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Tracking trends and gaps: A bibliometric review of ICT's role on uplifting women farmers

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Abstract

Information and Communication Technology (ICT) has emerged as transformative platform in addressing knowledge gap and enhancing women farmers decision-making ability in agriculture. This study employs bibliometric analysis to map the research landscape of ICT-enabled uplifting of women farmers in agriculture, analysing 257 publications from the Web of Science database (2001-2025). The findings reveal a significant surge in scholarly interest post-2015(in India?), driven by the proliferation of mobile technologies, digital advisories, and government initiatives like India's *Kisan Suvidha* and *eNAM*. Key themes include ICT's role in improving productivity (20-30%), financial inclusion, and decision-making autonomy. The United States, India, and Kenya dominate research output, though geographic gaps persist in Latin America and parts of Africa. Institutional collaborations, led by CGIAR and IFPRI, highlight interdisciplinary efforts bridging agronomy, gender studies, and digital development. Co-citation analysis identifies *Food Policy* and *Agriculture and Human Values* as central journals, while influential works by Quisumbing, Malapit, and Akter underscore the focus on gendered impacts of ICT. Thematic evolution reflects a shift from climate-smart agriculture to empowerment, migration, and intersectionality. Despite progress, challenges like digital literacy, infrastructural barriers, and socio-cultural constraints remain. The study advocates for inclusive policies, South-South research collaborations, and context-specific ICT solutions to maximize women's agricultural empowerment. By synthesizing trends and gaps, this paper provides a roadmap for policymakers and researchers to harness ICT's potential in achieving equitable rural transformation.

Keywords: ICT, women, empowerment, agriculture, mobile applications

1. Introduction

Information and Communication Technology (ICT) has revolutionized global agriculture, empowering women farmers who have traditionally faced systemic barriers such as limited access to land, credit, and extension services (World Bank, 2014) [22]. In developing countries, including India, ICT has emerged as a key enabler in bridging gender disparities in agriculture. Initially, tools like community radio and television disseminated basic agricultural knowledge to rural women farmers (Aker, 2011) [2]. However, with the rapid penetration of mobile phones, women farmers gained real-time access to weather forecasts, market prices, and modern farming techniques (GSMA, 2021) [7].

In India, where women constitute nearly 75% of the agricultural workforce yet own only 13% of farmland (FAO, 2019) [4], ICT has been transformative. Government initiatives like Kisan Call Centres (KCC**)** and eNAM (National Agricultural Market) have provided women with crucial agri-advisories and market linkages (Meinzen-Dick *et al*., 2019) [13]. Mobile apps such as Kisan Suvidha and WhatsApp-based advisory groups have further democratized access to information, helping women farmers optimize crop yields and reduce post-harvest losses (Qaim, 2020) [18]. Studies indicate that ICT adoption has improved women farmers agricultural productivity by 20-30% while enhancing their financial inclusion through digital payment systems like direct benefit transfer (DBT) (Trendov *et al*., 2019) [21].

While digital interventions have emerged as pivotal tools for empowering women farmers and transforming rural agriculture, existing research remains fragmented, with most studies focusing on isolated aspects such as mobile advisories or financial inclusion (Zupic & Čater, 2015) [24]. A comprehensive assessment of how ICT collectively enhances women's agricultural productivity, decision-making autonomy, and market access, particularly in the Indian context is notably absent. This gap obscures the synergistic potential of technologies like AI, IoT, and digital platforms in addressing systemic gender disparities in agriculture (Meinzen-Dick *et al*., 2019) [13]. To bridge this gap, the present study employs bibliometric analysis to map the research landscape, identify thematic clusters, and trace the evolution of ICT's role in women's agricultural empowerment (Donthu *et al*., 2021) [3]. By systematically analysing scholarly outputs, this study aims to uncover trends, key contributors, and underexplored areas—such as the scalability of grassroots digital initiatives or the

intersection of gender, policy, and technology. The findings will provide actionable insights for policymakers to design inclusive digital agriculture strategies and guide future research toward high-impact interventions.

2. Methodology

A systematic review was conducted by the authors as outlined by Kraus *et al*. (2021) [8] to accomplish the purpose of finding the impact of ICT on upliftment of women farmers. Three broad steps used in this process were (1) preparing the review, (2) carrying out the review, and (3) reporting the review. Section 4 (results) presents the final step. The authors followed Kumar, Kar, and Ilavarasan (2021) and Kushwaha, Kar, and Dwivedi (2021) to structure the analysis.

Method of analysis

Different methods and procedures were used to carry out the study. We used scientific mapping tools for bibliometric analysis. We selected VOSviewer and Biblioshiny as our analysis tools. The reason for this was that VOSviewer has better visualization in network and cluster analysis, and Biblioshiny is better in literature timeline analysis. A combination of these two tools can better achieve our research goals.

