

# The United Nations' Sustainable Development Goal 5 (SDG5) Research and Impact from a Gender Perspective: A Bibliometric Analysis in the IS Discipline

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## Abstract

*Promoting women's empowerment through ICTs is an essential driver for achieving gender equality (SDG5) goals. While an increasing number of women and girls are enjoying equal opportunities to access technologies and STEM education, how the academic world of Information Systems (IS) emphasizes gender equality remains less known. This bibliometric study addresses this gap by examining the landscape of SDG5 publications within the IS discipline and assessing the impact of these studies. In addition, we highlight the role of leading authors' gender (female) in driving SDG5 research. To empirically conduct this study, we self-trained an LSTM machine learning model to effectively identify authors' gender by their names. Our empirical analysis reveals that the IS discipline is less attentive on SDG5 topics. In addition, female scholars tend to publish more SDG5 studies but exert less impact on academic society compared to their male counterparts. We further discuss our findings and propose future research directions.*

**Keywords:** gender equality (SDG5), gender difference, scientific activeness, scientific impact, bibliometric study

## 1. Introduction

Information Communication Technologies (ICTs) are crucial in facilitating the Sustainable Development Goals (SDGs) of the United Nations by the target year of 2030. In practice, many programs have offered vulnerable populations equal opportunities in accessing technologies and STEM education. Among these populations, a large portion of effort has been attributed to women and girls. Over the past decades, the United Nations' intergovernmental processes have played a leading role in identifying key issues and proposing strategic actions to enhance women's empowerment through ICTs (United Nations, 2005; 2024). Indeed, the

realization of the SDGs hinges on the comprehensive fulfillment of the needs of all global citizens, particularly women. Introduced in 2015, SDG5 calls for collective action to achieve gender equality and empower all women and girls, a pivotal objective that underpins the success of the entire SDG framework (Beloskar et al., 2024).

Despite considerable attention to advancing gender equality across various contexts, there remains a lack of research evaluating the progress of SDG5 within academia, especially in the IS field. As an exception, Leong et al. (2020) conducted a literature review and observed a surprisingly low number of published studies in prestige IS journals between 2000 to 2020 that focused on SDG topics, especially in gender equality and women empowerment topics (SDG5). However, with the rapid expansion of the digital landscape and the emergence of new technologies such as Artificial Intelligence (AI), an updated understanding of the current status of SDG5 is needed. The IS discipline is particularly relevant as digital technology has been instrumental in bridging the digital gender divide and empowering women in various practical ways, such as political participation (Yin & Sun, 2021), health information acquisition (Alhassan & Adam, 2021), and financial wellness improvement (Yadav et al., 2022).

Against this backdrop, this study aims to *assess the current state of SDG5 research within the IS discipline using bibliometric analysis*, a method increasingly utilized to reveal emerging trends in research and journal performance (e.g., Donthu et al., 2021; Verma & Gustafsson, 2020).

Considering the notable gender imbalance in the IS field and the nature of SDG5, we incorporate a gender perspective to guide our analysis. Gender disparities in the scientific field manifest in employment, academic promotions, funding opportunities, publications, and social recognition. Previous studies have shown that women, compared to their male counterparts, publish approximately one-third fewer papers (Mairesse & Pezzoni, 2015), get less grants (Bornmann et al., 2007),

generate fewer commercial outcomes (Whittington & Smith-Doerr, 2005), and receive less recognition for their scientific contributions (Ross et al., 2022). Given that SDG5 aims to enhance the status of women, there is an expectation for increased involvement of female researchers in this area of study, both to advocate for their common interests and to provide a richer diversity of perspectives. However, the degree to which the academic achievements of female researchers, such as their citation impact, are recognized on an equitable basis continues to be a matter of uncertainty. To address this, we further *examine the gender differences in both scientific activeness (i.e., the number of articles) and scientific performance (i.e., the citation of articles) under SDG5*.

