

# How much does library and information science research contribute to research on sustainable development goals?

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**Abstract:** The call by the United Nations (UN) on the global community to support and contribute to the implementation of its sustainable development goals (SDGs) has ushered universities and their research units into the larger pool of stakeholders. This article examines the contribution of library and information science (LIS) to the SDGs' research by scrutinising the scholarly outputs of LIS authors whose papers are linked to the development goals. Data were obtained from SciVal and analysed using a variety of tools and techniques. The analysed data were used to examine trends in LIS research outputs that are linked to SDGs, determine LIS outputs' share of the world SDGs research outputs and impact, and assess the research focus areas of the LIS papers associated with SDGs. The findings showed that whereas LIS research pertaining to SDGs has increased over time, on average, the scholarly outputs account for less than one percent of all SDG-related publications (research). Given its multidisciplinary nature, LIS was found to contribute to all SDGs in terms of research and impact, albeit in a limited way, particularly in respect of topics associated with computer science, the decision sciences and the social sciences. Arguably, LIS has significant potential to contribute to sustainable development. To fully exploit this potential, LIS researchers should collaborate more with scholars in other disciplines and focus on developing integrated solutions that address the complex challenges confronting the world today. LIS researchers should continue to research and develop innovative solutions in areas that have the potential to contribute markedly to achieving the SDGs. These areas include, among others, information and knowledge access and sharing, digital literacy, and open government. Finally, the SDGs should be viewed as a framework that enables LIS researchers to make meaningful contributions to achieving the UN's agenda by 2030.

**Keywords:** Library and information science, Research, Research impact, Sustainable development, Sustainable development goals

## Introduction

The sustainable development goals (SDGs) of the United Nations (UN) (UN 2015) have come to guide numerous areas of human endeavour, including research and development. Since their adoption by the UN member states in 2015, the SDGs have continued to shape the development agenda of these countries and the larger, regional blocks. UN member states and international organisations such as the International Monetary Fund (IMF), the United Nations Educational, Scientific and Cultural Organization (Unesco), the United Nations Development Programme (UNDP), and the World Health Organization (WHO) are, to an increasing extent, promoting and/or implementing mechanisms to ensure the achievement of the SDGs, with the aim of eradicating poverty in all its forms and dimensions, including extreme poverty (UN 2015). The UN member states regard the SDGs as a comprehensive framework for sustainable development that can guide countries in their efforts to achieve economic, social and environmental sustainability. The SDGs cover a wide range of issues, including poverty reduction, quality education, gender equality, clean water and sanitation, affordable and clean energy, sustainable cities and communities, climate action, and peace and justice (UN 2015). These goals, which are interconnected and mutually reinforcing, provide a holistic approach to sustainable development that is applicable to all countries, regardless of their level of development (see Table 1). Unsurprisingly, therefore, the SDGs have been labelled “a series of issues related to social, economic and environmental dimensions” (Dibbern & Serafim 2022) and a “global strategy to solve critical world problems” (Bautista-Puig et al 2021: 1).

**Table 1: Sustainable development goals** (Source: UN 2015)

No.	SDG title	Official mission
1	No Poverty	End poverty in all its forms everywhere
2	Zero Hunger	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3	Good Health and Well-being	Ensure healthy lives and promote well-being for all at all ages
4	Quality Education	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5	Gender Equality	Achieve gender equality and empower all women and girls
6	Clean Water and Sanitation	Ensure availability and sustainable management of water and sanitation for all
7	Affordable and Clean Energy	Ensure access to affordable, reliable, sustainable and modern energy for all
8	Decent Work and Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9	Industry, Innovation and Infrastructure	Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation
10	Reduced Inequalities	Reduce inequality within and among countries
11	Sustainable Cities and Communities	Make cities and human settlements inclusive, safe, resilient and sustainable
12	Responsible Consumption and Production	Ensure sustainable consumption and production patterns
13	Climate Action	Take urgent action to combat climate change and its impacts
14	Life Below Water	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
15	Life on Land	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
16	Peace, Justice and Strong Institutions	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17	Partnerships for the Goals	Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development

The SDGs cut across many sectors and disciplines, hence the global call for all stakeholders – including universities – to assess their support for, and contribution to, efforts to realise the goals. In their analysis of the role of higher education institutions (HEIs) in achieving the missions and targets of the SDGs, Zhang et al (2020) express the view that universities can support and contribute to these goals through research, education, governance, operations and public engagement. In relation to research, Zhang et al (2020: 516) make the following observation: “To evaluate the contributions through research, universities aim at relating their scientific publications to SDGs, and automatically quantify the connectedness of these publications to the detailed targets and the unique indicators under SDGs.” The authors further identify four areas (specific to research) through which universities can do this, namely, (a) inter- and transdisciplinary research; (b) innovations and solutions; (c) the national and local implementation of research outputs; and (d) capacity building for SDG-related research (Zhang et al 2020).

Klofsten et al (2019), Leal Fihlo et al (2019), Zhou et al (2020) and Bautista-Puig et al (2021) acknowledge the central role that HEIs have played in global efforts to achieve the UN's 2030 Agenda for Sustainable Development (UN 2015) and, more particularly, to meet the 169 SDG targets through research. In their study entitled "Unveiling the research landscape of sustainable development goals and their inclusion in higher education institutions and research centers: major trends in 2000–2017", Bautista-Puig et al (2021) note that 85.6 per cent of SDG publications originated from HEIs and that the number of academic institutions participating in SDG research more than doubled in the period under study, increasing from only 660 in 2000 to 1 744 in 2017. The authors further report that the number of SDG publications grew from 251 in 2000 to 2331 in 2017 – a percentage increase of 828.7 (Bautista-Puig et al 2021). This trend is confirmed in several studies (see Diksha & Chakravarty 2022; Singh, Kanaujia & Singh 2022; Yamaguchi et al 2022; Yeh et al 2022), albeit with variations in the number of SDG publications reported per year. In addition to the increase in the number of outputs reporting SDG-related research over time, the research has expanded in terms of scope and breadth across disciplines, reflecting a positive response to the global call for a multi- and/or interdisciplinary approach to effectively realise and/or implement the SDGs (Cottafava et al 2022). As Cottafava et al (2022) note, SDG-related research extends across diverse research disciplines, fields and subfields, with some studies being conducted to assess their links/contributions to SDG research.