Preparing the Review

The study's selection criteria were included into a literature review process. The online Web of Science (WoS) database was used to gather and synthesize pertinent publications (data) for this investigation. The WoS is a web-based platform that was developed in 1960s and is owned by the Clarivate analytics firm (Kraus *et al*., 2021) [8]. WoS, which comprises the three ISI citation databases (Arts & Humanities Citation Index, Science Citation Index, and Social Sciences Citation Index), has been the standard tool for a significant portion of citation studies worldwide (Meho & Yang, 2007) [12]. The WoS consists of more than 12,000 live journals, 23 million patents, 148,000 congressional proceedings, and more than 40 million, and 760 million, sources of cited references (Sanchez, Rama, de la, & García, 2017). It offers a thorough overview of global scientific output (Mongeon & Paul-Hus, 2016) [14].

Carrying out the Review

We started by retrieving articles that had the term "digital intervention" along with related keywords. The query command for was TS (Topic Tag for Search (Yang *et al*., 2023) [23]) = “Women in Agriculture” OR “Impact of ICT” OR “Women Empowerment” AND “Awareness” AND “Perception”. A total of 4726 publications were retrieved. After the second step only 4354 articles were left as the publications were refined by fixing the time period from 2000 up to 2025. In the 3rd step only 2073 articles were left after refining them to open access research articles only. In the fourth step, for making the focus of the articles purely into the desired subject area they were further refined to 268 articles by selecting the WoS categories with agriculture multidisciplinary, agronomy, horticulture and communication. In the last and final step, the articles were again refined to only English language, helped in finalising 257 articles for this study purpose. The data retrieval took place on May 19, 2025.

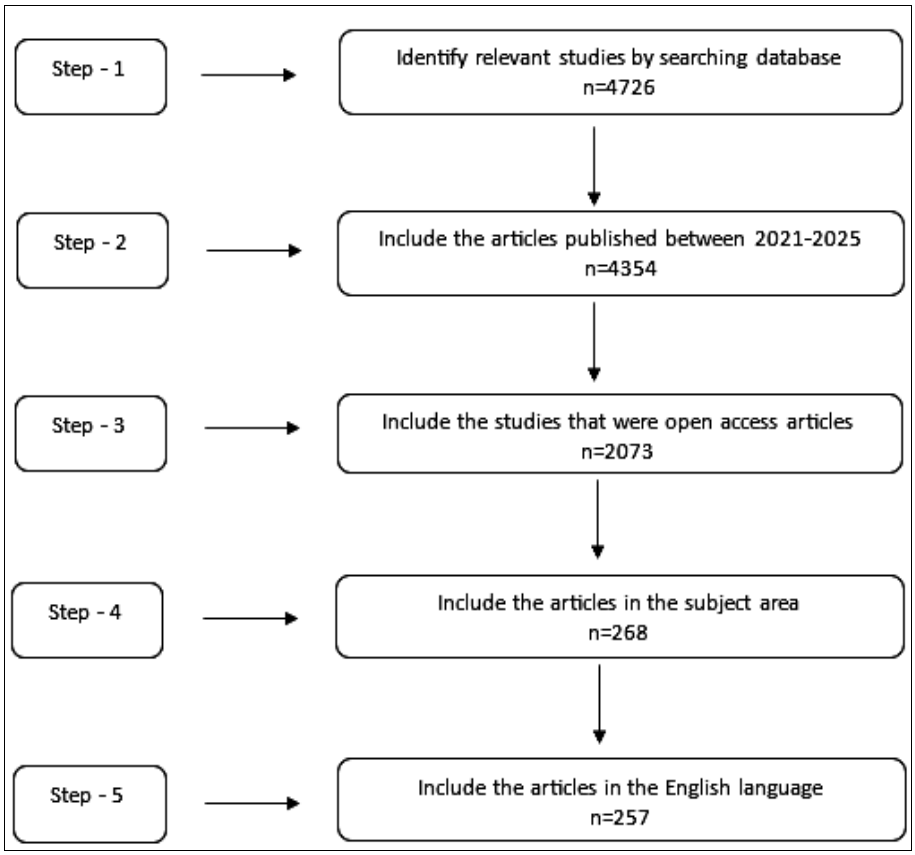

Fig 1: The data selection process

Method of Analysis

Different methods and procedures were used to carry out the study. We used scientific mapping tools for bibliometric analysis. We selected VOSviewer and Biblioshiny as our analysis tools as VOSviewer has better visualization in network and cluster analysis, and Biblioshiny is better in literature timeline analysis. A combination of these two tools can better achieve our research goals.

