

Mapping Digital Technology Adoption for Sustainable Development: A Bibliometric Analysis

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Abstract

This study employs a qualitative bibliometric approach to map research on digital technology adoption for sustainable development. Data were drawn from Scopus-indexed publications published between 2015 and 2025. The PRISMA flowchart was used to document the screening process, while VOSviewer and RStudio–Biblioshiny supported the analysis of publication trends, thematic structures, and research evolution. The findings show that scholarly output in this field was limited before 2020 but increased sharply thereafter, reflecting growing interest in sustainability-oriented digital transformation. Frequently occurring keywords such as sustainable development, digital transformation, sustainability, and digital technologies indicate

a strong integration of policy and governance perspectives. Thematic analyses further reveal increasing attention to behavioural and institutional factors, with technology acceptance frameworks, particularly the Unified Theory of Acceptance and Use of Technology (UTAUT), emerging as an important but still underexplored research stream. Based on these mapped patterns, the study outlines a conceptually informed extension of UTAUT to highlight key sustainability-related adoption drivers identified in the literature. The framework is presented as an agenda-setting outcome of the bibliometric synthesis, intended to support future empirical research rather than to offer a validated theoretical model.

Keywords: *Sustainable development, Digital technologies, Sustainability, Digital transformation, UTAUT*

1. Introduction

In recent years, digital technologies such as the Internet of Things (IoT), big data analytics, and artificial intelligence have been increasingly redefining how governments, organisations, and societies address economic, social, and environmental challenges (Clark et al., 2022; Rahmadian et al., 2023). These technologies support data-driven decision-making, improve service delivery, and enable new governance models that are central to sustainable development (Liao et al., 2024). Because of this, the United Nations has positioned digital transformation as a strategic enabler of the Sustainable Development Goals, particularly in areas such as inclusive growth, environmental protection, and institutional effectiveness (Hoosain et al., 2020).

However, the adoption of digital technology for sustainable development remains uneven across regions, sectors, and institutional settings. Previous studies have highlighted persistent gaps in technological capacity, organisational readiness, and user acceptance, especially in developing and emerging economies (Ding et al., 2021; Ghobakhloo et al., 2021). Many digital sustainability initiatives fail to scale or sustain impact because users and organisations do not fully adopt or integrate these technologies into long-term practices (Abbasi et al., 2021). These challenges demonstrate that technological availability alone is insufficient and highlight the urgent need to understand the behavioural and institutional mechanisms that shape digital technology adoption in sustainability-oriented contexts (Bajunaied et al., 2023).

To address technology adoption challenges, prior research has extensively relied on technology acceptance theories, particularly the Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh et al. (2003).

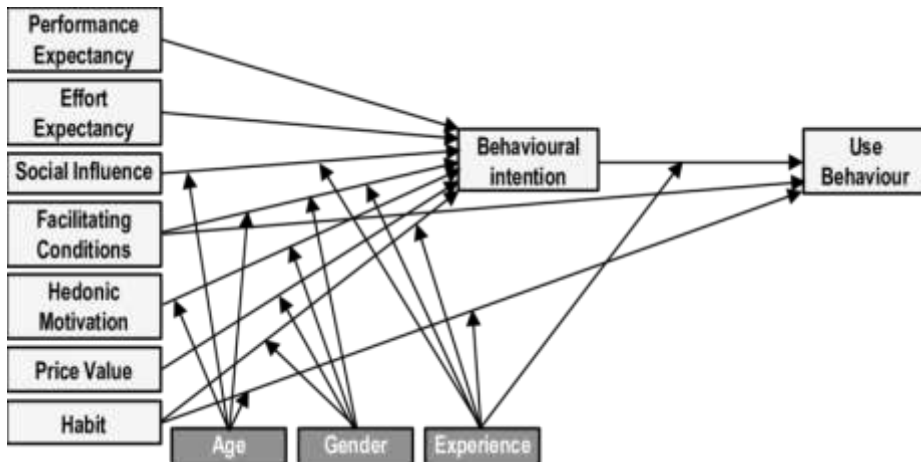


Figure 1. The UTAUT Extended Model 2
Source: Venkatesh et al. (2003)