Bibliometric studies focusing on education (Prieto-Jiménez et al 2021; Maryanti et al 2022), social psychology (Sánchez et al 2022) and rural tourism (Adenidji & Özçatalbas 2021; Tunti & Falikhatun 2022) have been conducted to assess the support and contribution of the different sectors and/or fields/disciplines to the SDGs. There is a dearth of studies linking LIS research to SDGs. However, there have been non-bibliometric attempts to study the role of libraries and information services (as a practice) in supporting efforts to implement and/or achieve the SDGs (see Samantaray 2017; Nwankwo et al 2020; Panda & Das 2022; Suprpto & Qosyim 2022). A literature review revealed that bibliometric studies of LIS research focus on diverse aspects, but not on the contribution that LIS research has made to SDG research as a way of assessing the former's support for the latter. In the main, bibliometric studies on LIS focus on collaboration (see Jabeen et al 2016; Maluleka, Onyancha & Ajiferuke 2016; Onyancha 2018b; Asubiaro & Badmus 2020; Onyancha 2020c), trends and patterns of research production by institution and/or country (see Qadri & Khan 2013; Siddique et al 2021; Wani, Ganaie & Rehman 2022), scientific impact (see Wang, Glänzel & Chen 2020) and LIS journals (Onyancha 2009; Ezema & Ugwu 2019; Khan, Ashar & Yuvaraj 2023).

### **Purpose of the study**

This study sought to examine the scholarly outputs and impact of LIS research linked to SDGs (hereafter simply SDG-L) to establish to what extent LIS supports and contributes to the sustainable development goals. Specifically, the study examined publication trends in LIS papers, the number of LIS papers linked to SDGs as a proportion of all LIS papers and SDGs papers combined, the proportional share of the number of SDG citations (and associated impact metrics) and views (and associated impact metrics) generated by LIS papers and the main topics of the SDG-L papers.

### **Data and materials**

Data for the study were obtained from the SciVal database with a view to assessing the extent to which LIS research contributes to, and supports, the UN's (2015) sustainable development goals. According to Elsevier, the proprietor of SciVal, the database is a research performance assessment tool that permits the analysis of the data in Scopus, which has indexed over 30 million publications to date. The tool provides access to the research performance of over 22 000 institutions in more than 230 countries, making it possible to analyse the research performance of researchers, institutions and even countries, in addition to analysing topics, clusters and research areas. SciVal allows the analysis and generation of reports, depending on the type of module selected from among overview, benchmarking, collaboration and trends. These modules are described as follows:

- *Overview.* This module speaks to research outputs, with metrics such as a summary, topics and topic clusters, publications, citations, authors, collaborations, institutions, economic impact, views and grants awarded.
- *Benchmarking.* This module enables a researcher to evaluate his/her research performance against that of others in the same region or country or the rest of the world.
- *Collaboration.* This module enables a researcher to evaluate the existing research collaboration of his/her institution and country.
- *Trends.* This module enables one to evaluate aspects of certain topics, clusters of topics and research areas, as well as publication sets.

The relevant data were downloaded between 5 and 10 August 2022 and saved in MS Excel or CSV format, in line with the envisaged analysis technique. The ‘research areas’ search option was used to access and download metrics related to each of the SDGs and LIS respectively. While the subject domain ‘library and information science’ was used to download the data relevant to LIS, the acronym SDG, accompanied by the goal number (e.g., SDG 1), was used to search for and obtain all publications linked to a specific development goal. To isolate LIS papers that were linked to SDGs, the results for each SDG were filtered according to the subjects using the following data access procedure/route: Overview >> Published >> By subject area. The targeted data that were extracted included citation-based impact metrics, namely, number of citations (C) and views (V). Descriptive statistics – more particularly, the mean scores (averages) – were used to compare the performance of SDG-L and LIS, on the one hand, and SDG-L and SDGs, on the other, to determine the contribution that LIS research makes to research relating to SDGs.

#### Limitations of the study

This study relied on the bibliographic, citation, and views data of papers published from 2012 until 2021, as provided in SciVal. It is worth noting that the search queries that Elsevier uses to identify SDG-linked papers are not perfect, and the results of this study may not reflect the true picture of the number of papers linked to SDGs. Nevertheless, Elsevier refined the search queries, which increased the recall by ten per cent in 2020, while keeping precision above 80 per cent (Elsevier 2023a).

#### Results and discussion

The results in respect of the publication trends of SDG-L in relation to LIS and SDG research, the percentage contribution of SDG-L research to SDGs, the impact of SDG-L and SDG research, and the topics of research in SDG-L research are presented and discussed in this section.

#### Publication trends

An examination of research publication trends in a subject domain is often carried out in bibliometric studies. It is one of the indicators of the scientific change or evolution of a discipline or research/subject area, in addition to making the visualisation of the research content possible (Diodato 1994; Onyancha 2020b). Figure 1 and Tables 2 and 3 show the publication trends related to SDG-L, LIS and SDG papers from 2012 until 2021. Figure 1 compares the publication trends as they relate to SDG-L and LIS papers and reveals that the pattern of publication of papers followed a relatively similar trajectory from 2012 until 2021, as demonstrated by the two trend lines.