Table 1: Summary of articles resulting from the searches

Description	Results
Timespan	2001:2025
Sources (Journals, Books, etc)	76
Documents	257
Average citations per doc	17.6
Keywords Plus (ID)	704
Author's Keywords (DE)	944
Authors	1057
Authors of single-authored docs	23
Single-authored docs	23
Co-Authors per Doc	4.5
International co-authorships%	51.36

3. Results

Overall trends in publications and citations

Figure 2 illustrates the temporal distribution of scholarly publications and citations from 2001 to 2025 on the theme of Information and Communication Technology (ICT) in empowering women in agriculture and fostering livelihood transformation. The period from 2001 to 2014 exhibited negligible academic engagement, with fewer than two articles published per year and minimal citation activity. A noticeable shift began in 2015, marking the emergence of the topic within mainstream research, as evidenced by 11 publications and a sharp increase in citations (n = 672). From 2016 to 2020, there was a steady increase in both publication volume and academic attention, with annual articles ranging from 8 to 21 and citations peaking in 2017 (n = 757) and 2019 (n = 745). This trend underscores growing scholarly interest in the transformative potential of ICT tools such as mobile advisory services, digital literacy, and market linkages for women farmers. A phase of rapid growth began in 2021, with annual publications exceeding 30 and reaching a peak of 50 in 2024, suggesting an intensified research focus on digital inclusion and gender-responsive innovation in agriculture. However, a contrasting decline in citations post-2020, dropping to just 3 by 2025, may reflect the recency of published work, the time lag for citation accrual, or a maturing discourse. Overall, the data indicate a dynamic and expanding body of literature emphasizing the critical role of ICT in empowering women and enhancing agrarian livelihoods globally.

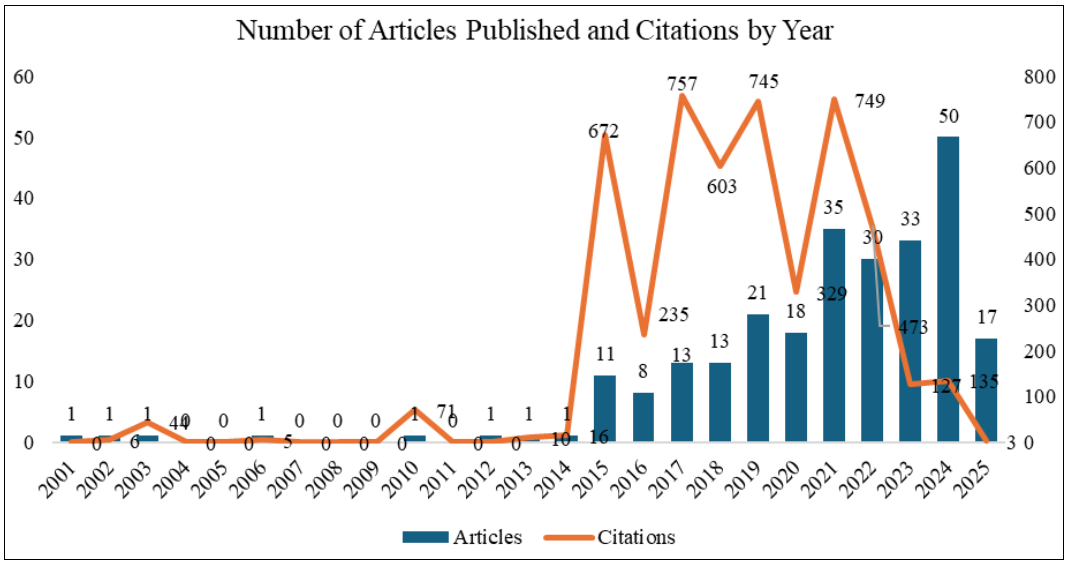

Fig 2: Total publications and citations from 2001 to 2025

Country distribution

In terms of geographical distribution, the majority of research on the role of ICT in empowering women in agriculture and facilitating livelihood transformation originates from high-income and emerging economies. The United States leads significantly with 57 publications, accounting for 22.18% of the total output. India ranks second with 16 publications (6.23%), reflecting growing academic engagement from the Global South, particularly in contexts where digital interventions intersect with gender and agrarian development. Other prominent contributors include Germany (14; 5.06%), Australia (13; 5.06%), and the United Kingdom (12; 4.67%). Notably, Kenya, a key country in sub-Saharan Africa, features prominently with 11 publications (4.28%), highlighting the relevance of ICT-based gender interventions in African agricultural systems. Countries like the Netherlands (3.50%), Canada (3.11%), China (3.11%), and Spain (3.11%) also demonstrate active scholarly participation. This distribution indicates a relatively diverse global interest, though with clear leadership from a few countries, suggesting the need for broader regional engagement, especially from underrepresented agricultural economies in Asia, Africa, and Latin America.