According to Venkatesh et al. (2003), UTAUT integrates performance expectancy, effort expectancy, social influence, and facilitating conditions to explain technology use, and was later extended to include hedonic motivation, price value, and habit (Naranjo-Zolotov et al., 2019). Numerous empirical studies have revealed that these constructs provide strong explanatory power for technology adoption decisions in contexts such as e-government, education, healthcare, and financial services (Abbasi et al., 2021; Dash et al., 2023).

Nevertheless, evidence from sustainability-oriented digital transformation research suggests that adoption decisions in this domain are shaped by additional factors that go beyond efficiency, usability, or cost (Taneja & Bharti, 2022). For example, studies have shown that digital initiatives aimed at sustainability often involve long-term value creation, collective action, regulatory alignment, and institutional legitimacy, rather than short-term productivity gains alone (Bican & Brem, 2020; Sakib et al., 2025). As a result, behavioural drivers related to social norms, environmental responsibility, and governance pressures play a more prominent role in shaping adoption outcomes (Liao et al., 2024; Youssef & Mejri, 2023).

In this context, recent scholars such as Wang et al. (2021) and Almojaibel et al. (2025) have questioned whether UTAUT is sufficiently adapted to capture sustainability-driven adoption dynamics. Mansoori et al. (2018) argued that UTAUT is frequently applied instrumentally in sustainability research, with limited reflection on whether its constructs adequately represent sustainability-related motivations and institutional pressures. Further, recent bibliometric analyses by Taneja & Bharti (2022) and Wang et al. (2021) reveal that much of the literature relies on sector-specific case studies

or focuses narrowly on technological outcomes, offering limited insight into how behavioural acceptance mechanisms evolve across sustainability domains and over time.

Despite growing scholarly attention in this field, the literature remains fragmented in terms of theoretical integration, methodological scope, and thematic coherence (Khan et al., 2025). Existing studies tend to examine either sustainability outcomes or technology acceptance models in isolation, with limited synthesis of how acceptance-based theories, particularly UTAUT, are conceptualised, adapted, or extended within sustainability-oriented research streams (Dash et al., 2023; Venkatesh, 2022). Moreover, practical challenges faced by policymakers and organisations, such as aligning digital adoption with long-term sustainability goals and institutional constraints, are rarely addressed through a cumulative, field-level perspective (Sakib et al., 2025). Thus, the central research problem addressed in this study is the limitations of systematic research that maps how behavioural acceptance theories (i.e., UTAUT) are positioned and evolving within the literature on digital technology adoption for sustainable development. Without such synthesis, theoretical development remains fragmented, and practitioners lack clear guidance on how digital adoption research informs sustainable policy and governance strategies.

Therefore, this study aims to address this problem by conducting a bibliometric analysis of digital technology adoption research for sustainable development using Scopus-indexed publications from 2015 to 2025. Specifically, it examines publication trends, influential authors and institutions, international collaboration patterns, keyword co-occurrence structures, thematic maps, and thematic evolution, with particular attention to the role of UTAUT as a behavioural acceptance model. Accordingly, this study addresses the following research questions:

- 1) How has scholarly attention to digital technology adoption for sustainable development evolved?
- 2) Which authors, publications, countries, and institutions have shaped the intellectual foundations of this field?
- 3) What thematic clusters and keyword co-occurrence structures characterise the literature?
- 4) What thematic evolutions reveal emerging theoretical directions and underexplored conceptual gaps?

2. Method

This study employs a qualitative descriptive bibliometric approach to map scholarly research on digital technology adoption for sustainable development using data retrieved from the Scopus database. Scopus was selected due to its multidisciplinary coverage, standardised indexing, and rigorous quality

control of peer-reviewed publications, making it suitable for large-scale science mapping and trend analysis (Redha et al., 2025).