The findings of this study provide significant implications for future research and policy development. First, by conducting a bibliometric study using a large recent dataset across multiple regions, we updated the current understanding of IS scholars' contributions to SDG5 studies. This evaluation offers timely insights for IS communities, especially considering the rapid advancements in new digital technologies and their potential for empowerment. Second, using a gender perspective, we discovered significant gender differences of those scholars who conducted SDG5 studies. The asymmetric relationship found between their academic activeness and scientific impact contributes to gender studies in the scientific arena. Lastly, by scrutinizing the progress of SDG5, our research helps inform the refinement of policies to better reflect the changing landscape of gender equality as we approach the target year of 2030, allowing necessary adaptations and adjustments to be made, ensuring that policies are more effectively aligned with the evolving dynamics of gender equality.

## 2. Method

To empirically explore the scientific enquiry participation in SDG5 topics, we employ a bibliometric study methodology (Donthu et al., 2021). Bibliometric studies have been widely used to examine the emerging trends in article and journal performance, collaboration patterns, research constituents, and the intellectual structure of a specific domain in the extant literature (e.g., Aksnes et al., 2019; Subramanyam, 1983; Thanuskodi, 2010; Verma & Gustafsson, 2020). In our research setting, bibliometric study enables us to systematically explore the IS communities' scientific output on SDG5 topics and the practical impacts accordingly.

### 2.1. Sample

A longitudinal publication dataset from January to December 2023 was collected using Elsevier's Scopus (SciVal), one of the largest bibliometric databases in the world. We focused on the regions of the United States, the United Kingdom, and Hong Kong because they represent essential areas with a prestigious reputation for scientific research and possess similar institutional backgrounds. Publications meeting our regional and temporal criteria were extracted, including details on author composition, names, institutions and national backgrounds, and publication citation metrics from SciVal. After removing duplicates, a total of 37,083 papers published from Jan 1 to Dec 31, 2023 were identified. Of these publications, 1,064 (2.87%) were related to SDG5 topics, while 36,019 (97.13%) were not. Specifically, 351 papers (0.85%) focused exclusively on SDG5 topics.

We used the All Science Journal Classification (ASJC) System<sup>1</sup> in Scopus to classify the fields of publications. The ASJC categorizes knowledge into four broad branches (Life Sciences; Physical Sciences; Health Sciences; Social Sciences and Humanities), 27 fields and more detailed sub-fields. We use "field" as our main level of categorization. Table 1 shows the distribution of SDG5 topics, all research topics, the ratio of SDG5 topics to all topics, as well as the ratio of SDG5 topics to all SDGs by fields. Figure 1 depicts the top ten fields of SDG5 publications.

To identify the IS discipline publications, we manually searched for "Information Systems" in the ASJC codes. Given the limited number of pure IS research and the multidisciplinary nature of IS, we traced its parent field for reference. Information Systems can be traced to three fields: Business, Management and Accounting (14\*\*), Computer Sciences (17\*\*), and Decision Sciences (18\*\*). Consequently, we used publications from these three fields as proxies for IS publications.

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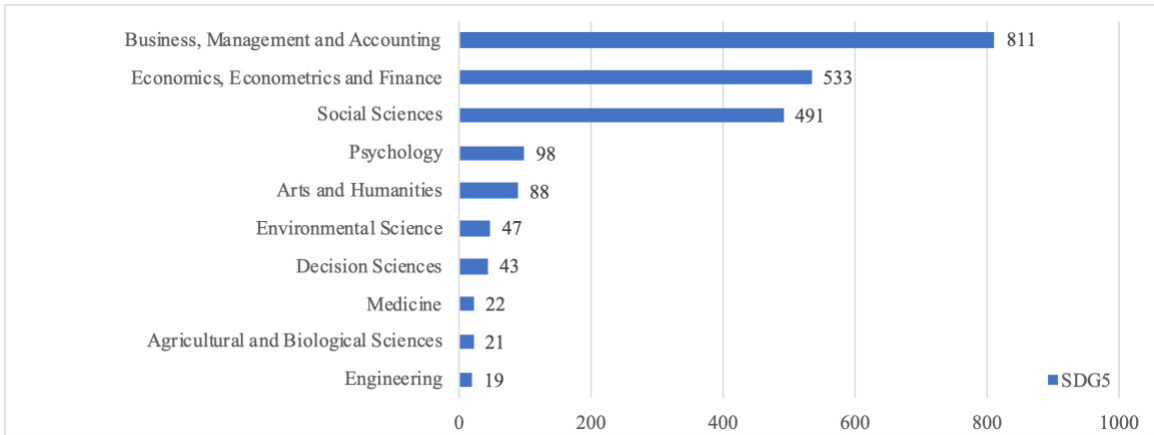
<sup>1</sup><https://scientificresearch.in/asjc-all-science-journal-classification-codes/>

