal	55	0.91	31	41	0.58	37	66	0.93	33	30
Tanzania	55	0.91	31	55	0.77	30	48	0.67	40	30
Uganda	75	1.24	19	38	0.53	43	43	0.60	43	32
Bangladesh	69	1.15	23	38	0.53	43	46	0.65	42	33
Austria	20	0.33	50	68	0.95	26	61	0.86	34	34
Ghana	66	1.10	24	49	0.69	34	31	0.43	53	35
South Korea	21	0.35	48	40	0.56	40	91	1.28	25	36
Taiwan	30	0.50	44	51	0.72	32	55	0.77	37	36
Portugal	11	0.18	63	83	1.16	23	78	1.09	28	38
Philippines	59	0.98	30	41	0.58	37	38	0.53	47	38
Iran	64	1.06	25	32	0.45	49	47	0.66	41	40
Chile	31	0.51	43	50	0.70	33	50	0.70	39	40
Argentina	19	0.32	51	47	0.66	35	77	1.08	31	42
Japan	84	1.39	18	6	0.08	94	137	1.92	16	43
Russian Federation	19	0.32	51	36	0.50	45	61	0.86	34	44
Peru	25	0.41	46	35	0.49	46	54	0.76	38	44
Viet Nam	25	0.41	46	41	0.58	37	32	0.45	51	46
Zimbabwe	75	1.24	19	26	0.36	54	22	0.31	64	47
Benin	43	0.71	39	25	0.35	56	41	0.58	45	48
Hong Kong	13	0.22	59	52	0.73	31	32	0.45	51	49
Turkey	8	0.13	69	31	0.43	51	78	1.09	28	50
Cameroon	34	0.56	42	26	0.36	54	30	0.42	55	51
Saudi Arabia	19	0.32	51	19	0.27	64	39	0.55	46	52
Ireland	8	0.13	69	47	0.66	35	23	0.32	61	53
Ecuador	13	0.22	59	22	0.31	59	38	0.53	47	53

(*continued*)

Table A1. Distribution of the literature according to the geographic region or country

