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A REVIEW OF GENDER RESEARCH IN INFORMATION SYSTEMS: FROM BIBLIOMETRIC ANALYSIS TO FUTURE RESEARCH DIRECTIONS

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ABSTRACT
Despite the rising attention to gender research in the information systems (IS) area, research papers about gender and IS are still relatively rare in the Basket of Eight journals. Moreover, while previous research has provided critical insights into the methods and theories of gender research, there is no bibliometric review available that clarifies the evolution and structure of the field. This paper aims not only to reveal the body of knowledge, impact, and evolution of gender research in the Basket of Eight, but also to suggest potential future research avenues for IS researchers in the field. This study applies the bibliometric technique to analyze the current literature of gender-related studies in the Basket of Eight journals published from 1980 to 2022.

KEYWORDS
Gender research, literature review, bibliometric analysis, VOSviewer, future directions

INTRODUCTION
In recent years, the importance on gender studies in Information Systems (IS) has been growing. However, the number of gender research papers published in the Basket of Eight journals is still relatively low compared to other mainstream IS topics (Gorbacheva, 2013). Especially in the acknowledged leading journals in the IS field, namely the Basket of Eight journals, which are recognized as the top journals in IS by the College of Senior Scholars. The Basket includes the European Journal of Information Systems (EJIS), Information Systems Journal (ISJ), Information Systems Research (ISR), Journal of the Association of Information Systems (JAIS), Journal of Information Technology (JIT), Journal of Management Information Systems (JMIS), Journal of Strategic Information Systems (JSIS), and MIS Quarterly (MISQ). In this study, we will use the bibliometric analysis in an investigation to get a comprehensive understanding of these phenomena in the Basket of Eight and estimate how gender research in IS evolved over the years. Getting a complete picture of the Basket of Eight journals can help us to scrutinize selected topics and shed light on the development of gender research holistically through bibliometric analyses. The results will highlight the unreinforced research aspects of gender research within the Basket of Eight and further guide scholars on the future research directions.

Bibliometric analysis is a method that uses statistical and mathematical methods to analyze the literature of a target field and provide quantitative analysis of investigations on patterns in its bibliographies (De Bellis, 2009). Many researchers use this method to explore the impact of a field, set of researchers, or particular paper (Hajikhani, 2017). Our study complements the rich body of existing literature reviews by introducing this novel method to assess the impact and evolution of gender research within the IS literature in particular. The objective of this paper is to systematically analyze the features of the gender studies and assist scholars in gaining a clear pathway about the importance and potential impact of emerging research directions.

This paper is part of an effort to assess gender research in IS through bibliometric analysis using VOSviewer. This software visualizes the bibliometric citation, co-citation, co-authorship, and co-occurrence maps, which help us examine the current state of publications on gender-related topics and identify emerging lines of gender research. The study selected the acknowledged leading journals in the IS field, the Senior Scholars Basket of Eight journals, which can provide meaningful insights for researchers to address the importance associated with gender research in IS. The development of research profiles can be a reliable resource to assist academics in deeply understanding their research and literature review and help practitioners to identify the experts and obtain the knowledge (Gerdts, Kongthon, & Vatananan, 2013).

This paper is organized according to the following sections. First a literature review that briefly introduces the current state of gender research in IS is presented. Then, the study design methodology and collected data are described, followed by the bibliometric analysis. Next, a detailed discussion of the analysis results and future directions are presented. Finally, we discuss conclusions.
RELATED LITERATURE

This section will briefly introduce the related literature of gender research in IS. Studies that have looked at gender within IS agree that the topic has received inadequate attention (Adam, Howcroft, & Richardson, 2004; Ahuja, 2002; Gorbacheva, 2013; Kvasny, Greenhill, & Trauth, 2005; Trauth, 2011, 2013). Further exacerbating the exclusion of gender related research studies in IS is a lack of gender and IS research citations, which leads to the prevention of such research becoming mainstream. Moreover, several IS journals in the Basket of Eight have no papers with gender as a core focus of the study (Gorbacheva, 2013).

