2023

What have we done? Information Systems Scholarship and the Unsustainable Development Goals

Cameron Guthrie

Samuel Fosso-Wamba

WHAT HAVE WE DONE? INFORMATION SYSTEMS SCHOLARSHIP AND THE UN SUSTAINABLE DEVELOPMENT GOALS.

Research-in-Progress

Guthrie, Cameron, TBS Business School, Toulouse, France, c.guthrie@tbs-education.fr

Fosso Wamba, Samuel, TBS Business School, Toulouse, France, s.fosso-wamba@ tbs-education.fr

Abstract

The professional and scholarly interest in the social impacts of information systems has been rapidly growing over the past decade. This article presents research-in-progress using bibliometric analysis to better understand how information systems scholars are contributing to the UN Sustainable Development Goals (SDG). The analysis covers 6741 published journal papers identified using the Scopus database. A descriptive analysis of the corpus allowed us to identify the most influential works and authors in the field. Four thematic clusters were identified using co-word analysis, demonstrating that decision science, information systems, and computer science and engineering all contributed to the development of the area. Further analysis in the completed paper of the extant IS literature by individual SDGs should allow for the identification of opportunities for research.

Keywords: Sustainable development, UN SDG, Bibliometrics, Grand challenges.

1 Introduction

The UN's 17 Sustainable Development Goals (SDGs) are a call to action to end poverty, protect the planet and improve the lives of people everywhere. The information management field has much to contribute to the achievement of these goals, from the digital transformation of humanitarian supply chains to the development of dedicated decision support systems. While there has been growing scholarly interest in information systems for social good (e.g., Fosso Wamba et al., 2021) , the IS community is yet to take stock of its contribution to the achievement of the SDGs.

The paper is organised as follows. We first define the key concepts and then outline the selected research methodology, The key results are then presented in section 4, followed by a discussion of their implications. The paper then concludes in section 5.

2 The IS discipline and sustainable development research

2.1 Sustainable development and the UN SDGs

In 1987, sustainable development was defined in the World Commission on Environment and Development's Brundtland report as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987).

Research into sustainable development strives to understand how to maintain development over time, taking into consideration both environmental protection, economic development and social inclusion. In 2015, the United Nations released "a plan of action for people, planet and prosperity" in the form of 17 sustainable development goals. The goals go beyond environmental protection and reflect the scientific consensus that the world's global challenges are interconnected. The 17 SDGs are listed in figure 1 below.

SDG 1: No Poverty
SDG 2: Zero Hunger
SDG 3: Good Health and Well-being
SDG 4: Quality Education
SDG 5: Gender Equality
SDG 6: Clean Water and Sanitation
SDG 7: Affordable and Clean Energy
SDG 8: Decent Work and Economic Growth
SDG 9: Industry, Innovation and Infrastructure
SDG 10: Reduced Inequality
SDG 11: Sustainable Cities and Communities
SDG 12: Responsible Consumption and Production
SDG 13: Climate Action
SDG 14: Life Below Water
SDG 15: Life on Land
SDG 16: Peace and Justice Strong Institutions
SDG 17: Partnerships for the Goals

Figure 1. UN Sustainable Development Goals (SDG)

169 targets have been set to direct and evaluate action for the 17 SDGs. Our study will focus on the first 16 goals as they lend themselves more readily to academic research.

2.2 The state of IS for SDG scholarship

There has been growing scholarly interest over the past decade in "making a better world" through IS research (Walsham, 2012). While IS scholars have addressed issues such as the role of information and communication technologies for social inclusion, in charitable organisations, and during natural disasters, "these examples are too far and few between." (Davison et al., 2023). Recent experiences during the Covid-19 pandemic have amplified calls in the literature for the IS community to further explore issues of sustainability (Pan and Zhang, 2020).

This study responds to these calls by taking stock of the IS community's contribution to the achievement of the UN SDGs.

3 Methodology

We set up inclusion and exclusion criteria so that the most relevant articles were extracted from the Scopus database. Only journal articles in English were included. A total of 1806 documents were retrieved using search queries for each of the 16 SDGs [1]. The search was limited to journals in management information systems from the FNEGE list of academic publications. The FNEGE list presents several advantages: initial rankings are based on statistical analysis (i.e., factor analysis) of a number of international journal rankings; it includes publications from the fields of decision science (DS), information systems (IS), and computer science (CS); the final inclusion and rankings of journals are determined by a panel of scholars with input from disciplinary scholarly associations.