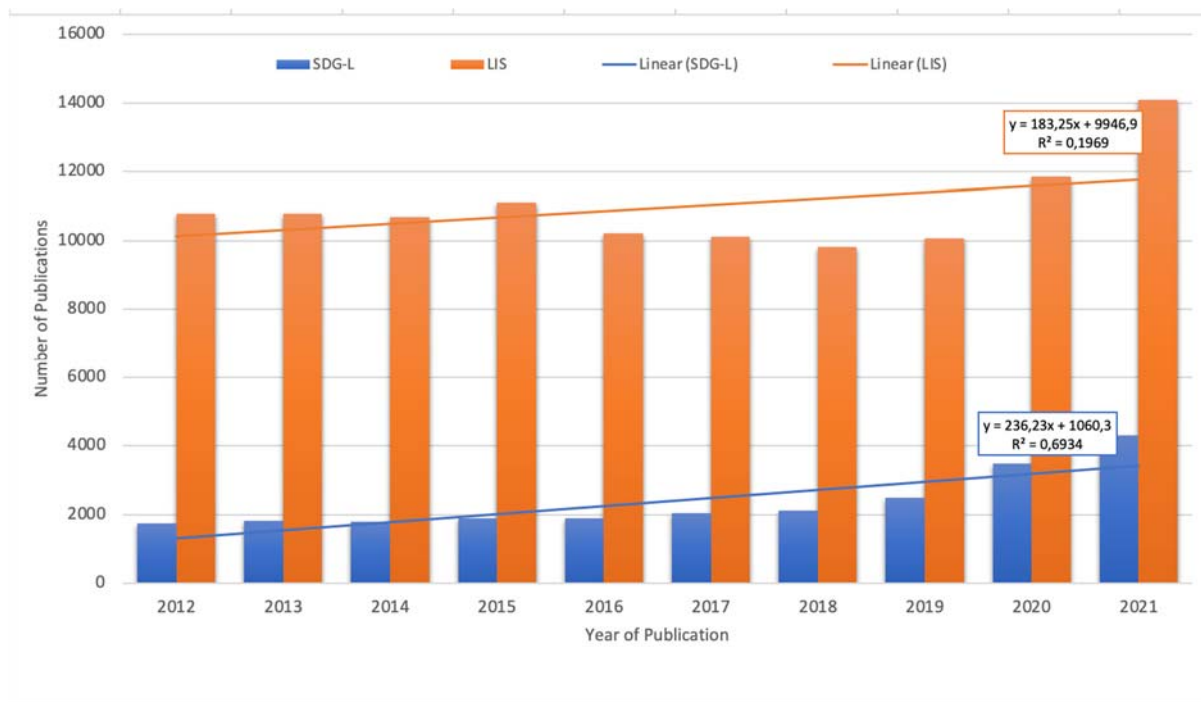


Figure 1: Publication trends of LIS and SDG-L papers, 2012–2021

The annual growth rate (AGR) indicated in Table 2 supports the observation captured in Figure 1 relating to the similarity in the publication trends of SDG-L and LIS papers. Generally, the AGR values in Table 2 reflect an increase in publications from one year to the next, with a few exceptions where the number of publications dropped in both cases. This drop may explain the differences observed in Figure 1, as illustrated in the equations and R-squared values. Table 2 further reveals that the rate of increase in the number of papers was higher for SDG-L papers than it was for LIS papers throughout the period covered by the study. In fact, the computation of the average annual growth rate (AAGR) for each category of papers shows an enormous difference, with an AAGR of 11.20 per cent for SDG-L papers, compared to 3.36 per cent for LIS papers. A Pearson correlation analysis of the two categories of papers yielded a coefficient value of  $r = 0.8428$ , which further supports the difference in publication trends. Whereas the trend lines in Figure 1 might reflect closely similar patterns of publication, the AGR values reveal some differences in scholarly interest in SDG-L and LIS research. It is worth noting, however, that the patterns of publication in Figure 1 and Table 2 are reported in several bibliometric studies that sought to examine the trend related to the publication of LIS research (e.g., Qadri & Khan 2013; Siddique et al 2021; Wani et al 2022) but not SDG-L research.

**Table 2: Publication trends and annual growth rate of SDG-L papers vis-à-vis LIS papers**

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
SDG-L papers	n	1760	1821	1803	1894	1916	2081	2134	2517	3625	4105
	AGR (%)		3.47	-0.99	5.05	1.16	8.61	2.55	17.95	44.02	13.24
LIS papers	n	10814	10710	11162	10331	10205	10016	10178	12024	14525	13526
	AGR (%)		-0.96	4.22	-7.44	-1.22	-1.85	1.62	18.14	20.80	-6.88

Further analysis was conducted of the trends and growth rates as related to the publication of SDG-L and SDG research from 2012 until 2021. Table 3 reflects the publication trend relating to SDG research and Table 4 presents the publication trend relating to SDG-L publications. Of the 16 SDGs, only two surpassed one million publications during the period covered by the study (2012–2022), namely, SDG 3: Good Health and Well-being ( $n = 4\ 193\ 141$ ) and SDG 7: Affordable and Clean Energy ( $n = 1\ 276\ 515$ ). Despite the dominance of these two SDGs in terms of the number of publications, SDG 10: Reduced Inequalities had the highest AAGR (17.11%). Other SDGs whose AAGR values were high were SDG 14: Life Below Water (AAGR = 13.90%), SDG 12: Responsible Consumption and Production and SDG 13: Climate Action, which posted an AAGR of 11.32 per cent each. The growth in the SDG literature ranged from -0.79 per cent in respect of SDG 5 in 2014 to 93.63 per cent in respect of SDG 10 in 2021. The implication is that although researchers conducted their research predominantly in respect of SDG 3 and SDG 7, the other SDGs continued to attract increased research interest during the period under examination.

**Table 3: Publication and growth trends in SDG research, 2012–2021**

SDG		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	AAGR
1	n	10451	10795	11008	11332	12391	13751	14412	15749	16510	18264	6.45
	AGR		3.29	1.97	2.94	9.35	10.98	4.81	9.28	4.83	10.62	
2	n	22094	23765	25367	27818	29476	32024	35496	40113	46034	53129	10.29
	AGR		7.56	6.74	9.66	5.96	8.64	10.84	13.01	14.76	15.41	
3	n	324632	342832	360941	374092	388414	397118	416277	440660	545852	622804	7.69
	AGR		5.61	5.28	3.64	3.83	2.24	4.82	5.86	23.87	14.10	
4	n	26256	29356	29547	30940	33461	36512	40282	45501	50868	55910	8.83
	AGR		11.81	0.65	4.71	8.15	9.12	10.33	12.96	11.80	9.91	
5	n	17770	20060	19934	20387	22371	23767	26243	27578	29772	33824	7.51
	AGR		12.89	-0.63	2.27	9.73	6.24	10.42	5.09	7.96	13.61	
6	n	31959	34972	37053	38074	41893	44420	49648	55097	61793	68685	8.92
	AGR		9.43	5.95	2.76	10.03	6.03	11.77	10.98	12.15	11.15	
7	n	86259	95838	105955	108935	118697	130727	144163	160325	161432	172892	8.09
	AGR		11.10	10.56	2.81	8.96	10.14	10.28	11.21	0.69	7.10	
8	n	26500	29018	30270	31159	34083	38769	42764	49527	55040	63245	10.23