The problem of gender bias in the ICT field is recognized by the majority of publications and was done continuously throughout all time. The theorization of gender was primarily considered in relation to technology acceptance models and IT adoption (Venkatsh, Thong, & Xu, 2012). As a part of STEM (Science, Technology, Engineering, and Mathematics) fields, the IS area still exists the acute problem of underrepresenting women scholars (Gorbacheva, 2013). Gender balance in IS has slightly improved in recent years; however, IS women scholars are still a significant minority in the U.S., constituting under 30% of the total number of IS academics (M. Gallivan & Ahuja, 2015). Meanwhile, prominent IS scholars have argued that gender research has not been a significant focus in mainstream IS research (Trauth, 2013). Women scholars face a series of obstacles not only arising from research productions but also from professional promotions. Promotions are highly influenced by scientific productivity. However, the research on gender imbalance in IS academia regarding publishing, citation patterns, perceived quality of work and academia career persistence and promotion is much more limited (Masiero & Aaltonen, 2020).

METHODOLOGY

A bibliometric approach was employed for this study to analyze research papers on the topic of gender in IS area. The bibliometric approach is applied to define general productivity in a specific research field and evaluate the productivity of individual researchers, journals, countries or any other levels of performance (Andrès, 2009). It gives a retrospective view of the published literature that evaluates academic contributions in a research field. Moreover, the bibliometric analysis identifies research trends and patterns based on the topics, keywords, and sub-fields of a scientific domain (McBurney & Novak, 2002). In this study, other analyses are employed within the data sources, the networks of authors and their citations, co-citations, co-authors, and co-occurrence of keywords.

This paper is a 42-year retrospective literature review of research papers on the topic of gender within the IS field, spanning the period from 1980 to 2022. In this paper, the core database of Scopus was selected as the data source. Scopus is one of the most utilized scientific online databases in the world and yields a broader range of coverage and identification of citable articles than the Web of Science (Cavacini, 2015; Gerdsri et al., 2013). Thus, this study uses the data sets from Scopus to conduct the analysis.

The search outlets consist of the IS Basket of Eight journals and the search was conducted in May 2022. Next, we selected the keywords that best represent gender-related research. Thus, several iterations of searches using different combinations of keywords were conducted. The following keywords include: gender, sex, wom?n, female, femin*, m?n, male, masculine*. The wildcard search term wom?n stands for woman or women, and femin* stands for such as feminine, femininity, feminism, feminist, feminization etc. (Gorbacheva, 2013). Similarly, a search using masculinity-related terms, such as men, man, male, masculine, masculinity etc. was also conducted.

The search followed the criteria mentioned previously and performed two rounds of screening and reviewing. The first round of searching yielded 1971 articles in Basket of Eight. This round included all articles that have a gender-related keyword(s). Next, after screening and reviewing the titles and abstracts, 125 articles remained. The papers without addressing the topic of gender or not relevant to gender research were excluded. For example, articles that only mentioned gender in their titles or abstracts, but did not fully explore it within the paper, were dropped.

RESULTS

This study used Version 1.6.17 of VOSviewer to create and visualize the bibliometric maps based on the online dataset. This technique examined and viewed the citation relations between publications and journals, collaboration relations between researchers, and co-occurrence relations between scientific terms (N. Van Eck & Waltman, 2010). This study applies this software to analyze the bibliometric maps and provide an overview of the state of art of the gender-related studies in IS. To clearly elaborate the visualizations, the results are shown in tables.

Before analyzing the data sets, it is necessary to understand the terminology used by the software: the items in maps are authors, publications, organizations, or terms etc. A link is connected to different items, which is a connection or a relation between two items. In this study, the links are bibliographic coupling links between publications, co-citation links between references and source articles, and co-occurrence links between terms. Each link has a strength that can indicate the number of
cited references two publications have in common. A network is constituted by a set of items together with the links between the items and items also could be grouped into clusters. In the network visualization, the weight of the item is represented by the size of the label and the circle of this item. The item with a higher weight has a larger size of label and circle. Various colors depict the different clusters the items belong to (N. J. Van Eck & Waltman, 2013). The following sections describe four different types of analysis: citation, co-citation, keywords, and co-authorship.