Bibliometric techniques to analyze the development and evolution of the field. In the social sciences and management research, bibliometrics has been similarly used to study the evolution of research in areas including artificial intelligence for societal good (Fosso Wamba et al., 2021) and the contribution of management research to the UN SDGs (Pizzi et al., 2020).

4 Results

4.1 The current state of the IS for SDG literature

All documents in the dataset were published between 1969 and 2023 from 44 sources (Table 1). The average document was authored by 3 scholars and received 42 citations. One in three documents involved an international co-authorship.

Description	Results
Timespan	1969:2023
Sources (journals, books, etc.)	44
Documents	6741
Average citations per doc	42.68
Authors	15114
Co-Authors per Doc	3.33
International co-authorships %	26.01

Table 1. Primary information about the dataset

The earliest paper in the dataset is entitled "A model for the description and evaluation of technical problem solving", published by Frischmuth and Allen in *IEEE Transactions on Engineering Management*. It modelled individual technical problem-solving processes used by engineers in R&D projects. This article contributes to *SDG 9 Industry, Innovation and Infrastructure*.

Figure 2 reports the annual production of documents and average yearly citations. We can see from the bar chart that the number of documents increased rapidly from 2019 onwards, with significant jumps in 2021 and 2022. Citations per year spiked in 2001, 2002 and 2005.

[1] The search was conducted on January 23, 2023

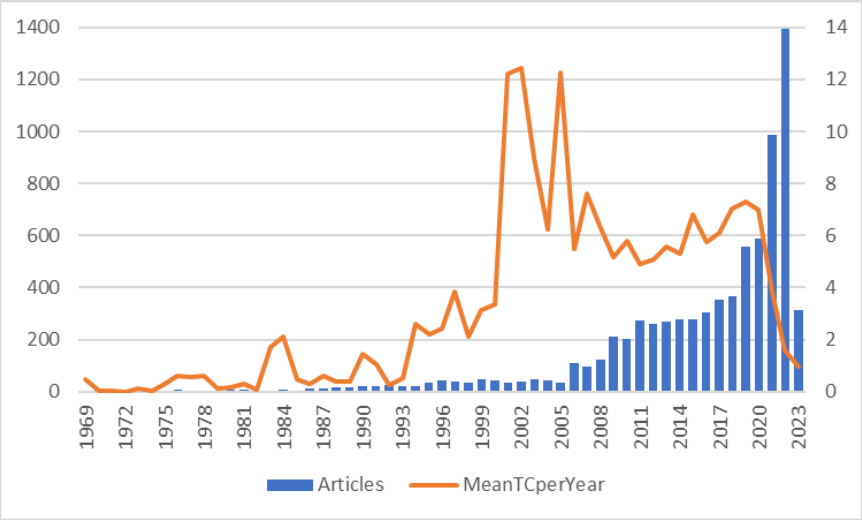

Figure 2. Annual scientific production

Table 2 presents the five most influential publications by total number of citations. The review paper entitled "The benefits of Facebook "friends:" Social capital and college students' use of online social network sites" published by Ellison et al in *Journal of computer-mediated communication* (Ellison, Steinfield and Lampe, 2007), is the most highly cited paper in the dataset. It examines the relationship between use of Facebook and the formation and maintenance of social capital. The authors found that social media usage interacted with measures of psychological well-being and suggest that "it might provide greater benefits for users experiencing low self-esteem and low life satisfaction" (p. 1143). This article contributes to *SDG 3 Good Health and Well-being*. Two of the top 5 papers contributes to *SDG 12 Responsible Consumption and Production*.