	AGR		9.50	4.31	2.94	9.38	13.75	10.30	15.81	11.13	14.91	
9	n	44112	47725	50398	51598	58892	66778	75670	89014	97831	107991	10.55
	AGR		8.19	5.60	2.38	14.14	13.39	13.32	17.63	9.91	10.39	
10	n	26708	28491	29338	31269	34286	37532	40570	43491	47371	54448	8.20
	AGR		6.68	2.97	6.58	9.65	9.47	8.09	7.20	8.92	14.94	
11	n	39027	44253	46257	47299	53521	58925	69150	78027	83698	91332	10.00
	AGR		13.39	4.53	2.25	13.15	10.10	17.35	12.84	7.27	9.12	
12	n	22763	26138	27002	28189	30916	36018	39219	45565	51268	59350	11.34
	AGR		14.83	3.31	4.40	9.67	16.50	8.89	16.18	12.52	15.76	
13	n	26823	31619	33054	33970	37558	41955	45135	49829	57196	67142	10.85
	AGR		17.88	4.54	2.77	10.56	11.71	7.58	10.40	14.78	17.39	
14	n	18568	19986	20805	21097	23047	24341	27072	29486	32649	35848	7.63
	AGR		7.64	4.10	1.40	9.24	5.61	11.22	8.92	10.73	9.80	
15	n	24453	26905	27738	29284	30757	33005	36105	38542	42779	47418	7.67
	AGR		10.03	3.10	5.57	5.03	7.31	9.39	6.75	10.99	10.84	
16	n	28454	31356	31982	33105	35808	39782	41724	43831	45194	50261	6.58
	AGR		10.20	2.00	3.51	8.16	11.10	4.88	5.05	3.11	11.21	

Notably, the number of SDG-L publications continued to increase, with a few exceptions (see Figure 1 and Table 2). The general publication trend in LIS publications for each SDG revealed a mixed pattern of growth, with only a few instances in which the number decreased from the previous year (2014, 2015 and 2017). By comparison, there was only one instance in which SDG research showed a negative growth rate, namely, SDG 5 (in 2014), but in that instance, the drop was less than one per cent (AGR = -0.79%). The AAGRs in Table 4, which depicts the growth pattern of SDG-L publications, show that although SDG 6: Clean Water and Sanitation yielded the second-lowest number of publications, it produced the most impressive AAGR of 55.91 per cent, followed by SDG 3: Good Health and Well-being (AAGR = 21.07%), SDG 13: Climate Action (AAGR = 19.81%), SDG 2: Zero Hunger (AAGR = 18.05%), SDG 11: Sustainable Cities and Communities (AAGR = 17.46%), SDG 1: No Poverty (AAGR = 17.32%) and SDG 12: Responsible Consumption and Production (AAGR = 17.15%). Some SDG-L publications registered inconsistent growth, however; for example, there was considerable growth in 2019 (AAGR = 100%) and 2020 (AAGR = 220%) for LIS papers on SDG 6, which resulted in a favourable AAGR score. It would be interesting to assess this trend in the next five to ten years to establish whether the pattern is sustainable and/or consistent, as a basis for reaching an informed conclusion.

**Table 4: Publication trends of LIS papers in respect to each SDG (i.e., SDG-L papers)**

SDG		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	AAGR
1	n	28	37	33	30	33	20	40	43	53	79	18.07
	AGR %		32.14	-10.81	-9.09	10.00	-39.39	100.00	7.50	23.26	49.06	
2	n	20	22	19	15	23	18	23	43	56	45	14.69
	AGR %		10.00	-13.64	-21.05	53.33	-21.74	27.78	86.96	30.23	-19.64	
3	n	228	254	277	292	262	301	285	329	725	901	20.58
	AGR %		11.40	9.06	5.42	-10.27	14.89	-5.32	15.44	120.36	24.28	
4	n	370	363	351	355	445	427	428	515	677	703	8.12
	AGR %		-1.89	-3.31	1.14	25.35	-4.04	0.23	20.33	31.46	3.84	
5	n	69	76	65	69	95	83	113	130	195	226	16.00
	AGR %		10.14	-14.47	6.15	37.68	-12.63	36.14	15.04	50.00	15.90	
6	n	8	4	11	18	11	21	5	10	32	36	55.22
	AGR %		-50.00	175.00	63.64	-38.89	90.91	-76.19	100.00	220.00	12.50	
7	n	66	55	72	79	31	36	47	89	93	98	12.12
	AGR %		-16.67	30.91	9.72	-60.76	16.13	30.56	89.36	4.49	5.38	
8	n	121	136	118	107	102	109	130	130	207	274	11.43
	AGR %		12.40	-13.24	-9.32	-4.67	6.86	19.27	0.00	59.23	32.37	
9	n	312	306	277	301	253	288	289	343	460	544	7.40