Table 2: Top 10 Publication Countries/Regions (N=257)

Countries	Publication Frequency (Percentage)
USA	57 (22.18%)
INDIA	16 (6.23%)
AUSTRALIA	13 (5.06%)
GERMANY	14 (5.06%)
UNITED KINGDOM	12 (4.67%)
KENYA	11 (4.28%)
NETHERLANDS	9 (3.50%)
CANADA	8 (3.11%)
CHINA	8 (3.11%)
SPAIN	8 (3.11%)

Institution distribution

Figure 3 highlights the most prolific institutional affiliations contributing to research on ICT-driven empowerment of women in agriculture. CGIAR stands out prominently as the leading contributor, with 103 articles, reflecting its central role in agricultural innovation, development policy, and digital transformation efforts across the Global South. The International Food Policy Research Institute (IFPRI) follows with 33 publications, underlining its strong emphasis on evidence-based policy for gender equity and rural development. Other notable institutions include Wageningen University and Research (21 articles) and CIRAD (20 articles), both recognized for their interdisciplinary research in sustainable agriculture and gender-inclusive innovation systems. The International Livestock Research Institute (ILRI) and University of Nairobi each contributed 15 and 13 articles, respectively, underscoring Africa's growing scholarly engagement in this domain. Academic institutions such as the University of California System (13), Cornell University (12), and Jumuiya (11) also feature among the key contributors. Collectively, this distribution demonstrates a blend of global research centres, regional universities, and international organizations driving the knowledge frontier on ICT-enabled agricultural empowerment for women, particularly in resource-constrained settings.

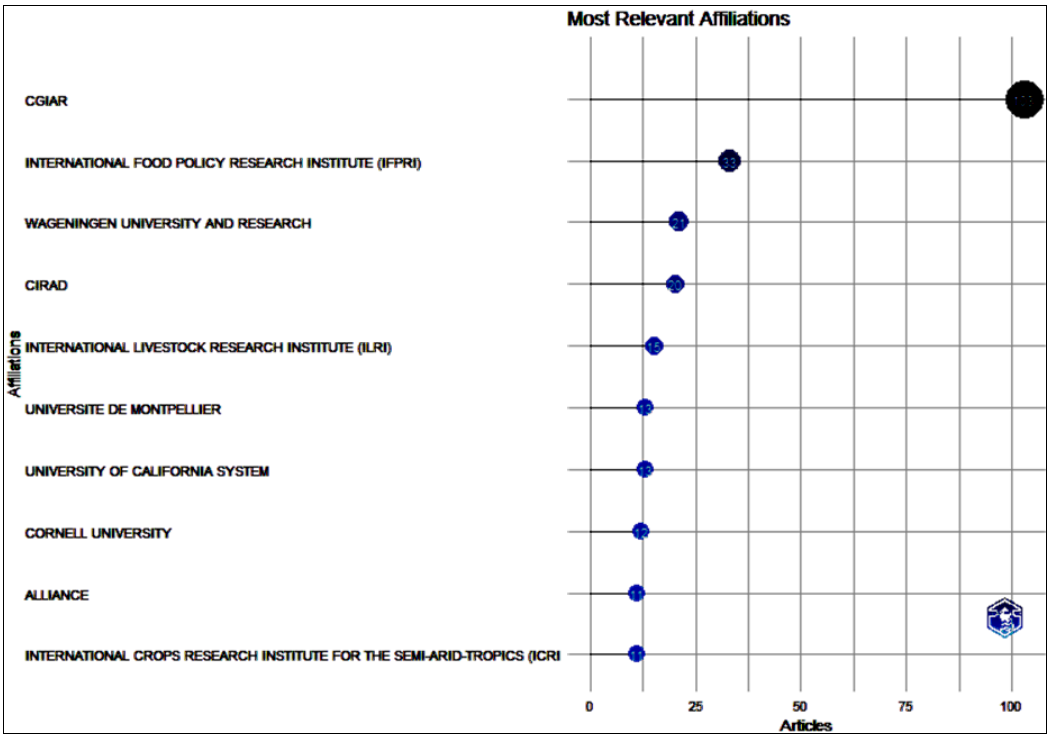

Fig 3: Top 10 publishing institutions

Co-authorship network

The Figure 4 illustrates the institutional co-authorship network on ICT's role in empowering women in agriculture and supporting livelihood transformation, generated using VOSviewer. The network map is derived from co-authored publications and depicts 24 institutions grouped into three distinct clusters, represented by different colours. The yellow cluster, prominently led by the International Food Policy Research Institute (IFPRI), appears as the central node with the highest number of connections, reflecting its pivotal role in global research collaboration. It shares strong linkages with key institutions such as the World Bank, International Livestock Research Institute, and University of Florida, indicating multi-dimensional research spanning policy, livestock, and regional studies.

The red cluster is characterized by dense collaboration among institutions such as Michigan State University, University of California Davis, Wageningen University, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), and International Institute of Tropical Agriculture (IITA). These entities show a high degree of intra-cluster cooperation, particularly in agronomic innovation, gender-inclusive digital extension, and participatory technology development.

The green cluster features strong European and African institutional ties, including University of Montpellier, Biodiversity Institute, and International Maize and Wheat Improvement Center (CIMMYT). This grouping reflects research collaboration focused on genetic resources, sustainable cropping systems, and biodiversity in ICT-

mediated agricultural frameworks. Overall, the visualization demonstrates that institutional collaboration in this field is both regionally grounded and globally connected, with core institutions like IFPRI, ICRISAT, and Bioversity International serving as hubs for knowledge co-creation. The emergence of these clusters underlines the interdisciplinary and international nature of research efforts aimed at leveraging ICT for gender empowerment and livelihood improvement in agriculture.