Country/territory	IK ($N = 6025$) n	(%)	R	LK ($N = 7129$) n	(%)	R	TK ($N = 8089$) n	(%)	R	Overall rank
Czech Republic	17	0.28	55	25	0.35	56	26	0.36	57	55
Greece	8	0.13	69	39	0.55	41	23	0.32	61	56
Botswana	54	0.90	34	20	0.28	63	14	0.20	76	57
Bolivia	15	0.25	57	18	0.25	65	31	0.43	53	58
Fiji	21	0.35	48	10	0.14	79	35	0.49	49	59
Poland	6	0.10	75	34	0.48	47	28	0.39	56	60
Egypt	16	0.27	56	17	0.24	66	26	0.36	57	61
Burkina Faso	13	0.22	59	28	0.39	52	16	0.22	71	62
Israel	10	0.17	65	33	0.46	48	15	0.21	72	63
Namibia	60	1.00	28	9	0.13	83	14	0.20	76	64
Singapore	10	0.17	65	25	0.35	56	15	0.21	72	65
Morocco	12	0.20	62	15	0.21	68	21	0.29	65	66
Costa Rica	7	0.12	72	22	0.31	59	19	0.27	68	67
Sri Lanka	18	0.30	54	10	0.14	79	20	0.28	66	67
Malawi	26	0.43	45	14	0.20	72	10	0.14	88	69
Venezuela	9	0.15	67	12	0.17	74	13	0.18	79	70
Mongolia	5	0.08	81	12	0.17	74	15	0.21	72	71
Madagascar	3	0.05	98	21	0.29	62	19	0.27	68	72
Slovenia	4	0.07	88	12	0.17	74	20	0.28	66	72
Hungary	1	0.02	131	32	0.45	49	34	0.48	50	74
Georgia	7	0.12	72	5	0.07	105	25	0.35	59	75
Mali	6	0.10	75	10	0.14	79	11	0.15	83	76
Zambia	15	0.25	57	7	0.10	90	9	0.13	92	77
Solomon Islands	5	0.08	81	8	0.11	86	15	0.21	72	77
Senegal	6	0.10	75	22	0.31	59	5	0.07	114	79
Papua New Guinea	4	0.07	88	8	0.11	86	14	0.20	76	80
Algeria	2	0.03	114	15	0.21	68	18	0.25	70	81
Vanuatu	6	0.10	75	6	0.08	94	11	0.15	83	81
Romania	1	0.02	131	17	0.24	66	23	0.32	61	83
Serbia	1	0.02	131	15	0.21	68	24	0.34	60	84
Laos	5	0.08	81	9	0.13	83	8	0.11	96	85
Estonia	4	0.07	88	7	0.10	90	11	0.15	83	86
United Arab Emirates	3	0.05	98	14	0.20	72	8	0.11	96	87
Panama	4	0.07	88	11	0.15	78	7	0.10	100	87
Rwanda	7	0.12	72	6	0.08	94	7	0.10	100	87
Niger	11	0.18	63	8	0.11	86	4	0.06	118	90
Jamaica	4	0.07	88	6	0.08	94	9	0.13	92	91
Mozambique	5	0.08	81	6	0.08	94	7	0.10	100	92
Greenland	4	0.07	88	4	0.06	112	13	0.18	79	93
Lebanon	3	0.05	98	6	0.08	94	10	0.14	88	94
Sudan	6	0.10	75	4	0.06	112	6	0.08	107	95
Congo	5	0.08	81	3	0.04	120	8	0.11	96	96
Uruguay	2	0.03	114	9	0.13	83	6	0.08	107	97
Iceland	2	0.03	114	7	0.10	90	7	0.10	100	97
New Caledonia	2	0.03	114	7	0.10	90	7	0.10	100	97
Mauritius	4	0.07	88	3	0.04	120	8	0.11	96	97
Oman	3	0.05	98	3	0.04	120	10	0.14	88	101
Samoa	5	0.08	81	3	0.04	120	6	0.08	107	102
Tunisia	0	0.00	160	15	0.21	68	12	0.17	82	103
Jordan	2	0.03	114	10	0.14	79	4	0.06	118	104
Syrian Arab Republic	6	0.10	75	5	0.07	105	3	0.04	132	105
Trinidad and Tobago	5	0.08	81	5	0.07	105	3	0.04	132	106
Slovakia	1	0.02	131	5	0.07	105	11	0.15	83	107
Guatemala	3	0.05	98	5	0.07	105	4	0.06	118	108
Bhutan	3	0.05	98	3	0.04	120	6	0.08	107	109
Brunei Darussalam	4	0.07	88	3	0.04	120	4	0.06	118	110
Cote d'Ivoire	2	0.03	114	12	0.17	74	2	0.03	144	111

(*continued*)

Table A1.