2.1. Data Cleaning Processing

A methodical data cleaning procedure was implemented to ensure consistency and reliability in the bibliometric dataset. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were adopted as a screening and documentation framework, enabling transparent reporting of identification, screening, and inclusion stages (Pigola et al., 2021). Initial standardisation addressed inconsistencies in bibliographic records, followed by the removal of duplicate entries and irrelevant documents based on predefined criteria (Zhao et al., 2023). This process ensured coherence across metadata fields and preserved the integrity of the dataset used for subsequent analysis (Lim et al., 2024).

2.2. Search Strategy

Systematic mapping was selected over traditional systematic reviews due to its capacity to classify large bodies of literature, identify thematic clusters, and track research evolution rather than synthesise empirical findings (Lim et al., 2024). Once the data source was established, a structured search strategy was applied using Scopus's advanced search interface, guided by clearly defined inclusion parameters (Youssef & Mejri, 2023).

2.3. Inclusion Criteria

The PRISMA flow diagram (Figure 2) illustrates the study selection process. Publications were included if they were peer-reviewed journal articles or conference papers published between 2015 and 2025, addressing the adoption of digital technology in sustainability-related contexts. This timeframe was selected to capture contemporary research developments, reduce historical bias, and reflect recent trends in digital transformation for sustainable development (Portillo et al., 2020). No restrictions were placed on study design or geographical scope.

2.4. Exclusion Criteria

Exclusion followed three PRISMA-guided stages. Records with indexing errors or incomplete metadata were removed during initial screening. Duplicate documents were eliminated after standardisation, and publications not aligned with the study's thematic scope were excluded. Since bibliometric analysis relies on metadata, full-text availability was not required (Radovanović et al., 2020).

2.5. Tools and Software

Bibliographic records were organised using Microsoft Excel to ensure consistency across metadata fields. The PRISMA flowchart was generated using the PRISMA Flow Diagram Generator (version 2020). No custom

algorithms were developed, as the study relied on established bibliometric tools to ensure methodological transparency and replicability.

2.6. Selection Process and Visualisation

VOSviewer was used to construct bibliometric networks and visualise relationships among keywords, authors, countries, and thematic clusters, while RStudio–Biblioshiny supported statistical analysis, thematic mapping, and thematic evolution (Putri et al., 2025). The analysis was based on metadata extracted from titles, abstracts, author keywords, and indexed terms. The Scopus search query yielded an initial dataset of 4,277 documents. Based on the PRISMA-guided workflow in Figure 2, the dataset was refined through a transparent and sequential screening process to ensure relevance, consistency, and methodological rigour:

- a. *Initial Retrieval:* The initial search was conducted in Scopus using the following query: TITLE-ABS-KEY (“digital technologies” OR “UTAUT”) AND TITLE-ABS-KEY (“sustainable development”). The search produced 4,277 documents.
- b. *Timeframe Limitation:* The results were restricted to publications published between 2015 and 2025 to capture the longitudinal development of the topic while maintaining contemporary relevance. This step reduced the dataset to 4,133 documents.
- c. *Subject Area Filtering:* To ensure disciplinary alignment, the dataset was limited to the Social Sciences subject area, resulting in 1,292 documents.
- d. *Document Type Selection:* Only peer-reviewed journal articles and conference papers were retained, as these document types represent original and validated scholarly contributions. This refinement reduced the dataset to 933 documents.
- e. *Language Refinement:* The final screening step restricted the dataset to English-language publications, ensuring consistency in analysis and interpretation. After this step, 877 documents remained and constituted the final dataset used for the bibliometric analysis.