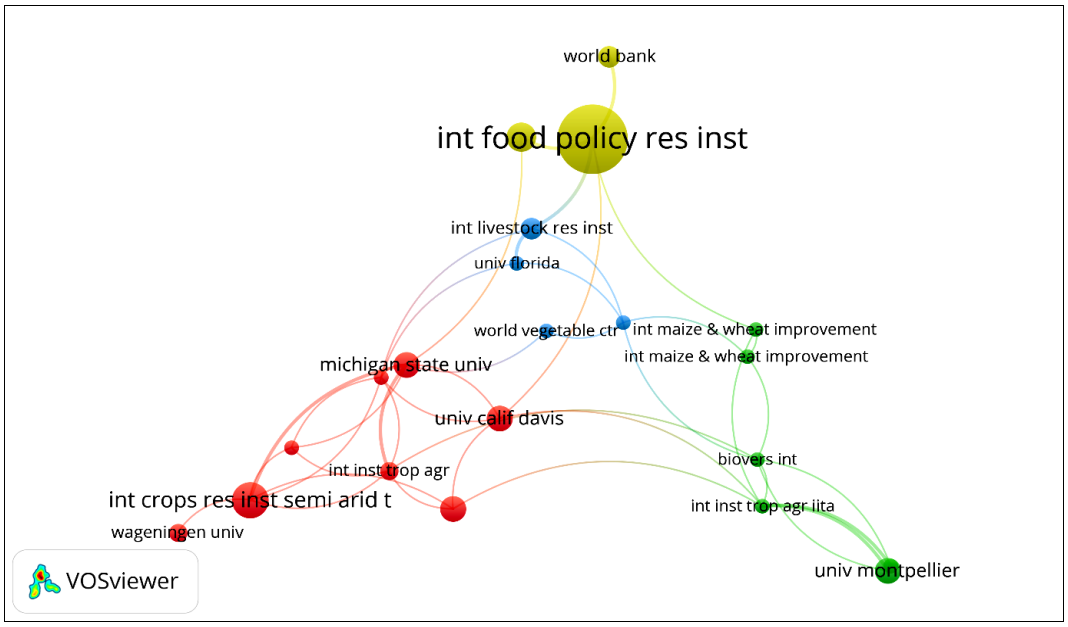

Fig 4: Top 10 publishing institutions

Highly contributively journals, authors, papers and citations

Top 10 journals

The analysis (Figure 5), derived from bibliometric mapping using the Bibliometrix package in R, is based on the number of documents published per source. Food Policy leads the chart with 28 documents, underscoring its prominence as a key outlet for research connecting agricultural development, policy analysis, and ICT-mediated interventions. It is followed by Agriculture and Human Values with 24 publications, indicating a significant scholarly interest in the ethical, cultural, and societal implications of agricultural innovations, particularly as they affect gender roles.

Other notable contributors include Agricultural Systems (14 documents), Agriculture-Basel, International Journal of Agricultural Sustainability, and SAGE Open, each with 13 publications, reflecting a multidisciplinary convergence around sustainable and inclusive farming practices. Journals such as Agricultural Economics (12), Cogent Food & Agriculture (10), and Applied Economic Perspectives and Policy (6) offer economic and policy perspectives, while Humanities & Social Sciences Communications (6) represents the social science lens. The diversity in sources demonstrates that the topic transcends disciplinary boundaries, incorporating development studies, agronomy, gender analysis, economics, and sustainability science.