	AGR %		-1.92	-9.48	8.66	-15.95	13.83	0.35	18.69	34.11	18.26	
10	n	77	92	101	120	119	113	162	160	242	253	15.57
	AGR %		19.48	9.78	18.81	-0.83	-5.04	43.36	-1.23	51.25	4.55	
11	n	110	142	129	155	123	253	180	233	268	278	16.05
	AGR %		29.09	-9.15	20.16	-20.65	105.69	-28.85	29.44	15.02	3.73	
12	n	32	33	27	28	30	40	33	42	71	90	14.97
	AGR %		3.13	-18.18	3.70	7.14	33.33	-17.50	27.27	69.05	26.76	
13	n	15	22	20	23	22	28	29	42	74	62	20.43
	AGR %		46.67	-9.09	15.00	-4.35	27.27	3.57	44.83	76.19	-16.22	
14	n	12	7	11	19	10	10	21	17	24	13	14.13
	AGR %		-41.67	57.14	72.73	-47.37	0.00	110.00	-19.05	41.18	-45.83	
15	n	19	13	21	20	32	23	25	30	43	36	12.54
	AGR %		-31.58	61.54	-4.76	60.00	-28.13	8.70	20.00	43.33	-16.28	
16	n	273	259	271	263	325	311	324	361	405	467	6.55
	AGR %		-5.13	4.63	-2.95	23.57	-4.31	4.18	11.42	12.19	15.31	

### Contribution of LIS research to SDG research

The contribution of LIS research to SDGs was assessed by expressing the number of SDG-L publications, citations and views as a percentage share of SDG publications, citations and views. Table 5 shows that LIS research contributed less than one per cent to the literature (or research) relating to more than half of the SDGs in each year from 2012 until 2021, with the exceptions being SDG 3, 4, 8, 9, 11 and 16. These SDGs may also reflect LIS scholars' areas of research interest, namely, climate action; quality education; decent work and economic growth; industry, innovation and infrastructure; sustainable cities and communities; and peace, justice and strong institutions. Generally, LIS research made the greatest contribution to SDG 4 (Quality Education) with a percentage share of 4.10, followed by SDG 3 (Climate Action) (3.41%), SDG 9 (Industry, Innovation and Infrastructure) (2.97%) and SDG 16 (Peace, Justice and Strong Institutions) (2.89%), to name only those SDGs to which LIS research contributed more than two per cent of publications. LIS contributed less than two per cent in the case of the remaining SDGs, with the lowest contribution relating to SDG 14 (Life Below Water) (0.13%) and SDG 6 (Clean Water and Sanitation) (0.14%). This pattern of contribution per SDG is explained in detail in the section on topics and clusters of topics of SDG-L research.

**Table 5: SDG-L papers as a percentage of SDG papers, 2021–2021**

SDG	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Mean
1	0.27	0.34	0.30	0.26	0.27	0.15	0.28	0.27	0.32	0.43	0.29
2	0.09	0.09	0.07	0.05	0.08	0.06	0.06	0.11	0.12	0.08	0.08
3	0.07	0.07	0.08	0.08	0.07	0.08	0.07	0.07	0.13	0.14	0.09
4	1.41	1.24	1.19	1.15	1.33	1.17	1.06	1.13	1.33	1.26	1.23
5	0.39	0.38	0.33	0.34	0.42	0.35	0.43	0.47	0.65	0.67	0.44
6	0.03	0.01	0.03	0.05	0.03	0.05	0.01	0.02	0.05	0.05	0.03
7	0.08	0.06	0.07	0.07	0.03	0.03	0.03	0.06	0.06	0.06	0.05
8	0.46	0.47	0.39	0.34	0.30	0.28	0.30	0.26	0.38	0.43	0.36
9	0.71	0.64	0.55	0.58	0.43	0.43	0.38	0.39	0.47	0.50	0.51
10	0.29	0.32	0.34	0.38	0.35	0.30	0.40	0.37	0.51	0.46	0.37
11	0.28	0.32	0.28	0.33	0.23	0.43	0.26	0.30	0.32	0.30	0.31
12	0.14	0.13	0.10	0.10	0.10	0.11	0.08	0.09	0.14	0.15	0.11
13	0.06	0.07	0.06	0.07	0.06	0.07	0.06	0.08	0.13	0.09	0.07
14	0.06	0.04	0.05	0.09	0.04	0.04	0.08	0.06	0.07	0.04	0.06
15	0.08	0.05	0.08	0.07	0.10	0.07	0.07	0.08	0.10	0.08	0.08
16	0.96	0.83	0.85	0.79	0.91	0.78	0.78	0.82	0.90	0.93	0.85

With respect to research impact, the researcher considered the number of citations, views and patent citations as proxy measures for scientific, societal and economic impact, respectively (see OECD 2002; D'Este et al 2018; Ramos-Vielba et al 2018; Fecher & Hebing 2021; Elsevier 2022a, 2022b). Table 6 presents the findings that demonstrate the

contribution of SDG-L paper citations and views to the overall impact of SDGs. A comparison of the findings in Tables 5 and 6 shows that LIS performed better in relation to its share in the number of publications than it did in relation to citations and views. Its percentage share of the literature citations and views in the case of all but two SDGs was below one per cent. The exceptions were SDG 4 (Quality Education), where the contribution by LIS stood at 1.69 per cent (views) and 1.04 per cent (citations), and SDG 16, where LIS contributed 1.64 and 1.67 per cent to the total views and citations relating to the SDG, respectively. Table 6 further shows that the views percentage share was higher than the citations percentage share of the SDGs’ impact, implying that LIS research contributed more to total views than to the total citations in relation to the SDGs.

**Table 6: SDG-L citation impact vs SDG citation impact**

SDG	SDG papers				SDG-L				Proportion of citations
	N	FWCI	C/p	OTCP	n	FWCI	C/p	OTCP	n as % of N
1	1589679	1.08	11.8	11.3	5182	1.36	13.1	16.7	0.33
2	5634918	1.17	16.8	12.4	3872	1.24	13.6	8.8	0.07
3	79896441	1.22	19	11.6	54710	1.5	14.2	16.6	0.07
4	3521206	1.01	9.3	10.6	37887	1.05	8.2	10.5	1.08
5	2953011	1.1	12.2	11.3	11508	1.06	10.3	12.7	0.39
6	8374741	1.09	18.1	11.9	2135	1.19	13.7	13.5	0.03
7	26996455	1.41	21	16.2	9081	1.43	13.6	17.6	0.03
8	5524741	1.16	13.8	12.9	13570	1	9.5	11.2	0.25
9	10339441	1.28	15	14.6	50497	1.47	15	15.8	0.49
10	4417122	1.14	11.8	12.1	16169	1.15	11.2	13.2	0.37
11	8112163	1.1	13.3	12.2	27221	1.51	14.5	16.8	0.34
12	6349306	1.23	17.3	14.1	5013	1.04	11.8	8.9	0.08
13	9868825	1.46	23.3	17.1	8991	1.67	26.7	17.8	0.09
14	4449482	1.14	17.6	11.8	2091	1.19	14.5	16.7	0.05
15	5294720	1.06	15.7	10.6	4007	1.21	15.3	14.9	0.08
16	3791536	1.04	9.9	11.1	62626	2.11	19.2	21.5	1.65
<b>MEAN</b>	<b>11694612</b>	<b>1.17</b>	<b>15.37</b>	<b>12.61</b>	<b>19660</b>	<b>1.32</b>	<b>14.03</b>	<b>14.58</b>	<b>0.17</b>