Description	TC	TC/year	SDG
Ellison, N. B., Steinfield, C. and C. Lampe (2007). "The benefits of Facebook "friends:" Social capital and college students' use of online social network sites." *Journal of computer-mediated communication 12*(4), 1143-1168.	6002	353,1	3
Bhattacherjee, A. (2001) "Understanding information systems continuance: An expectation-confirmation model." *MIS Quarterly* 351-370.	4616	200,7	12
McKnight, D. H., Choudhury, V. and C. Kacmar (2002) "Developing and validating trust measures for e-commerce: An integrative typology." *Information systems research 13*(3), 334-359.	3279	149	16
Pavlou, P. A. (2003) "Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model." *International journal of electronic commerce 7*(3), 101-134.	3153	150,1	12
Bock, G. W., Zmud, R. W., Kim, Y. G., and J. N. Lee (2005). "Behavioral intention formation in knowledge sharing: Examining the roles of extrinsic motivators, social-psychological forces, and organizational climate." *MIS Quarterly*, 87-111.	2978	156,7	13

Table 2. Most influential publications

The most influential sources by h-index are presented in table 3. The h-index is a measure of the quantity and the quality of scholarly output. It is defined as "the number of papers with citation number $\geq h$" (Hirsch, 2005). Publications from the three fields are all present in the table. The most influential publication is *Expert Systems with Applications* with a h-index of 118 and four papers amongst the most highly cited in the dataset ("top 50"). Since 1990, the journal has produced significantly more papers around sustainability than other FNEGE list journals, representing 25% of papers in the dataset.

Publication	Field	H-index	Cita-tions	Publica-tions	Top 50	Start year
Expert Systems with Applications	DS	118	64432	1692	4	1990
MIS Quarterly: Management Infor-mation Systems	IS	75	34194	131	13	1990
International Journal of Information Management	IS	75	18340	282	3	1986
Decision Support Systems	DS	63	18909	270	7	1988
Computers and Industrial Engineering	CS	60	16997	830	0	1976

Table 3. Most influential sources

Table 4 ranks the most influential authors by their local h-index. Y Wang from China is the most prolific author in the dataset with 29 publications and a h-index of 12.

Author	H-index	Citations	Publications	Country	Top 50	Citations per year	Start year
Wang Y	12	960	29	China	0	80,0	2012
Chen Y	6	582	8	China	0	32,3	2006
Polat K	6	547	6	Turkey	0	30,4	2006
Li X	5	989	8	China	1	61,8	2008
Zhu K	4	1630	5	China	2	81,5	2004

Table 4. Most influential authors

The most influential institutions are ranked according to their h-index and total citations in table 5. The first ranked institution is Islamic Azad University with 36 publications and a h-index of 18. Three Chinese and three North American affiliations are amongst the top 10 most influential in the dataset.

Institution	**H-index**	**Citations**	**Publications**	**Country**
Islamic Azad University	18	1358	36	Iran
National Cheng Kung University	17	997	25	China
Hong Kong Polytechnic University	16	1601	19	Hong Kong
University of Granada	15	1041	20	Spain
National University of Singapore	14	5098	22	Singapore

Table 5. Most influential institutions

Table 6 ranks countries according to their h-index and total citations. China is the most influential country for publications IS and sustainability, with a h-index of 56 and eight publications in the top 50. North American scholars are less productive but have been active the longest, boasting 16 publications in the top 50.

Country	**H-index**	**Citations**	**Publications**	**Top 50**	**Start year**
China	56	11814	254	8	2002
USA	54	25182	152	16	1970
United Kingdom	22	1750	39	0	1999
Australia	21	1892	31	0	2000

India	20	1807	45	2	2001

Table 6. Most influential countries

4.2 Intellectual structure of the IS for SDG field

We used co-word analysis to analyse the thematic evolution of the field. Co-word analysis identifies groups of keywords that reflect different themes developed within a research field. Multiple Correspondence Analysis (MCA) was used to quantify co-occurrence of keywords[2] and plot them on a two-dimensional map (figure 3). The distance between the words represents how frequently they appear together.