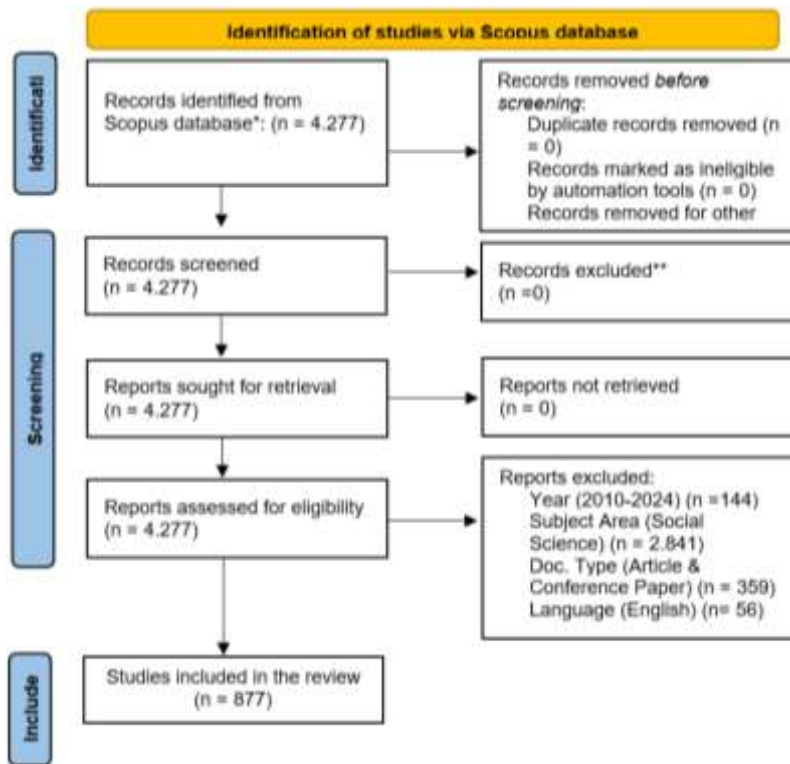


Figure 2. PRISMA Bibliometric Analysis Workflow
Source. Adopted by the author

3. Results

3.1 Basic Information on Bibliometric Analysis

The bibliometric dataset includes 877 publications published between 2015 and 2025 across 293 academic sources. The high annual growth rate of 65.16% shows that research on digital technology adoption for sustainable development is expanding rapidly. This pattern reflects rising interest from both researchers and practitioners as digital tools become central to sustainability policies and development programs. The low average document age of 1.57 years indicates that this field is still taking shape, with many ideas and findings yet to be tested over time. As a result, the average citation rate of 18.86 should be read carefully, since influence is concentrated in recent and highly visible studies. Authorship patterns point to strong collaboration, with an average of 3.57 authors per paper. The international co-authorship rate of 28.51% highlights the global nature of sustainability challenges and the need for shared digital solutions. For research, this supports knowledge exchange across regions. For practice, it suggests that findings are shaped by diverse country experiences, which strengthens their relevance for policy design and implementation. Table 1 presents the main bibliometric information.

Table 1. Basic Information on Bibliometric Analysis

<i>Description</i>	<i>Results</i>
MAIN INFORMATION ABOUT DATA	
Timespan	2015:2025
Sources (Journals, Books, etc.)	293
Documents	877
Annual Growth Rate %	65.16
Document Average Age	1.57
Average citations per doc	18.86
References	7,963
DOCUMENT CONTENTS	
Keywords Plus (ID)	2,525
Author's Keywords (DE)	2,843
AUTHORS	
Authors	2,981
Authors of single-authored docs	109
AUTHORS COLLABORATION	
Single-authored docs	113
Co-Authors per doc	3.57
International co-authorships %	28.51
DOCUMENTS TYPES	
Article	789
Conference paper	88

3.2 Publication Trend by year, top 10 influential authors, and documents

3.2.1 Publication Trend

In this section, we evaluated the distribution of publications by year within the scope of the dataset used in this research. The result is shown in Figure 3.