The average citation impact in relation to the number of citations per paper, the field-weighted citation impact and the outputs in the top citation percentiles was higher for SDG-L papers than it was for SDG papers. For example, the SDG-L and SDG papers recorded 32 and 17 per cent above the world average, respectively. A similar pattern was observed in the case of the top citation percentiles. However, the two sets of papers posted an average of 15.37 and 14.03 citations per paper per SDG, respectively, between 2012 and 2021.

**Table 7: SDG-L views impact versus SDG views impact**

SDG	SDGs				SDG-L				Proportion of views
	N	FWVI	v/p	OTVP	n	FWVI	v/p	OTVP	n as % of N
1	4110086	1.26	30.5	15.8	25128	2.68	63.5	29	0.61
2	12161303	1.37	36.3	18.2	14308	1.96	50.4	16.5	0.12
3	96984755	1.05	23.00	10.10	124528	1.28	32.30	15.00	0.13
4	12674589	1.46	33.50	21.10	214765	1.63	46.30	24.00	1.69
5	6842534	1.29	28.30	16.60	54274	1.73	48.40	22.90	0.79
6	18922390	1.30	40.80	16.70	6552	1.57	42.00	23.10	0.03
7	46503175	1.33	36.20	17.20	33399	1.90	50.10	27.80	0.07
8	16162806	1.47	40.40	21.20	83057	2.12	57.90	27.10	0.51
9	31166490	1.70	45.20	25.80	202352	2.16	60.00	31.70	0.65
10	10449767	1.23	28.00	15.10	56710	1.41	39.40	20.50	0.54
11	21305798	1.36	34.80	18.60	79592	1.51	42.50	19.30	0.37



12	19615490	1.75	53.50	27.90	33598	2.94	78.90	35.20	0.17
13	19004089	1.53	44.80	22.60	19950	2.09	59.20	27.60	0.10
14	9080647	1.29	35.90	16.00	5732	1.41	39.80	18.10	0.06
15	11328340	1.22	33.60	14.50	11533	1.48	44.00	20.60	0.10
16	10753465	1.33	28.20	18.10	180549	2.12	55.40	31.40	1.68
<b>MEAN</b>	<b>21691608</b>	<b>1.37</b>	<b>35.81</b>	<b>18.47</b>	<b>71627</b>	<b>1.87</b>	<b>50.63</b>	<b>24.36</b>	<b>0.48</b>

With respect to views impact, Table 7 shows that the LIS papers linked to SDGs (i.e., SDG-L) yielded higher average values in respect of the outputs in top view percentiles (i.e., 24.36 vs 18.47), views per paper (i.e., 50.63 vs 35.81) and field-weighted views impact (i.e., 1.87 vs 1.37). The average number of views for SDG-L was 71 627 out of the 21 691 606 views per SDG between 2012 and 2021. This pattern of views impact was similar across all SDGs.

**Table 8: SDG-L citation impact vs SDGs citation impact**

SDG	SDG papers				SDG-L papers			
	Citing-patents count	Patent-cited scholarly output	Patent-citations count	Patent-citations per scholarly output	Citing-patents count	Patent-cited scholarly output	Patent-citations count	Patent-citations per scholarly output
1	149	57	149	1.1	0	0	0	0
2	5622	2264	8103	24.2	0	0	0	0
3	160602	105229	545706	129.5	116	42	120	31.1
4	661	295	777	2.1	9	3	9	1.9
5	1669	534	2213	9.2	0	0	0	0
6	6013	3307	8804	19	0	0	0	0
7	48225	24809	91008	70.8	59	7	59	88.6
8	1699	567	1842	4.6	0	0	0	0
9	23933	7629	30839	44.7	9	4	9	2.7
10	969	272	1014	2.7	0	0	0	0
11	5023	2003	5998	9.8	9	7	13	6.9
12	5831	2110	6945	19	0	0	0	0
13	6948	3496	11017	26	0	0	0	0
14	2340	1092	3058	12.1	0	0	0	0
15	2103	746	2494	7.4	0	0	0	0
16	924	275	1047	2.7	3	3	3	0.9
<b>MEAN</b>	<b>17044</b>	<b>9668</b>	<b>45063</b>	<b>24.06</b>	<b>13</b>	<b>4</b>	<b>13</b>	<b>8.79</b>

**Key:** Citing-patents count (count of patents citing the scholarly output published in SDG-L); patent-cited scholarly output (count of scholarly outputs in SDG-L cited in patents); patent-citations count (count of patent-citations received in SDG-L); patent-citations per scholarly output (average patent-citations received per 1 000 scholarly outputs published in SDG-L).

Finally, the proportional contribution of SDG-L to SDGs' patent impact, as shown in Table 8, revealed that an average of 13 patents cited SDG-L papers, compared to SDGs' 17 044 but only four LIS papers per SDG were cited in patents, leading to 8.79 patent-citations per paper (calculated as 13 [average patent citations] x 1 000 divided by 1 479 [average SDG-L papers per SDG]). Table 8 further reveals that, in several instances, there were no data as far as patent citations were concerned – this was the case for ten out of the 16 SDGs.