Citation Analysis

A citation analysis identifies the most cited and prominent publications, which have a more significant influence on a specific research topic than other publications that are cited less often (Sánchez-Teba, Benítez-Márquez, & Porras-Alcalá, 2020). Given the results from VOSviewer, the article named “Women in the Information Technology Profession: A Literature Review, Synthesis and Research Agenda” is the seventh most-cited article with 559 citations. The importance of this article lies in the fact that it highlighted the effects of the imbalance on women in the IT profession and encouraged more researcher on the topic. As Table 1 represents, all of top five most cited articles focus on the research direction of gender equity in IT. Additionally, the results reinforce the fact that gender and ICT research were discussed for the most period of time and had much more impact than gender studies on diversity and inclusion. Although the largest set of connected citations includes the citations on social diversity, further research about this topic is still needed with more attention compared to the ICT and gender research direction.

<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Journal</th>
<th>Year</th>
<th># Cites</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Gefen, D., &amp; Straub, D. W. (Gefen &amp; Straub, 1997)</td>
<td>Gender Differences in the Perception and Use of E-mail</td>
<td>MISQ</td>
<td>1997</td>
<td>1,360</td>
</tr>
</tbody>
</table>

MISQ = Management Information Systems Quarterly

Table 1. Five Most Cited Articles

Co-Citation Analysis

Another important way to gain insights into the impacts of the most important gender research articles among others is co-citation analyses. A co-citation analysis is a bibliometric analysis to analyze the “self-organized” streams of research and theory that underlie a field of study as it evolves over time (White & McCain, 1998). It defines the frequency with which pairs of documents are cited together (Sánchez-Teba et al., 2020) and assumes the authors share a theoretical or empirical similarity (Zupic & Cater, 2015). Whereas citation analysis highlights the influential authors, co-citation analysis sheds lights on the important sources of theoretical influence on the direction of the underlying knowledge base on which a field is grounded (Aung & Hallinger, 2022).

Regarding the bibliometric map of cited references, it can help researchers identify the most important scientific articles based on their connections among others (Sánchez-Teba et al., 2020). Given the results from VOSviewer, along with the list of top five co-cited articles shown in Table 2, we conclude that the majority of articles have cited the papers about the IT acceptance model. This research topic has evolved for an extended period and is still interesting to many researchers in the field.
Keyword Analysis

Building upon the co-occurrence of keywords, keyword maps produced for constructing a network that represents the conceptual space and development of a research domain (Zupic & Čater, 2015). The keyword analysis shows the distribution and relationship between the most frequently used keywords in the studies from the second round. Keywords co-occur if they emerge in the same context. The distance between the two keywords is proportional to how strongly these two keywords are related to each other (Su & Lee, 2010; N. J. Van Eck & Waltman, 2011; Zupic & Čater, 2015).

To visualize the evolution of major keyword clusters while also displaying emerging topics, we considered all keywords that were mentioned at least five times in publications. Therefore, 20 of the total 1,013 keywords are included. Table 3 shows the ranking of the five most frequently used keywords in IS gender studies. Although “gender” is the largest cluster of keywords map, the sub-topics of “gender” such as “decision making”, “knowledge management” and “internet” are indirectly relevant to social diversity and social inclusion.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Keyword</th>
<th># Number of Times Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gender</td>
<td>27</td>
</tr>
<tr>
<td>2</td>
<td>Information systems</td>
<td>26</td>
</tr>
<tr>
<td>3</td>
<td>Information technology</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>Social networking (online)</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>Gender differences</td>
<td>9</td>
</tr>
</tbody>
</table>

Table 3. Five Most Frequently Used Keywords

Co-Authorship Analysis

In scientific research, co-authorship is the most formal indication of intellectual collaboration, which involves two or more authors achieving a greater quality or quantity of scientific output (Hudson, 1996). Given the results from VOSviewer, the largest set of co-authors and one of the top five most productive co-author is Ahuja M.K.. This author leads the gender studies on diversity and inclusion in IT. As discussed previously, the articles with two or more authors seem to have a more significant impact, and co-authorship represents an opportunity for a researcher to signal her or his value to others (Collins & Steffen-Fluhr, 2019). Therefore, it is necessary to encourage more collaborations between authors from different directions of gender studies in IS.