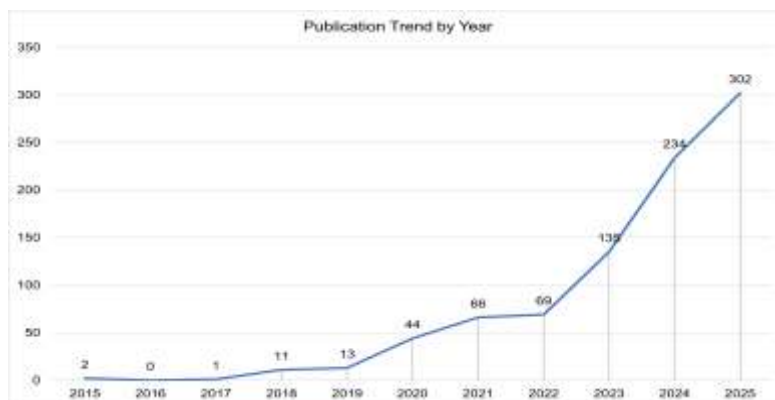


Figure 3. Publication trend in the research domain
Source: Data processing from the Scopus database

Figure 3 shows a substantial increase in research output on digital technology adoption for sustainable development after 2015. The growth pattern is not gradual. The strong increase from 2020 reflects a clear change in research priorities, as digital tools became central to governance, service delivery, and sustainability responses during the COVID-19 period. This shift signals that digital technology has moved from being supportive to being essential in sustainability debates. The strong rise between 2023 and 2025 accounts for more than one-third of total publications, but this concentration also limits citation maturity and requires careful interpretation. Beyond COVID-19, the continued growth after 2021 suggests lasting institutional commitment. Policy alignment with the Sustainable Development Goals and wider digital transformation across sectors appears to have anchored this topic more firmly within sustainability research (Hoosain et al., 2020). These trends show that digital technology adoption is now shaping both academic inquiry and real-world sustainability practice.

3.2.2 Influence Authors

Figure 4 highlights the most influential authors based on publication output and fractionalized authorship, which accounts for collaboration intensity.

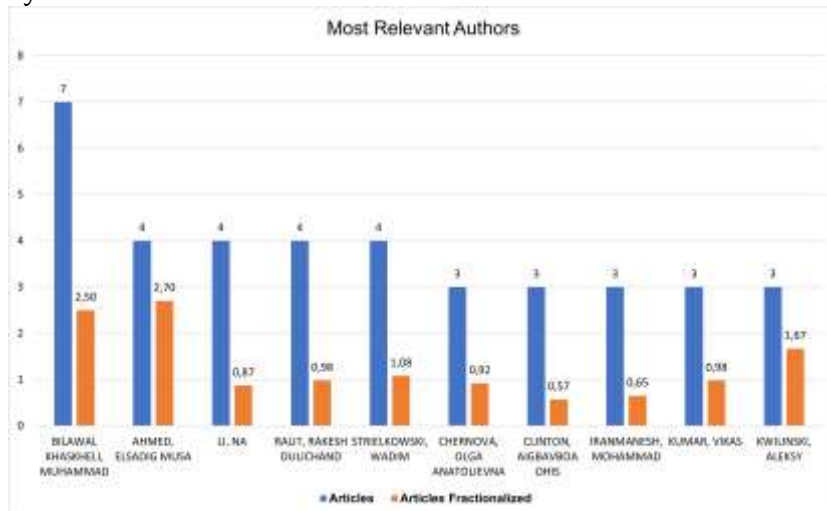


Figure 4. Documents by authors

Source: Data processing from RStudio (Biblioshiny)

The distribution shown in Figure 4 suggests that influence in this field is broadly shared rather than concentrated among a small group of dominant authors. This pattern indicates an open and evolving research space, where ideas develop through collaboration rather than authority. In RStudio's bibliometric analysis, fractionalised authorship highlights that

research impact is closely linked to joint work across disciplines and institutions (Haleem et al., 2022). Bilawal Khaskheli, M., records the highest number of publications, yet several authors display similar fractional influence with fewer papers. For science, this supports knowledge diversity and cross-fertilisation. For practice, it implies that applied insights emerge from shared global experiences rather than isolated research agendas, strengthening the relevance of findings for policy and implementation.