The findings based on citation, view and patent impact suggest that LIS research has made a significant contribution to the SDGs, as evidenced by the high citations and view impact of SDG-L. The higher citation impact is an indication that the research conducted in the LIS field is of a high quality and is recognised by the scientific community, indicating the importance of LIS research in contributing to the SDGs. The higher views impact also implies that LIS research is greatly accessible to the general public and policymakers, which can help to promote awareness and understanding of the SDGs. However, the lower patent citation impact of SDG-L papers compared to that of SDG papers could suggest that LIS research has a limited impact on innovation and technological progress in relation to

achieving the SDGs. This may be due to the nature of LIS research, which focuses more on developing theories and frameworks than creating new products or technologies. Nevertheless, the fact that SDG-L papers were cited in patents and contributed to patent impact suggests that LIS research has some impact on innovation and technological progress in respect of achieving the SDGs.

### Contribution of LIS to SDGs in respect of subject areas and topics

An analysis of the SDG-L publications according to topics and topic clusters was carried out to shed light on LIS researchers' subject areas of interest, as well as the areas and sectors in which LIS research contributed to SDG research. Elsevier (2023b) defines a topic cluster as "an aggregation of topics with similar research interest into broader, higher-level areas of research", adding that the clusters can provide a broader understanding of an entity's research before an exploration of the more specific or niche underlying topics is undertaken. SciVal analyses data research according to 96 000 topics and 1 500 topic clusters. Table 9 presents the top 20 topic clusters within which LIS research on SDGs was published and Table 10 shows the topics that yielded 100 and more publications each. The tables illustrate that LIS researchers conducted research in a variety of areas, including libraries and librarianship, research (evaluation), information and communications technology (ICT), media and journalism, information systems, LIS education and training, and information and knowledge management. In addition, the visibility of non-LIS topics and topic clusters, such as Covid-19, SARS, coronavirus, HIV, and work, psychology and personality, in Table 9 reflects the interdisciplinarity of LIS research, which in turn explains the extension of LIS research into all 16 SDGs. The presence of topics associated with research evaluation – and, more particularly, bibliometrics (or bibliometric studies) – among the top 10 topics in SDG-L research further explains the distribution of LIS papers across all SDGs. Bibliometric studies are conducted on any aspect dealing with information, ranging from information production or access to use and reuse (Diodato 1994). Bibliometrics has become one of the most common keywords in LIS literature (Chang, Huang & Lin 2015; Onyancha & Majanja 2017; Onyancha 2018a; Onyancha 2020a). Therefore, it is not surprising to observe that some LIS publications have been linked to SDGs where one would least expect it. For example, an informetric study of HIV/Aids is likely to be linked to SDG 3 because of the keywords HIV and HIV/Aids, even if the study is simply describing the HIV/Aids-related literature and is not necessarily intended to ensure healthy lives and promote well-being for all at all ages.

**Table 9: Topic clusters of SDG-L research, 2012–2021**

No.	Topic clusters	Papers	Percentage
1	Library; Librarian; Information	3188	13.51
2	Research; Technology; Industry	1180	5.00
3	Publications; Periodicals as Topic; Research	1022	4.33
4	Archives; Library; Collections	742	3.14
5	Industry; Innovation; Entrepreneurship	699	2.96
6	Media; News; Journalism	599	2.54
7	Industry; Information Systems; Research	589	2.50
8	Semantics; Models; Recommender Systems	557	2.36
9	Students; Teacher; Learning	542	2.30
10	Students; Teaching; Education; e-Learning	529	2.24
11	Industry; Research; Marketing	479	2.03
12	Health Literacy; Patients; Internet	387	1.64
13	Libraries; Metadata; Ontology	364	1.54
14	Work; Personality; Psychology	240	1.02
15	HIV; HIV Infections; HIV-1	238	1.01
16	Design; Human–Computer Interaction; Websites	236	1.00
17	Covid-19; SARS-CoV-2; Coronavirus	229	0.97
18	Gambling; Internet; Students	222	0.94
19	Knowledge Management; Industry; Research	218	0.92
20	Periodicals as Topic; Open Access; Library	212	0.90

The specific topics in Table 10 indicate that open government and e-governance, information literacy and user education, archives and records management, internet use and the digital divide, and the adoption and use of ICT were central themes in SDG-L research. Several scholars have also made this observation in their published works (see

Chang et al 2015; Onyancha, 2018a; Papić & Buhin 2019). For example, Papić and Buhin (2019) found the following to be prominent topics in LIS research: scholarly communication, social media, information security and privacy, the Internet of Things (IoT), big data analytics, electronic/mobile health, e-government, knowledge management, and information retrieval and information behaviour. In this regard, Onyancha (2018a) notes that bibliometrics, knowledge management, social media, academic libraries, the internet, citation analysis, information retrieval, knowledge sharing, information literacy, collaboration, e-government, innovation, research and social networks were the main topics of research in LIS between 2011 and 2015.

**Table 10: Topics of SDG-L research, 2012–2021**

No.	Topics	Papers	Percentage
1	Open Government; Transparency; e-Governance	710	3.01
2	Information Literacy; Library Instruction; Librarians	639	2.71
3	Cultural Heritage; Archival Science; Forms and Records Control	347	1.47
4	Digital Divide; Internet Use; Education	232	0.98
5	Technology Acceptance Model; Mobile Payment; e-Learning	212	0.90
6	Co-authorship; Scientific Collaboration; Bibliometric Analysis	189	0.80
7	Education; Land Information System; Informatician	183	0.78
8	Research Personnel; Research Productivity; Women in Science	179	0.76
9	Intellectual Structure; Bibliometric Analysis; Scientometrics	173	0.73
10	Library Schools; Information Needs; Farmers	169	0.72
11	Political Participation; Social Media; Media Use	161	0.68
12	Web Accessibility; Library Services; Visually Impaired	153	0.65
13	Smart Cities; Big Data; Internet of Things	149	0.63
14	Boundary Objects; Affordances; Innovation	148	0.63
15	Entrepreneurial University; Academic Entrepreneurship; Innovation	141	0.60
16	Electronic Books; Patron-driven Acquisitions; Library Science	138	0.58
17	Health Information Seeking; LIDA; Medical Information	132	0.56
18	Academic Libraries; Survey Research/Design; Library Service	121	0.51
19	Research Personnel; Data Reuse; Librarians	113	0.48
20	Social Capital; Information Literacy; Contingent Valuation	113	0.48
21	Information Source; Electronic Resources; University Libraries	112	0.47
22	Social Media; Election Campaigns; Political Communication	108	0.46
23	Archivists; Digitisation Projects; Primary Source	105	0.44