**Table 1. Distribution of SDG5 publication across fields<sup>2</sup>**

Code	Field	SDG5	All Topics	SDGs	Non-SDGs	SDG5/All Topics	SDG5/SDGs
1000	Multidisciplinary	2	13	8	5	15.38%	25.00%
11**	Agricultural and Biological Sciences	21	851	577	274	2.47%	3.64%
12**	Arts and Humanities	88	1622	629	993	5.43%	13.99%
13**	Biochemistry, Genetics and Molecular Biology	3	191	42	149	1.57%	7.14%
14**	Business, Management and Accounting (^)	811	26938	10096	16842	3.01%	8.03%
15**	Chemical Engineering	0	35	16	19	0.00%	0.00%
16**	Chemistry	0	53	20	33	0.00%	0.00%
17**	Computer Science (^)	13	2646	654	1992	0.49%	1.99%
18**	Decision Sciences (^)	43	4742	1369	3373	0.91%	3.14%
19**	Earth and Planetary Sciences	1	66	36	30	1.52%	2.78%
20**	Economics, Econometrics and Finance	533	18592	8123	10469	2.87%	6.56%
21**	Energy	4	1233	909	324	0.32%	0.44%
22**	Engineering	19	3509	1713	1796	0.54%	1.11%
23**	Environmental Science	47	2656	2038	618	1.77%	2.31%
24**	Immunology and Microbiology	0	0	0	0	0.00%	0.00%
25**	Materials Science	4	140	53	87	2.86%	7.55%
26**	Mathematics	4	1632	316	1316	0.25%	1.27%
27**	Medicine	22	900	337	563	2.44%	6.53%
28**	Neuroscience	3	50	18	32	6.00%	16.67%
29**	Nursing	7	252	91	161	2.78%	7.69%
30**	Pharmacology, Toxicology and Pharmaceutics	1	34	18	16	2.94%	5.56%
31**	Physics and Astronomy	0	63	13	50	0.00%	0.00%
32**	Psychology	98	1971	621	1350	4.97%	15.78%
33**	Social Sciences	491	11012	5134	5878	4.46%	9.56%
34**	Veterinary	0	0	0	0	0.00%	0.00%
35**	Dentistry	0	0	0	0	0.00%	0.00%
36**	Health Professions	4	287	59	228	1.39%	6.78%
<b>Total</b>		<b>2219</b>	<b>79488</b>	<b>32890</b>	<b>46598</b>	<b>2.79%</b>	<b>6.75%</b>

Note: Fields identified as the IS disciplines are marked with a caret (^).

<sup>2</sup> The total numbers exceed 37,083 because a single publication can be associated with multiple fields.



**Figure 1. Top ten fields of SDG5 publications**

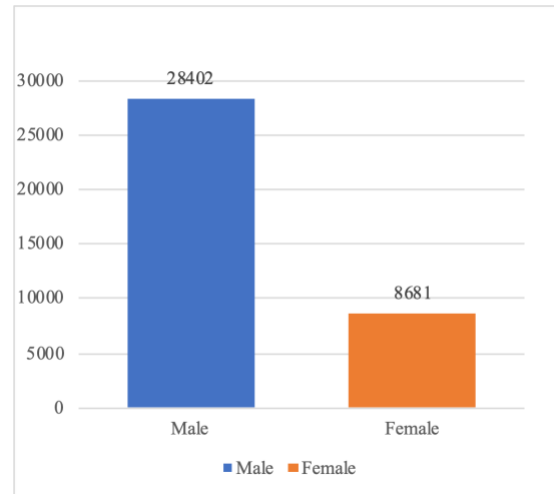
## 2.2. Gender identification

Since the gender information of authors is not presented in our database, we self-trained a long short-term memory (LSTM) machine learning model for gender identification and prediction.