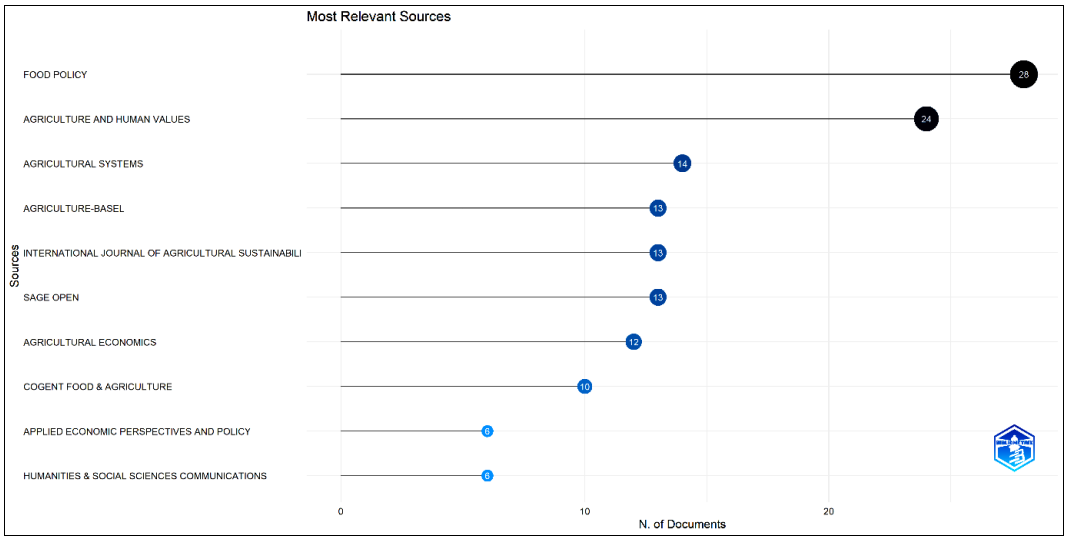

Fig 5: Top 10 publishing journals

The figure 6 presents the co-citation network of scholarly journals that frequently appear together in the reference lists of the publications analysed. This map was generated using VOSviewer and reflects the intellectual structure of the research field, particularly on topics intersecting agriculture, food systems, sustainability, and ICT interventions. Nodes represent journals, while the links between them indicate the frequency with which two journals were cited together. The size of each node corresponds to the number of co-citations, and the color clusters denote closely linked groups of journals with similar citation patterns.

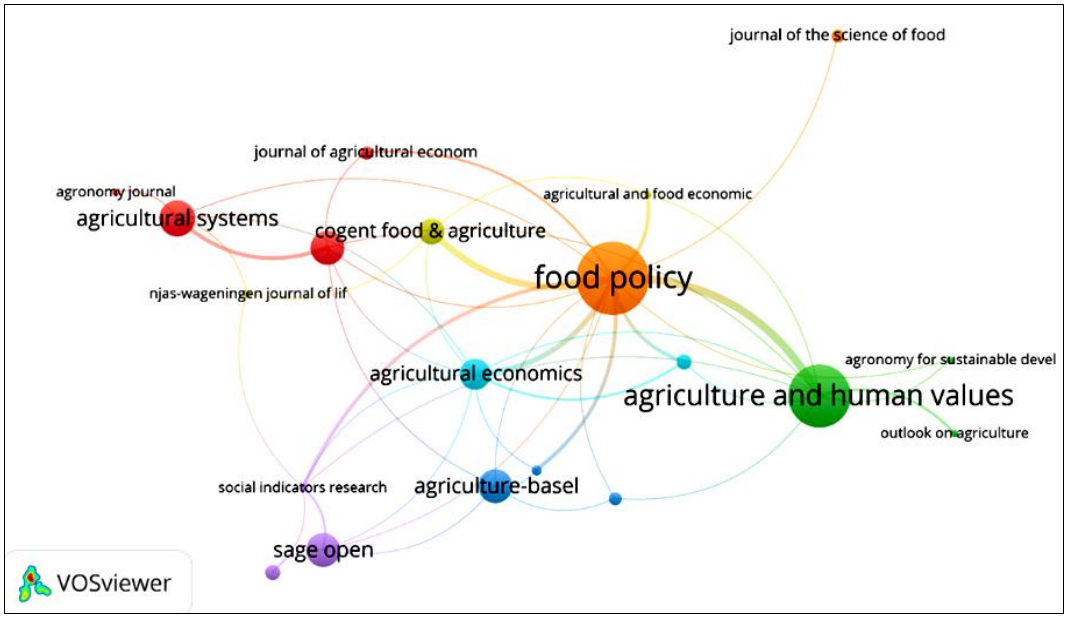

Fig 6: The co-citation network of journals

The journal Food Policy emerged as the most central and heavily co-cited source, indicating its foundational role in bridging research across agriculture, development, and policy analysis. Closely connected to Food Policy are Agriculture and Human Values, Agricultural Economics, Cogent Food & Agriculture, and Agricultural Systems, forming the core intellectual nexus of the field. The cluster around Agriculture and Human Values includes journals such as Outlook on Agriculture and Agronomy for Sustainable Development, suggesting a strong thematic overlap related to sustainability and ethical considerations in agricultural transformation. Another cohesive group is formed around Agriculture-Basel and Agricultural Economics, which are interconnected with journals like SAGE Open, Social Indicators Research, and Agronomy Journal, indicating contributions from the domains of open-access publishing, interdisciplinary metrics, and agronomic practices. This co-citation structure highlights the interdisciplinary nature of the research landscape, combining agronomy, economics, sustainability, and policy sciences. It also identifies the journals that serve as key nodes of knowledge exchange, reflecting the dominant epistemic communities contributing to the discourse on agriculture and development.

The author-level analysis (Table 3) revealed that *Quisumbing A* and *Quisumbing AR* emerged as the most influential contributors, jointly accounting for 11 publications with a high fractionalized score of 3.86, reflecting their substantial and consistent involvement in collaborative research on gender, agriculture, and food systems. Other prominent contributors included *Farnworth CR*, *Galiè A*, and *Raghunathan K*, each with four publications, though varying in fractional contributions, suggesting differing levels of authorship roles and engagement in multi-author studies. Authors such as *Baudron F*, *Bekunda M*, *Fisher M*, *Brown B*, and *Gupta S* also made significant contributions, each authoring three articles that span across institutional innovations, sustainable intensification, and socio-economic development in rural contexts. The diversity in fractionalized scores among the top authors indicates a highly collaborative research environment, characterized by interdisciplinary engagement across agricultural development, gender equity, and rural transformation themes. This author network also highlights the global nature of the research, bringing together voices from different continents and institutions to collectively address critical issues in agriculture and food systems.