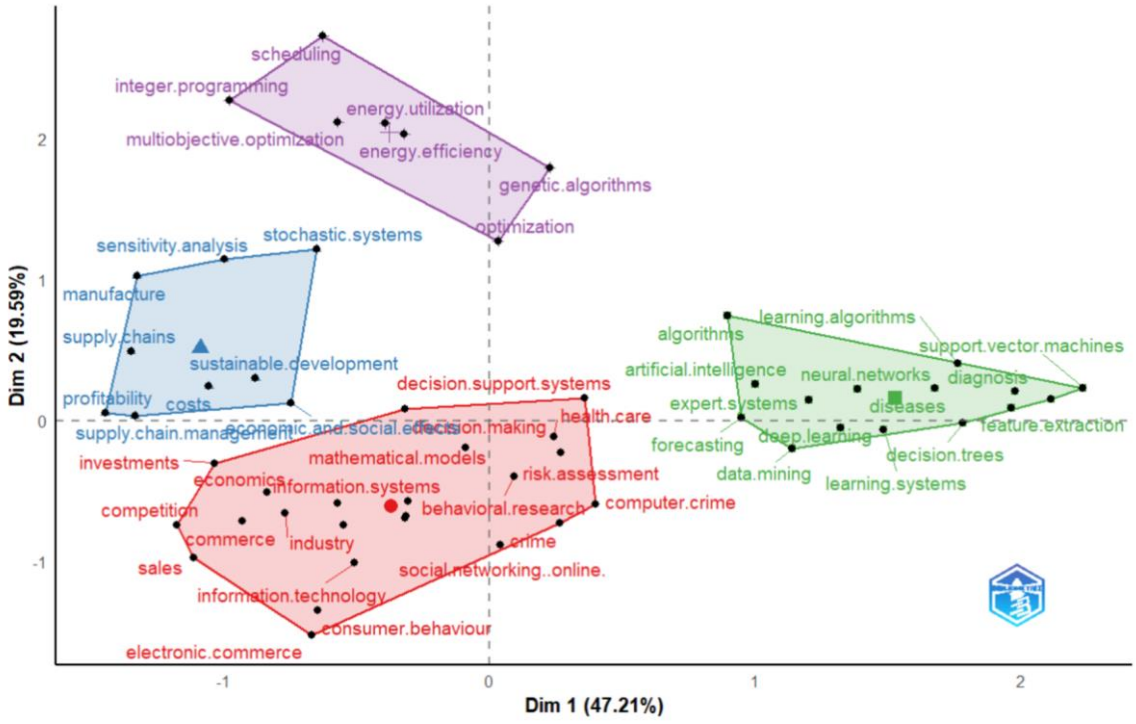

Figure 3. Keyword clusters

Four clusters were identified reflecting the multidimensional conceptual structure of the field. The first cluster (red) groups together keywords pertaining to information systems, decision making, and consumer behaviour. A representative article in this cluster is Ellison et al. (2007) who study social capital and online networks and contributed to *SDG 3 Good Health and Well-being*. The second cluster (blue) covers the theme of supply chains and manufacturing. The most cited article related to this cluster is by Dorling et al. entitled "Vehicle routing problems for drone delivery" and published in *IEEE Transactions on Systems, Man, and Cybernetics* (Dorling et al., 2016). It contributes to *SDG 7 Affordable and Clean Energy*. The third cluster (green) groups keywords relating to the use of artificial intelligence. The fourth cluster (purple) describes a theme relating to energy efficiency and optimization.

[2] Automatically generated Keywords Plus words were used.

4.3 IS research by SDG

The corpus was then broken down by SDG. The number of articles contributing to each goal is presented in figure 4. We can see that research into sustainable development in the information management field has covered all areas targeted by the 16 SDGs.