<table>
<thead>
<tr>
<th>Author</th>
<th># Documents</th>
<th># Cites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venkatesh V.</td>
<td>7</td>
<td>7,982</td>
</tr>
<tr>
<td>Trauth E.M.</td>
<td>4</td>
<td>452</td>
</tr>
<tr>
<td>Ahuja M.K.</td>
<td>3</td>
<td>897</td>
</tr>
<tr>
<td>Boroudi J.J.</td>
<td>3</td>
<td>320</td>
</tr>
<tr>
<td>Igbaria M.</td>
<td>3</td>
<td>472</td>
</tr>
</tbody>
</table>

Table 4. Five Most Productive Co-authors

DISCUSSION AND CONTRIBUTION

This bibliometric analysis sought to explore the hidden research patterns and structural roots of gender studies in IS. Our bibliometric analysis shows that gender research is a continuously growing field. In relation to prior reviews of gender research
in IS, two critical research categories were identified as pillars of this emerging literature: gender difference in IT adoption and social diversity in IT.

Combined with the analysis results and the reviewed articles, we can conclude that the studies of gender in IS mainly fall into three categories and examine the research problems from two perspectives. One research perspective evaluates the correlation between the gender and the Information Technology (IT) users’ acceptance and IT-related behavior. This can be demonstrated in the co-occurrence network, “gender” has strong connections with “information technology”, “social networking”, and “information technology”. Within the connections of “social networking”, “technology acceptance” is one of the most frequently used keywords. Moreover, in co-citation analysis, several clusters of authors have published and cited works on this research topic direction. In this context of research, gender is used as an explanatory variable to investigate the existing theoretical models (TAM, UTAUT) and technology acceptance and use, attitudes towards technology.

Another research direction focuses on social diversity and social inclusion, which gains less attention compared to other mainstream IS research topics. In this research area, there are two sub-categories. One category of studies focuses on the underrepresentation of women in IT profession. Studies in this category mainly examine the causes and consequences of gender imbalance in the IT industry, and interventions to address gender imbalance (Masiero & Aaltonen, 2020). However, drawn on the results of the citation and co-citation networks, no studies of top five most cited or co-cited articles are in this research area (Table 1 & Table 2). Another category of studies concern about forms of gender imbalance and diversity policies in IS academia (M. Gallivan & Ahuja, 2015; M. J. Gallivan & Benbunan-Fich, 2007; Gupta, Loiacono, Dutchak, & Thatcher, 2019). The related keywords of the studies in this category are not shown in the keyword network analysis, which represents the lack of efforts on the development of this area.

Based on the analysis results, numerous studies on gender investigate the gender differences in IT behaviors and technology uses. Still, less studies take a comprehensive view of gender diversity and inclusion in IT industry and IS academia. IT usage and adoption are still predominant in IS area, and the bibliometric maps illustrate the long-lasting impact of these study directions in gender research. As influential scholars can signal their impacts to others, scholars who are interested in gender diversity can seek opportunities to cooperate with researchers in the center cluster and expand the influence of this research direction. Moreover, there is a positive trend in that the number of publications has increased in recent periods, but these studies mostly consider gender diversity building upon demographic differences.

In conclusion, the literature review on gender research in the IS Basket of Eight has revealed a diverse body of work. However, there is a need for more in-depth studies that examine the intersectionality of gender with other factors. Researchers can investigate gender from a demographic perspective and in conjunction with socio-cultural, individual differences, and other issues such as race, ethnicity, class etc. (Trauth, Quesenberry, & Huang, 2006; Trauth, Quesenberry, & Morgan, 2004). Secondly, while we have tried to encompass a broad number of studies, it would be beneficial to conduct comparative studies that examine gender differences across different cultures and regions and consider external factors such as technological developments and cultural changes. Finally, while there are no apparent patterns of research in the Basket of Eight on IS academia inclusion and diversity shown in bibliometric maps, it is important to acknowledge that this limited scope may not fully represent the full body of gender research in IS. Thus, we suggest encouraging future research and theorizing along with this dimension of gender research in IS by taking a more holistic approach.

Our paper makes several contributions. First, this comprehensive overview helps to understand better trends and the role and importance of gender research in the IS Basket of Eight journals. Second, we derive research findings based on the bibliometric analysis. The findings provide valuable guidance for researchers and practitioners looking to promote gender diversity and equity in IS. Finally, we provide a clear pathway forward for further gender research in IS. It can potentially inform the development of more effective strategies for promoting gender diversity and equity in the study and practice of IS.

ACKNOWLEDGMENTS

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