We took a four-step process to train the model. First, we extracted sample data from publications in the United States in 2023 and cleaned author full names. We then split the data with a 20/80 ratio for training and testing datasets. We trained the LSTM model with training data and validated our model with testing data. Lastly, we applied our model to the complete original sample to predict gender and probabilities for all authors based on their full name.

To evaluate our model, we conducted a comparative analysis using generative AI (i.e., ChatGPT 3.5 Turbo), commercial gender prediction models (i.e., Gender API, Genderize, and NamSor) and supervised machine learning models (i.e., Linear Regression Model, Naive Bayes Model, XGBoost Model). Given the advanced development and data richness of the ChatGPT 4.0 model, we used its predictions as the standard for validation. After comparing the model performance, data volume handling and application relatedness across these models, we found that our LSTM Model has the best accuracy in gender prediction and consistency of

prediction probabilities while also capable of processing large datasets effectively. Specifically, the comparison between the LSTM and ChatGPT 4.0 models revealed a high matching rate of 91.72%. This high degree of alignment confirmed the reliability and accuracy of the LSTM model for gender prediction. As a result, among the 37,083 papers we identified, 28,402 (76.59%) were led by male authors and 8,681 (23.41%) were led by female authors. Figure 2 demonstrates the gender distribution of leading author as identified.



**Figure 2. Distribution of leading author's gender**

### 2.3. Measurement

We collected a series of variables for our empirical analysis.

**2.3.1. Gender.** We used the first author's gender as a proxy for the gender of the leading author of each publication. Gender is coded as a dummy variable: 1 if the publication is led by a female author, and 0 if led by a male author.

**2.3.2. Scientific activeness.** We used the number of SDG5 publication articles as an indicator of scientific activeness. SDG5 publication is a dummy variable that is 1 when the publication is labeled as “SDG5” in the SciVal database and 0 otherwise.

**2.3.3. Scientific performance.** We used the number of SDG5 citations as an indicator of scientific performance. The data collection date, April 1, 2024, was chosen as the reference date. To normalize the citations, we calculated the difference in months between the publication date and the reference date (i.e., months since publication) and divided the number of citations by months since publication. SDG5 citation is therefore treated as a continuous variable.

## 3. Data analysis and results

In the following section, we discuss our data analysis procedure and report our empirical study results. We adopted Python 3.10 for data entry, management, and analyses.

### 3.1. The current status in the IS discipline regarding SDG5 topics

We first identified the overall SDGs related publications in the IS discipline. The total number of SDGs related publications is 21,406<sup>3</sup>. As shown in Figure 3, the majority of publications focused on SDG1 (No poverty), with 5,648 publications. Other SDGs also received significant attention, such as SDG8 (Decent Work and Economic Growth) with 2,605 publications, SDG9 (Industry, Innovation, and Infrastructure) with 2,743 publications, and SDG12 (Responsible Consumption and Production) with 1,813 publications. All SDGs except SDG17 were covered.

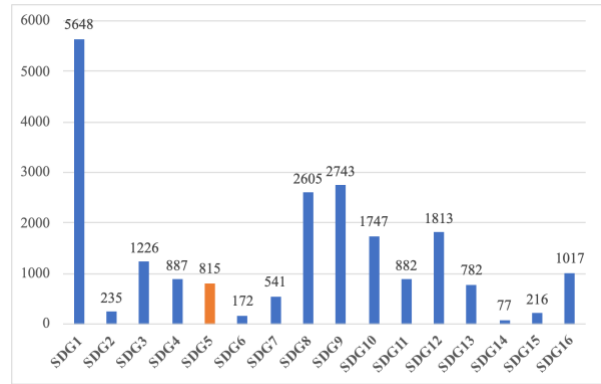


Figure 3. SDGs publications in the IS discipline

Specifically, there were 815 IS publications focused on SDG5 related issues. Compared to other SDG topics, SDG5 is less popular in the IS community. However, it is still an encouraging indicator of the growing interest and commitment since Leong et al. (2020) that more IS scholars start to address and promote gender equality issues.