Table 3: Top 10 authors

Authors	Articles	Articles fractionalized
Quisumbing A	6	1.65
Quisumbing AR	5	2.21
Farnworth CR	4	0.73
Galiè A	4	0.63
Raghunathan K	4	0.99
Baudron F	3	0.56
Bekunda M	3	0.33
Brown B	3	0.41
Fisher M	3	0.70
Gupta S	3	0.71

The citation analysis of the top 10 most influential articles highlights foundational contributions in the domain of ICT-mediated agricultural transformation and women's empowerment. The most cited article is Malapit and

Quisumbing (2015) [11], published in Food Policy, with 246 citations, underscoring its pivotal role in shaping gender-responsive agricultural frameworks. This is followed by Akter *et al*. (2017) and Palacios-Lopez (2017) [16], also in Food Policy, with 215 and 173 citations respectively, demonstrating the journal's critical position in disseminating evidence on digital inclusion and labor dynamics. Quisumbing *et al*. (2015) [19], published in Agriculture and Human Values and cited 160 times, further reinforces the intersectional lens on values, ethics, and gender in agricultural settings. Notably, López-Pérez *et al*. (2022) [10], appearing in IEEE Communications Surveys and Tutorials with 129 citations, signals the growing relevance of interdisciplinary perspectives from the communications and ICT sectors. Other highly cited works include those by Kristjanson *et al*. (2017) [9], Pan *et al*. (2018) [17], Galiè *et al*. (2019) [5], Adhikari *et al*. (2021) [1], and Snapp *et al*. (2018) [20]—with citations ranging from 91 to 123—published across respected journals such as International Journal of Agricultural Sustainability, American Journal of Agricultural Economics, Social Indicators Research, and Agricultural Systems. Collectively, these studies have laid a robust empirical and theoretical foundation for advancing inclusive digital innovation in agriculture, emphasizing gender equity, decision-making, productivity, and livelihood resilience.

Table 4: Top 10 articles according to number of citations

Authors	Source title	Times Cited
Malapit and Quisumbing (2015) [11]	Food Policy	246
Akter *et al*. (2017)	Food Policy	215
Palacios-Lopez (2017) [16]	Food Policy	173
Quisumbing *et al*. (2015) [19]	Agriculture and Human Values	160
López-Pérez *et al*. (2022) [10]	IEEE Communications Surveys and Tutorials	129
Kristjanson *et al*. (2017) [9]	International Journal of Agricultural Sustainability	123
Pan *et al*. (2018) [17]	American Journal of Agricultural Economics	116
Galiè *et al*. (2019) [5]	Social Indicators Research	114
Adhikari *et al*. (2021) [1]	Agricultural Systems	107
Snapp *et al*. (2018) [20]	Agricultural Systems	91

Thematic evolution

Thematic evolution from 2001 to 2025 in the scholarly discourse on agriculture, gender, and technology shows a marked progression from foundational issues towards more intersectional, inclusive, and socially grounded themes. Between 2001 and 2022, dominant keywords such as climate-smart agriculture, technology adoption, climate change, food security, sustainability, and sustainable agriculture reflected a strong emphasis on agricultural innovation, environmental resilience, and productivity, often analysed within specific regional contexts like Kenya, Bangladesh, and Sub-Saharan Africa. Central to this period was the focus on gender, women, and the role of ICT and technology in facilitating agricultural development.

Fig 7: The co-citation network of journals

However, in the post-2022 phase (2023-2025), the research focus expands both conceptually and geographically. Emerging themes such as empowerment, women's empowerment, aspirations, migration, and agroecology point to a growing recognition of social agency, personal choice, and human development as essential dimensions of agricultural transformation. The consistent presence of gender across both periods underlines its centrality, but the discourse now integrates it more with nuanced layers of empowerment and intersectionality. Countries like Ghana and Malawi appear as new focal points, signalling a geographic broadening and comparative depth in recent

studies.

Furthermore, the rise of ICT as a bridge between earlier concerns on technology and current emphases on inclusion and access suggests a convergence of digital transformation with social justice goals. This evolution also highlights a shift from systems-level adaptation to community- and individual-level agency, with researchers increasingly exploring how technologies and policies translate into real-world impacts. In sum, the field has matured from exploring macro-level innovations to embracing localized, equity-focused, and multidisciplinary approaches, reflecting the dynamic and evolving nature of agricultural and gender research in the digital and climate era.