Figure 2 reflects SDG-L papers as a proportion of SDG papers according to the 27 broad subject areas under which scholarly outputs are categorised in Scopus. The figures represent the number of SDG-L papers as a percentage of SDG papers in each subject area. Overall, the study found that most SDG-L papers were domiciled in the social sciences (SOCI), which yielded an average of 1 479 papers per SDG, followed by computer science (COMP) (686) and the decision sciences (DECI) (196). The other fields or subject areas yielded fewer than 100 SDG-L papers per SDG. Figure 2, in which the subject areas are plotted on the x-axis and the percentage contribution of SDG-L papers towards SDGs on the y-axis, shows that 5.58 per cent of SDG 5 papers were associated with COMP and 5.09 per cent of SDG 16 papers were associated with DECI. Of the 27 subject areas in which LIS research linked to SDGs was conducted, COMP and DECI featured prominently, while SOCI and ARTS registered some high percentage values (see Figure 2). An examination of the topics and cluster topics in Tables 6 and 7 may help to explain the prominence of the fields as far as SDG-L papers are concerned. First, LIS research seems to focus on the adoption and use of ICT, which are closely linked to COMP. Second, although LIS is a multidisciplinary field, it is often classified as a social science, hence the prominence of SOCI. Third, the decision sciences and LIS are closely related fields since both deal with the processing, analysis and interpretation of information to support decision-making processes. The emergence of bibliometrics and scientometrics among the top researched topics in LIS may explain the high concentration of SDG-L papers in DECI.

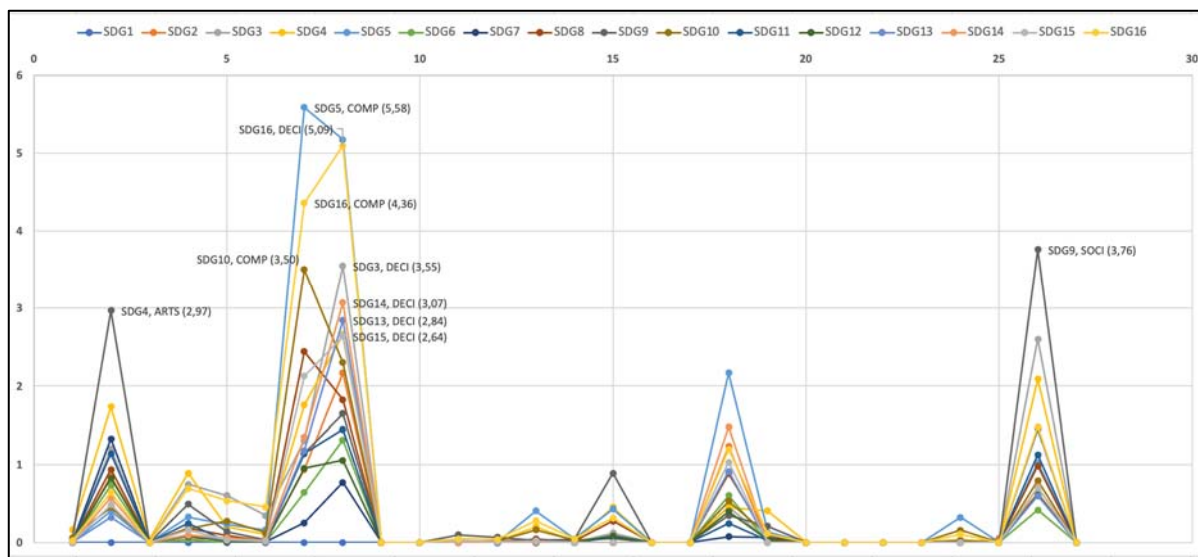


Figure 2: SDG-L papers as a proportion of SDG-linked papers, according to subject areas

## Conclusion

The findings of this study indicate that while LIS papers linked to SDGs have increased over the years, their percentage share of papers published on SDGs remains small. Nevertheless, the fact that LIS contributed papers in all the SDGs under investigation in the study underscores the critical role that LIS research can play in advancing SDGs. The low percentage of SDG-L papers compared to the overall number of SDG papers suggests that information science has not fully exploited its potential to contribute to the achievement of the SDGs. The high citation and view impact of SDG-L papers demonstrates the value of LIS research in contributing to the scientific community's knowledge base and promoting awareness and understanding of SDGs among policymakers and the general public. The lower patent citation impact of SDG-L papers suggests that further research may be necessary to understand how LIS research can better contribute to innovation and technological progress in achieving the SDGs. Finally, the fact that most SDG-L papers are domiciled in the social sciences, computer science and the decision sciences highlights the need for interdisciplinary collaboration to achieve the SDGs. LIS researchers can collaborate with colleagues from other disciplines to develop integrated solutions aimed at addressing the complex challenges confronting the world today. The contributions of SDG-L research in areas such as open government, information literacy and the digital divide, among others, underscore the importance of information access and sharing in achieving the SDGs. Information science can play a significant role in promoting information access and sharing by developing platforms and systems that enable people to access and share information easily.

## Implications of the study

The importance of conducting research within national and global frameworks, such as national development plans, regional block agendas and the SDGs, cannot be overemphasised. Significantly, the SDGs have been labelled as indicators of societal impact, and researchers and institutions are urged to conduct research in pursuit of the 17 sustainable development goals (see Chankseliani & McCowan 2020; Chapman et al 2020; Oefelein 2020; Elsevier 2022a, 2022b). It is therefore gratifying to note that the LIS sector is involved, albeit to a limited degree, in supporting the achievement of the SDGs through research. LIS schools around the world should consider harnessing LIS research for SDGs as a valuable contribution towards realising development goal targets. LIS schools may find this study invaluable in their endeavours to refine research niche areas for the purpose of conducting research that responds to societal needs and/or challenges.

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