Meanwhile, we also identified the gender of leading authors across SDGs publications. Figure 4 shows that, in all cases, male scholars outnumbered female scholars in its absolute value. For SDG5 related publications, 68.34% (n = 557) are led by male scholars while 31.66% (n = 258) are led by female scholars. Further discussions on gender differences will be presented in Section 3.2.

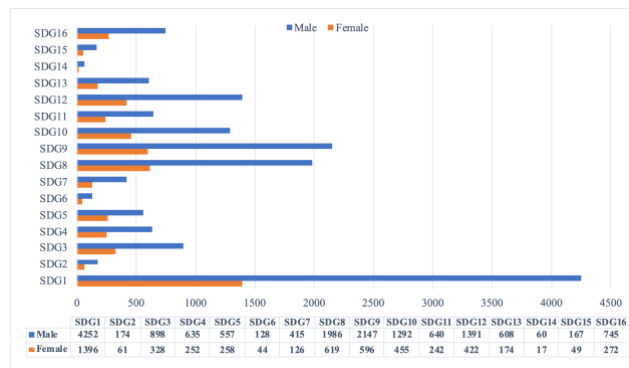
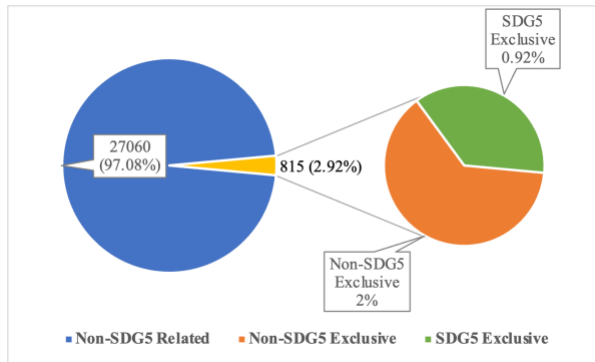


Figure 4. Gender of leading author in SDG5 publication in the IS discipline

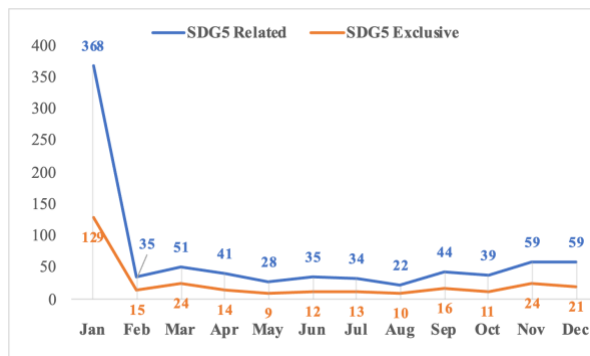
We then further identified the total number of SDG5 publications within the IS community. Figure 5 illustrates the distribution of SDG5 publication in the IS discipline. Among the total number of 27,875 publications in the IS discipline in 2023, most of the publications (n = 27060, 97.08%) were non-SDG5 related, 815 (2.92%) were related to SDG5 topics, and 298 (1.07%) focused exclusively on SDG5 topics.

<sup>3</sup> Same publication can be counted more than one time.



**Figure 5. Distribution of SDG5 publication in the IS discipline**

Figure 6 presents the timeline of SDG5 publications within the IS discipline. The temporal analysis reveals a notable surge in SDG5 research publications in January 2023. We then witnessed a consistent trend of publications from February to December 2023. On average, approximately 40 publications per month were dedicated to SDG5-related topics, while around 15 publications per month focused exclusively on SDG5.