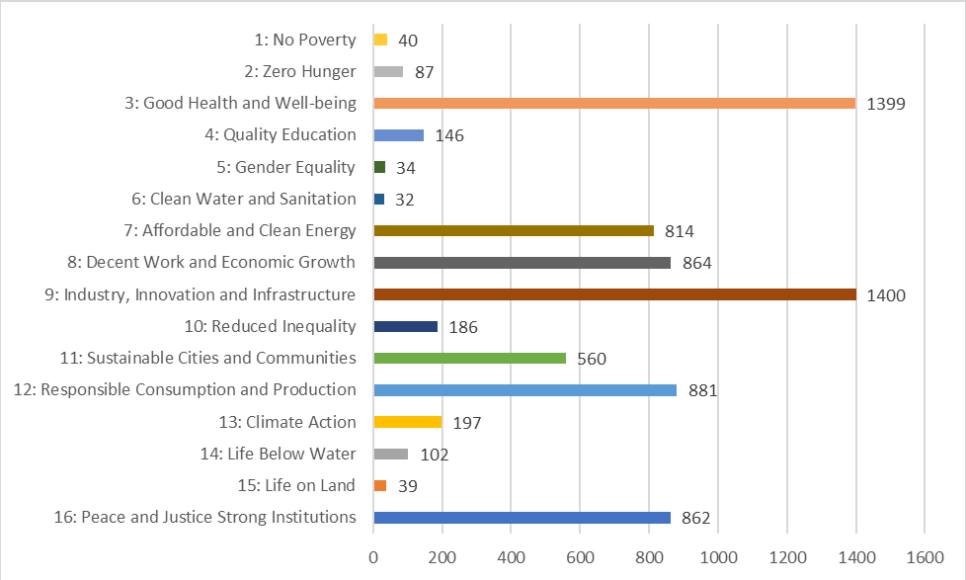

Figure 4. Research activity by SDG

However, not all SDGs have received the same interest from IS scholars. Most of the focus has been in seven areas, with two accounting for over 40% of all contributions: health and wellbeing (SDG 3), and industry, innovation, and infrastructure (SDG 9). Little research has addressed issues of poverty (SDG 1), hunger (SDG 2), gender equality (SDG 5), clean water and sanitation (SDG 6), and life on land (SDG 15). The following sections examine research undertaken for each UN SDG.

4.3.1 SDG 1: No Poverty

The objective of SDG 1 is to "end poverty in all its forms everywhere". Co-word analysis was used to describe the intellectual structure of contributing extant IS literature. Five clusters emerged, with the three main clusters reflecting the themes of costs and food banks, food storage, and agriculture and economic development. IS research has mainly focused on two of five UN targets to achieve this goal

4.3.2 SDG 2 to 16: Research-in-progress

5 Discussion

There are increasing calls for management and IS scholars to address global challenges such as climate change, poverty and inequality. Our study has examined the contribution of the IS community, using the UN SDGs and an international list of journals to structure our inventorying. While IS research has contributed to all 16 SDGs, some goals require greater scholarly attention, such as poverty, hunger, and equality.

6 Conclusions

The main expected contributions of this research-in-progress are an overview of IS scholarship for sustainability and suggested research directions for understudied SDGs.

References

Brundtland, G. H. (1987), "Our Common Future World Commission On Environment And Developement", UN: Brundtland Commission.

Davison, R. M., Majchrzak, A., Hardin, A. and Ravishankar, M. N. (2023), "Special issue on responsible IS research for a better world", Wiley Online Library pp. 1-7.

Dorling, K., Heinrichs, J., Messier, G. G. and Magierowski, S. (2016), "Vehicle routing problems for drone delivery", *IEEE Transactions on Systems, Man, and Cybernetics: Systems,* 47(1), 70-85.

Ellison, N. B., Steinfield, C. and Lampe, C. (2007), "The benefits of Facebook "friends:" Social capital and college students' use of online social network sites", *Journal of computer-mediated communication,* 12(4), 1143-1168.

Fosso Wamba, S., Bawack, R. E., Guthrie, C., Queiroz, M. M. and Carillo, K. D. A. (2021), "Are we preparing for a good AI society? A bibliometric review and research agenda", *Technological Forecasting and Social Change,* 164, 120482.

Hirsch, J. E. (2005), "An index to quantify an individual's scientific research output", *Proceedings of the National academy of Sciences,* 102(46), 16569-16572.

Pan, S. L. and Zhang, S. (2020), "From fighting COVID-19 pandemic to tackling sustainable development goals: An opportunity for responsible information systems research", *International journal of information management,* 55, 102196.

Pizzi, S., Caputo, A., Corvino, A. and Venturelli, A. (2020), "Management research and the UN sustainable development goals (SDGs): A bibliometric investigation and systematic review", *Journal of cleaner production,* 276, 124033.

Walsham, G. (2012), "Are we making a better world with ICTs? Reflections on a future agenda for the IS field", *Journal of Information Technology,* 27, 87-93.