4. Discussion

The bibliometric landscape mapped in this study provides critical insight into the evolution, scope, and scholarly attention toward ICT-driven empowerment of women in agriculture. The results demonstrate that the research field, while emergent, has gained significant traction over the past decade, especially post-2015. The upward trajectory in publications and citations signals growing scholarly and policy interest in how digital tools can transform agrarian livelihoods and reduce gender disparities (Donthu *et al*., 2021; World Bank, 2014) [3, 22]. Notably, the surge in articles post-2020, peaking in 2024, reflects the accelerated digitalization of rural sectors, driven by increasing mobile penetration and the expansion of government and NGO-led digital inclusion programs (GSMA, 2021; NITI Aayog, 2022) [7, 15].

In terms of geographic distribution, the dominance of countries like the USA, India, and Kenya underscores a concentration of research in high-capacity and high-impact regions. While the Global North contributes significantly to theoretical and policy framing, emerging economies in Asia and Africa are increasingly producing empirical evidence grounded in localized interventions (Trendov *et al*., 2019) [21]. However, the limited representation from Latin America and other parts of the Global South points to a gap in geographically diverse scholarship. Addressing this imbalance is crucial for enhancing the global relevance and applicability of ICT-driven agricultural strategies (Aker, 2011) [2].

Institutionally, CGIAR, IFPRI, and Wageningen University appear as central actors in knowledge production and dissemination. These organizations not only dominate in publication volume but also serve as critical nodes in global research networks, as evidenced by their high co-authorship and co-citation linkages. The institutional collaboration networks suggest an encouraging trend of interdisciplinary and cross-regional partnerships, particularly those blending agronomy, gender studies, and digital development (Meinzen-Dick *et al*., 2019) [13]. Yet, the clustering also reveals siloed regional engagements, signalling the need for broader South-South collaborations and more inclusive research consortia.

The thematic and co-citation analysis affirms that journals like Food Policy, Agriculture and Human Values, and Agricultural Systems are foundational in shaping discourse at the intersection of agriculture, ICT, and gender. These sources reflect the field's interdisciplinary orientation, encompassing ethics, economics, technology, and sustainability. The dominance of Food Policy in both publication volume and citation strength reinforces its role as a flagship journal for evidence-based, policy-relevant research in this area.

Author-level analysis shows that scholars like Quisumbing and collaborators are intellectual anchors in this field. Their repeated contributions and leadership in high-impact studies (e.g., Malapit & Quisumbing, 2015; Quisumbing *et al*., 2015) [11, 19] highlight the importance of sustained, long-term inquiry into women's roles, rights, and resources within agriculture. Their work, among others, has laid the foundation for measuring empowerment, understanding household dynamics, and evaluating gendered outcomes of digital interventions.

The most cited articles indicate a robust concern with measuring empowerment (e.g., Malapit & Quisumbing, 2015) [11], evaluating ICT adoption (Akter *et al*., 2017), and framing gendered labor roles (Palacios-Lopez, 2017) [16]. The emergence of newer works also signals a growing confluence between agriculture and broader technological discourses, including artificial intelligence, digital connectivity, and data-driven development. Finally, the thematic evolution over time, from initial focus areas like climate-smart agriculture and food security to more recent emphases on empowerment, aspirations, and migration demonstrates the field's maturation. ICT is no longer seen merely as a technical solution but as a facilitator of socio-economic transformation and agency (Qaim, 2020) [18]. This shift reflects the integration of feminist development perspectives and the capability approach into agrarian digital discourse, acknowledging women farmers not only as recipients of technology but as active agents of change.

Implications and future research

The findings of this bibliometric study have several implications for research and policy. First, future research must address regional gaps, particularly by including underrepresented regions such as Latin America and the Pacific. Second, deeper exploration is needed into the intersectionality of gender, caste, age, and geographic remoteness in shaping access to and impacts of ICT. Third, future bibliometric work can benefit from integrating Scopus and Google Scholar databases for broader coverage. Furthermore, longitudinal and mixed-method studies are required to trace the actual behavioural, economic, and social transformations driven by ICT among rural women.

On the policy front, the results suggest that scalable and inclusive digital agricultural strategies must be informed by a nuanced understanding of women's realities and structural constraints. Public-private partnerships, digital literacy campaigns, and gender-responsive agri-tech design are essential to unlocking the full potential of ICT in rural transformation.

5. Conclusion

This study underscores the pivotal role of ICT in transforming women's participation in agriculture by enhancing access to information, markets, and financial services. While research has demonstrated significant gains in productivity and empowerment, gaps persist in regional representation and intersectional analysis, particularly in underrepresented areas like Latin America. The findings call

for gender-responsive policies, scalable digital literacy programs, and inclusive agri-tech innovations to address structural barriers. Future research should adopt interdisciplinary approaches, expand geographic coverage, and leverage emerging technologies like AI and IoT. By fostering collaborative efforts among policymakers, researchers, and practitioners, ICT can drive sustainable and equitable agricultural development, ensuring women farmers fully benefit from the digital revolution.

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