Country/territory	IK ($N = 6025$) n	(%)	R	LK ($N = 7129$) n	(%)	R	TK ($N = 8089$) n	(%)	R	Overall rank
Bulgaria	0	0.00	160	6	0.08	94	13	0.18	79	112
Qatar	3	0.05	98	2	0.03	136	7	0.10	100	113
Cuba	1	0.02	131	4	0.06	112	9	0.13	92	114
Honduras	4	0.07	88	5	0.07	105	2	0.03	144	115
Macao	1	0.02	131	6	0.08	94	5	0.07	114	116
French Polynesia	2	0.03	114	3	0.04	120	6	0.08	107	117
Myanmar	0	0.00	160	6	0.08	94	10	0.14	88	118
Micronesia	2	0.03	114	2	0.03	136	9	0.13	92	118
Croatia	1	0.02	131	2	0.03	136	11	0.15	83	120
Iraq	0	0.00	160	6	0.08	94	7	0.10	100	121
Puerto Rico	2	0.03	114	4	0.06	112	3	0.04	132	122
Eswatini (Swaziland)	9	0.15	67	2	0.03	136	0	0.00	159	123
Barbados	3	0.05	98	3	0.04	120	2	0.03	144	123
Marshall Islands	4	0.07	88	0	0.00	156	4	0.06	118	123
Guinea	3	0.05	98	2	0.03	136	3	0.04	132	126
North Macedonia	1	0.02	131	3	0.04	120	4	0.06	118	127
Nicaragua	3	0.05	98	4	0.06	112	0	0.00	159	127
Angola	1	0.02	131	2	0.03	136	6	0.08	107	129
Palestine	3	0.05	98	3	0.04	120	0	0.00	159	130
Cambodia	0	0.00	160	8	0.11	86	3	0.04	132	131
Timor-Leste	1	0.02	131	5	0.07	105	2	0.03	144	132
Belarus	1	0.02	131	6	0.08	94	1	0.01	156	133
Latvia	1	0.02	131	3	0.04	120	3	0.04	132	134
Lithuania	1	0.02	131	3	0.04	120	3	0.04	132	134
Ukraine	0	0.00	160	4	0.06	112	5	0.07	114	136
Democratic Republic Congo	2	0.03	114	3	0.04	120	0	0.00	159	137
Togo	3	0.05	98	2	0.03	136	0	0.00	159	137
Haiti	1	0.02	131	3	0.04	120	2	0.03	144	139
Belize	1	0.02	131	1	0.01	148	4	0.06	118	140
Kyrgyzstan	1	0.02	131	0	0.00	156	5	0.07	114	141
Afghanistan	3	0.05	98	1	0.01	148	1	0.01	156	142
Niue	2	0.03	114	0	0.00	156	3	0.04	132	142
Sierra Leone	1	0.02	131	4	0.06	112	0	0.00	159	142
Guinea-Bissau	0	0.00	160	4	0.06	112	3	0.04	132	145
Albania	1	0.02	131	0	0.00	156	4	0.06	118	146
Kiribati	1	0.02	131	0	0.00	156	4	0.06	118	146
Palau	1	0.02	131	0	0.00	156	4	0.06	118	146
Dominican Republic	2	0.03	114	2	0.03	136	0	0.00	159	149
Malta	2	0.03	114	2	0.03	136	0	0.00	159	149
Bahrain	1	0.02	131	1	0.01	148	3	0.04	132	151
Eritrea	3	0.05	98	0	0.00	156	0	0.00	159	152
Guyana	3	0.05	98	0	0.00	156	0	0.00	159	152
Tajikistan	3	0.05	98	0	0.00	156	0	0.00	159	152
Faroe Islands	2	0.03	114	0	0.00	156	2	0.03	144	155
French Guiana	2	0.03	114	0	0.00	156	2	0.03	144	155
Montenegro	1	0.02	131	0	0.00	156	3	0.04	132	157
Cyprus	0	0.00	160	0	0.00	156	6	0.08	107	158
Cape Verde	1	0.02	131	1	0.01	148	2	0.03	144	158
Libyan Arab Jamahiriya	0	0.00	160	3	0.04	120	2	0.03	144	160
Seychelles	0	0.00	160	3	0.04	120	2	0.03	144	160
Lesotho	2	0.03	114	0	0.00	156	0	0.00	159	162
Tonga	2	0.03	114	0	0.00	156	0	0.00	159	162
Kazakhstan	1	0.02	131	0	0.00	156	2	0.03	144	164
Bahamas	0	0.00	160	0	0.00	156	4	0.06	118	165

Table A1. (*continued*)

Country/territory	IK ($N = 6025$) n	(%)	R	LK ($N = 7129$) n	(%)	R	TK ($N = 8089$) n	(%)	R	Overall rank
Bosnia and Herzegovina	0	0.00	160	0	0.00	156	4	0.06	118	165
El Salvador	0	0.00	160	0	0.00	156	4	0.06	118	165
Guam	0	0.00	160	0	0.00	156	4	0.06	118	165
Chad	1	0.02	131	1	0.01	148	1	0.01	156	169
Cook Islands	1	0.02	131	0	0.00	156	0	0.00	159	170
Guadeloupe	1	0.02	131	0	0.00	156	0	0.00	159	170
Liberia	1	0.02	131	0	0.00	156	0	0.00	159	170
Maldives	1	0.02	131	0	0.00	156	0	0.00	159	170
Suriname	0	0.00	160	0	0.00	156	3	0.04	132	174
Gambia	0	0.00	160	2	0.03	136	0	0.00	159	175
Kuwait	0	0.00	160	2	0.03	136	0	0.00	159	175
Uzbekistan	0	0.00	160	2	0.03	136	0	0.00	159	175
Luxembourg	0	0.00	160	0	0.00	156	2	0.03	144	178
Burundi	0	0.00	160	1	0.01	148	0	0.00	159	179
Central African Republic	0	0.00	160	1	0.01	148	0	0.00	159	179
Djibouti	0	0.00	160	1	0.01	148	0	0.00	159	179

Notes: Key: n = number of papers; % = percentage contribution for each country in each label; R = Ranking of each country using the number of papers in each label

Table A1.

Corresponding author
Omwoyo Bosire Onyancha can be contacted at: onyanob@unisa.ac.za