**Figure 6. Timeline of SDG5 publication in the IS discipline**

### 3.2. Gender and scientific activeness

To examine gender differences in scientific activeness, we conducted Chi-square analyses using Python 3.10. The results revealed significant disparities in SDG5 publication numbers between male and female authors in both SDG5-related papers (chi-square = 25.75,  $df=1$ ,  $p < .001$ ) and SDG5 exclusive papers (chi-square = 8.71,  $df=1$ ,  $p < .01$ ). Specifically, more female authors have contributed to SDG5 publications than expected.

Table 2 illustrates that a higher number of females ( $n = 258$ ) had SDG5-related publications compared to the expected frequencies ( $n = 196.45$ ), while fewer

males ( $n = 557$ ) published SDG5 related papers than expected ( $n = 618.55$ ). Similarly, Table 3 demonstrates that for SDG5 exclusive papers, more females ( $n = 94$ ) published exclusive SDG5 papers than expected frequencies ( $n = 71.83$ ), whereas fewer males ( $n = 204$ ) published exclusive SDG5 papers than expected ( $n = 618.55$ ). Our findings suggest that although female scholars were underrepresented compared to male scholars, they tended to contribute more to SDG5 topics.

**Table 2. Crosstab table for SDG5 related publication**

Gender	Observed (SDG5)	Observed (Non-SDG5)	Expected (SDG5)	Expected (Non-SDG5)
Male (0)	557	20599	618.55	20537.45
Female (1)	258	6461	196.45	6522.55
<b>Total</b>	<b>815</b>	<b>27060</b>	<b>815</b>	<b>27060</b>

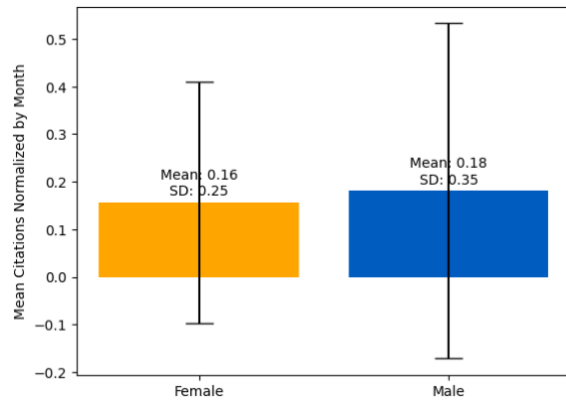
**Table 3. Crosstab table for SDG5 exclusive publication**

Gender	Observed (SDG5)	Observed (Non-SDG5)	Expected (SDG5)	Expected (Non-SDG5)
Male (0)	204	20952	226.17	20929.83
Female (1)	94	6625	71.83	6647.17
<b>Total</b>	<b>298</b>	<b>27577</b>	<b>298</b>	<b>27577</b>

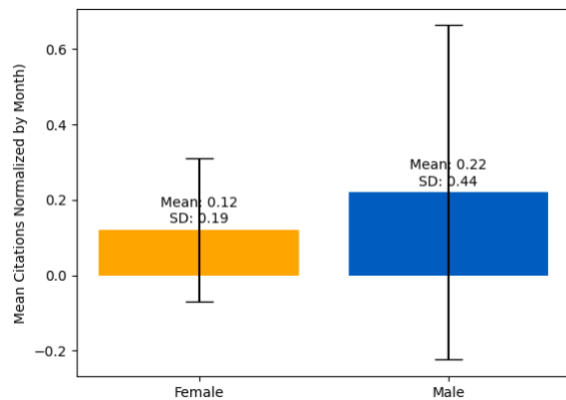
### 3.3. Gender and scientific performance

To examine the gender difference in SDG5 scientific performance within the IS discipline, we conducted several T-tests in Python 3.10. Specifically, we compared the mean citations between publications authored by male and female scholars for SDG5 publications. To ensure the accuracy of our comparisons, we used normalized monthly citation numbers to mitigate the effect of timing, as the number of citations can vary greatly depending on the date of release.