3.2.3 Top Influential Articles

Table 2 shows the top 10 most cited documents within this field of study. The publication titled “Climate change and COP26: Are digital technologies and information management part of the problem or the solution? An editorial reflection and call to action,” written by Dwivedi et al. (2022), received the highest number of citations of 578.

Table 2. Top 10 most cited publications from 2015 – 2025

No	Publication	Author (s)	Year	Citations
1.	Climate change and COP26: Are digital technologies and information management part of the problem or the solution? An editorial reflection and call to action	Dwivedi, Yogesh K., et al.	2022	606
2.	Enabling technologies and sustainable smart cities	Ahad, Mohd Abdul, et al.	2020	515
3.	Industry 4.0, innovation, and sustainable development: A systematic review and a roadmap to sustainable innovation	Gbobakhloo, Morteza, et al.	2021	342
4.	Digital Business Model, Digital Transformation, Digital Entrepreneurship: Is there a sustainable "digital"?	Bican, Peter M., and Brem, Alexander	2020	334
5.	Digital economy, technological innovation, and high-quality economic development: Based on spatial effect and mediation effect	Ding, Chenhui, et al.	2022	304
6.	Application of digital technologies for sustainable	Rusch, Magdalena, et al.	2023	272

No	Publication	Author (s)	Year	Citations
	product management in a circular economy: A review			
7.	Digital technologies can enhance the climate resilience of critical infrastructure.	Argyroudis, Sotirios A., et al.	2022	242
8.	Adapting universities for sustainability education in Industry 4.0: Channel of challenges and opportunities	Mian, Syed Hammad., et al.	2020	229
9.	A framework of digital technologies for the circular economy: Digital functions and mechanisms	Liu, Qinglan, et al.	2022	227
10.	The impact of sustainable development strategy on sustainable supply chain firm performance in the digital transformation era	Nayal, Kirti, et al.	2022	214

3.3 Co-occurrence analysis

To examine the conceptual structure of the field, a co-occurrence analysis was conducted using 250 author keywords. Figure 5 presents the keyword cloud, where node size reflects keyword frequency, providing an overview of dominant research attentions.



Figure 5. Author keyword cloud
Source: Data processing from RStudio (Biblioshiny)

Figure 5 shows that frequently used terms such as “sustainable development,” “digital transformation,” and “sustainability” sit at the centre of the literature. This concentration suggests that research in this field is

guided more by sustainability goals and policy concerns than by technology alone. Digital-related terms such as “digital technologies,” “artificial intelligence,” and “digital economy” appear closely linked to these core concepts, indicating that technology is mainly discussed as a tool to support broader development outcomes. This pattern reflects a growing agreement that digital adoption matters most when it contributes to long-term social and environmental goals, rather than technical efficiency in isolation (Pigola et al., 2021; Ta & Lin, 2023). For practice, this signals that applied research increasingly aligns digital innovation with sustainability priorities.

Furthermore, Figure 6 provides an overlay visualisation of author keywords, highlighting shifts in research focus over time. Earlier themes such as “COVID-19,” “smart cities,” and “IoT” reflect short-term responses to disruption and rapid digital uptake during crisis conditions (Kumar et al., 2020). Later keywords show a clearer turn toward structural issues, including “digital divide,” “digital literacy,” and “sustainability,” pointing to growing concern with inclusion and uneven access (Tan et al., 2025). More recent terms such as “sustainable development goals,” “artificial intelligence,” “digital economy,” and “UTAUT” suggest deeper engagement with adoption drivers, governance capacity, and policy design. This progression indicates that the field is moving from reactive adoption studies toward more theory-informed and policy-relevant analysis (Abbasi et al., 2021; Sá & Serpa, 2020; Almojaibel et al., 2025; Sakib et al., 2025).