We found that there were significant mean differences in SDG5 exclusive publications,  $t(1)=2.71$ ,  $p < .01$ . To be specific, the citations of publication led by female scholars ( $M=0.12$ ,  $SD=0.19$ ) were reported significantly lower than that of male scholars ( $M=0.22$ ,  $SD=0.44$ ). Same patterns were also found in SDG5 related publications; however, the differences were not statistically significant ( $t(1)=1.10$ ,  $p = .27$ ). See Figure 7 and Figure 8 for details. Our findings reveal that for publications exclusively focused on SDG5, those led by female scholars achieved significantly lower scientific performance compared to those led by their male counterparts.



**Figure 7. Mean citations difference by gender for SDG5 related publication**



**Figure 8. Mean citations difference by gender for SDG5 exclusive publication**

To further examine the relationship between gender and scientific performance, we also conducted a set of OLS (Ordinary Least Squares) regressions. Similar patterns were found. See Table 4 for results.

For SDG5 exclusive publications, our analysis reveals a statistically significant relationship between the gender of the first author and the number of citations. Specifically, the gender of the leading author is significantly negatively correlated with the citations ( $\beta = -0.0994$ ,  $p < .05$ ). This negative coefficient suggests that papers led by female authors receive, on average, 0.0994 fewer citations per month compared to those led by male authors. The model explains 1.5% of the variance in monthly citations. For SDG5 Related publications, although a negative coefficient was observed ( $\beta = -0.0238$ ,  $p = .33$ ), the effect is not statistically significant.

In summary, our results highlighted a notable gender disparity in IS scholars' scientific performance (i.e., the number of citations) specifically for publications exclusively focused on SDG5.

**Table 4. Coefficient table for OLS regression results**

SDG5 Related Publications						
Term	Coefficient	Std Err	t-value	P> t	[0.025	0.975]
const	0.1805	0.014	13.128	0	0.153	0.207
gender (female)	-0.0238	0.024	-0.975	0.33	-0.072	0.024
SDG5 Exclusive Publications						
Term	Coefficient	Std Err	t-value	P> t	[0.025	0.975]
const	0.2188	0.027	8.186	0	0.166	0.271
gender (female)	-0.0994	0.048	-2.088	0.04	-0.193	-0.01

## 4. Discussion

While a growing number of gender equality initiatives have been made in practice, little is known about the progress in IS academia – an essential arena influencing real-world practice, policy formulations, organizational decisions, and individual behaviors. Indeed, enhancing the use of ICTs to promote the empowerment of women is a key objective of gender equality goal (SDG5). Through a bibliometric analysis of 37,083 publications collected from Scopus in 2023, we depicted the overall engagement on SDG5 topics within the IS discipline, noting a relatively low level of attention by IS scholars. Adopting a gender perspective, we also identified significant gender differences in both scientific activeness and performance. Specifically, while female scholars tend to publish more on SDG5 topics, their studies generally exert less impact on the academic community compared to those of their male counterparts.

Our study is unique in that we use a bibliometric study method and deploy a large dataset across multiple regions to describe the present status of SDG5 studies in the IS field. We hope our work echoes Leong et al. (2020)'s call for more policy-driven studies in narrowing the gaps between academics and policy makers, and the work of our community can be presented in a better light beyond the confines of our academic discipline. In specific, we add to Leong et al. (2020) that SDG studies, especially SDG5 studies, remain less attractive in the IS community especially to men. Moreover, through a uniquely trained machine learning model to help us identify scholars' gender by name, we find that though female scientists tend to devote themselves to SDG5 studies, their effort is less recognized in the academic community.

This research further provides an in-depth analysis of gender differences in the scientific activeness and impact in SDG5 studies within the IS academic sphere. Previous studies have suggested that women can play a pivotal role in the progress and sustainability of the world if they are empowered through education and employment opportunities in science, technology, innovation and through changing the social stereotypes that restrain them in certain workplaces (Fathima et al.,

2020). However, in our study, we found that while females are more likely to publish in gender equality and female empowerment topics, their effort is less recognized by the academic society. Our finding reveals a crucial phenomenon that though women in academia are keen in alleviating gender discrimination and improving social conditions in treating the female group, the actual impact is far less satisfying.