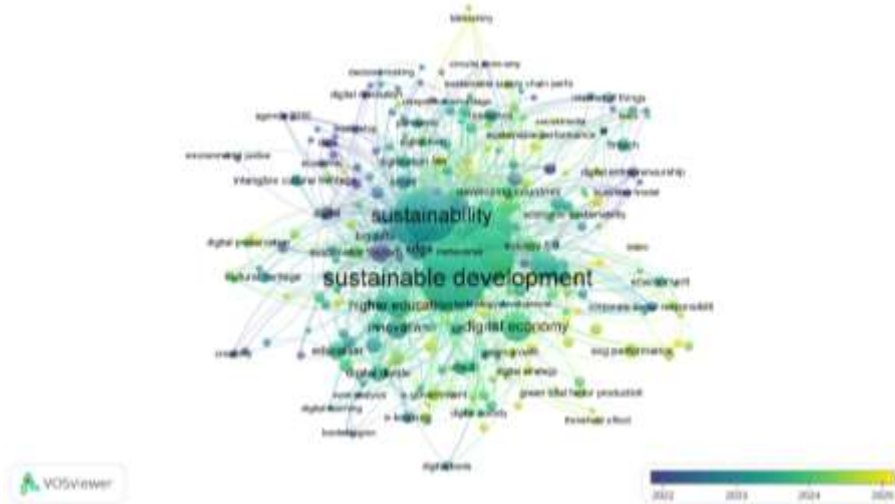


Figure 6. Overlay map of Author keywords node

Source: Data processing from VOSviewer

3.4 Co-Authorship Collaborations and Affiliations

3.4.1 Co-Authorship & Countries

Figure 7 presents the international co-authorship network in this research field, where node size reflects publication output and link strength indicates

collaboration intensity. China's central position reflects more than high output; it shows an ability to coordinate large, multi-country research efforts that link digital innovation with sustainability agendas. This centrality shapes the direction of the field by setting research priorities that often emphasise large-scale digital systems and policy-driven solutions. The United States and the United Kingdom act as secondary hubs, connecting Europe, Africa, and the Asia-Pacific regions. Their role suggests continued influence in framing research questions, methods, and interdisciplinary integration, even as leadership becomes more distributed.