More importantly, we hope to inform policymakers with this study. By scrutinizing the progress of SDG5, our research will inform the refinement of policies to better reflect the changing landscape of gender equality as we approach the target year of 2030. This assessment allows for necessary adaptations and adjustments to be made, ensuring that policies are more effectively aligned with the evolving dynamics of gender equality.

First, despite the variation in disciplines and their research focus, we found a relatively low level of engagement in SDG5 studies especially in the IS area. However, it is also quite promising that the involvement is gradually increasing in the IS community. Considering the interdisciplinary nature of our field and the impact we can possibly make, we call for more studies that help promote the UN's SDG5 goals.

Second, though policies in research systems to empower female scientists have been increasingly formulated, adopted and executed to alleviate the "productivity gap" of women, the scientific debate over the role of women in the academic system may potentially contribute to broader problems such as gender discrimination and internalized sexism. Women scientists receive less recognition for their scientific contributions (Ross et al., 2022), and even for gender equality topics, women scientists also exert less impact compared to their male counterparts. We call for more inclusive programs and policies in the academic institutions to support the gender and other diversity members. In the IS area, new technology adoption may offer a potentially powerful solution in empowering female scholars from internalized sexism and reducing gender discrimination.

Third, increasing knowledge sharing and transfer among different groups may help promote both SDG studies and the academic impact. Knowledge sharing is found to be critical in effectively creating a collective community and alleviating inequality among social groups (Qureshi et al., 2018). We call for more inclusive programs in establishing a common ground for open discussion and promoting interactions and communications across different genders, ethnic groups, and other minorities. A deeper understanding towards vulnerable populations in academia may effectively bridge the gender gap and help achieve the gender equality goal.

Fourth, the research society can benefit from social media by enhancing the impact of academic studies through social platforms and others. Social media is found to be a powerful tool in promoting digital activism and sustaining movement continuity (Leong et al., 2019). For SDG studies, scholars can leverage social media in amplifying the impact not only within the academic community but also the general public.

Last but not least, social and cultural biases are also incorporated from within: women are more or less inevitably affected by internal factors (e.g., self-expectations) that constrain their performance and impact. For example, Konrad & Cannings (1997) has found that gender difference in salary is partially due to the multiple roles women assume – wife, mother and caretaker – that affect their professionalism. Therefore, policies and interventions that help reduce internalized discrimination are also of great importance to alleviate gender inequality and promote SDG5 in the society.

## 5. Limitations and future directions

Our study is not without its limitations. First, we only focus on gender equality (SDG5) as our main research topic. Among all SDG goals, IS discipline is directly or indirectly related to not only SDG5 but others including the use of ICT, information access, and technology development. We call for future research in expanding our research scope to other IS SDG topics and discovering the current status of such studies to promote both our field and the UN sustainable goals.

Second, we only extracted publications in 2023 of the United States, the United Kingdom, and Hong Kong from Elsevier's Scopus and SciVal database as a demonstrating sample for our bibliometric study. A larger sample from multiple data sources can provide greater detailed descriptions and landscape of current SDG5 studies in the IS area. In addition, longitudinal study with a longer time spectrum will display the evolution and dynamic of SDG studies.

Third, due to lack of gender information in the publication database, we trained and used a machine learning model to predict authors' gender using their full names. Predicting gender by name has been widely used in scientific research for decades (Cassidy et al., 1999), but it is still with limitations. Future research may seek gender information from researchers' personal webpage or other sources to alleviate the potential mis-prediction by name.

Fourth, our study provides a descriptive overview of the current state of SDG5 research in the IS field, along with a comparative analysis of how gender influences both the drivers and the impacts of these studies. Future research may further this study by integrating theories and synthesizing existing works to



comprehensively study how we, as IS researchers, may further our field with greater impact to both academia and policy.

Last but not least, we only focus on SDG studies in the IS fields and our findings may fall short in the generalizability to other disciplines. In fact, some disciplines, though suffering from female under-representativeness, may share even less interest in gender equality studies than IS. However, this phenomenon does not diminish the importance, if not strengthening, of the promotion of SDG studies. We call for future research in conducting comparative studies across various disciplines to shed more light on this issue.

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