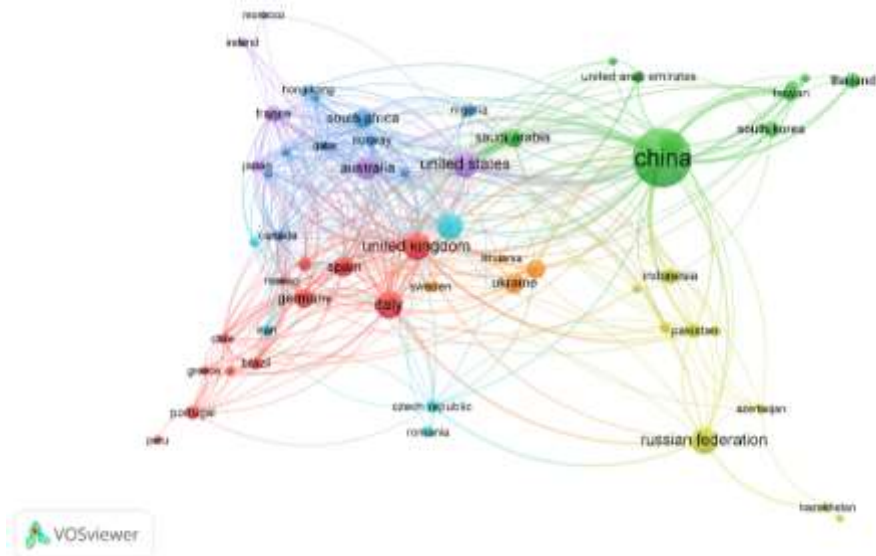


Figure 7. Co-authorship network
Source: Data processed in VOSviewer

European countries such as Italy, Germany, Spain, and France form a dense collaborative cluster. This reflects stable funding structures and shared sustainability policies that support long-term cooperation. Emerging economies such as Pakistan, Indonesia, Nigeria, and Saudi Arabia show increasing participation, but with narrower collaboration networks. This uneven pattern highlights a practical challenge for the field: limited cross-regional exchange may constrain context-sensitive solutions for sustainable digital adoption. Strengthening South–South and South–North collaboration would improve both knowledge diversity and practical relevance.

3.4.2 Institutional Affiliations

Figure 8 shows the most productive institutional affiliations. The University of Johannesburg leads with 11 publications, signalling sustained engagement rather than dominance. Its position reflects the growing contribution of Global South institutions in shaping debates on digital

adoption and sustainability. This trend broadens the empirical and policy focus beyond traditional Western contexts. Universiti Sains Malaysia follows with eight publications, reinforcing Southeast Asia’s rising role in applied digital sustainability research.

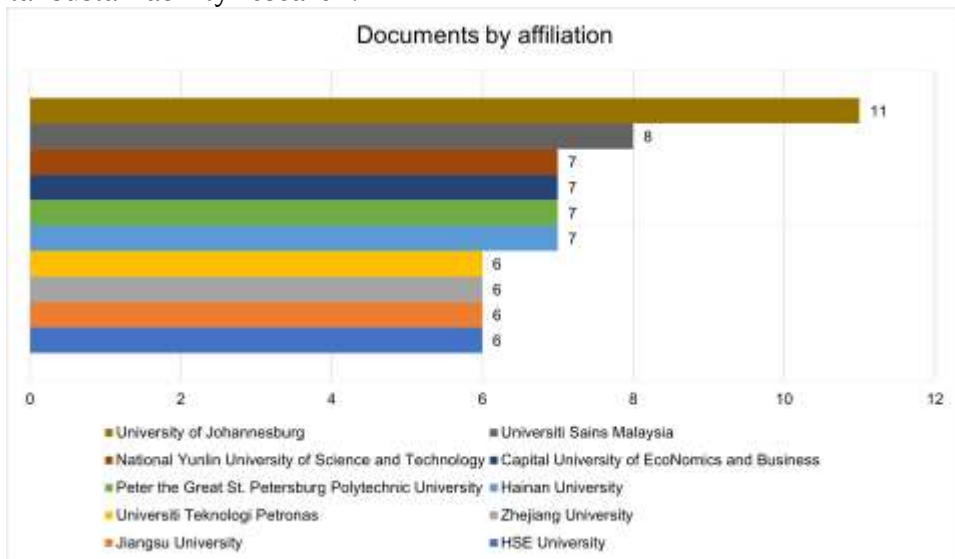


Figure 8. Most productive institutional affiliations
Source: Data processed in VOSviewer

Other institutions, including Hainan University, Peter the Great St. Petersburg Polytechnic University, and Capital University of Economics and Business, show comparable outputs, indicating geographically dispersed but thematically aligned research efforts. The affiliation pattern points to a decentralised knowledge structure where regional priorities guide research agendas. This has practical value, as it supports solutions tailored to local development needs rather than universal models (Kwilinski et al., 2023).

3.5 Trending Topics, Thematic Map, and Evolution

3.5.1 Trend Topics

Figure 9 shows how research topics in this field have changed over the past decade, using keywords that appeared at least five times. The concentration of trends in the last five years confirms that research on digital technology adoption for sustainable development is no longer fragmented, but has entered a phase of rapid consolidation.

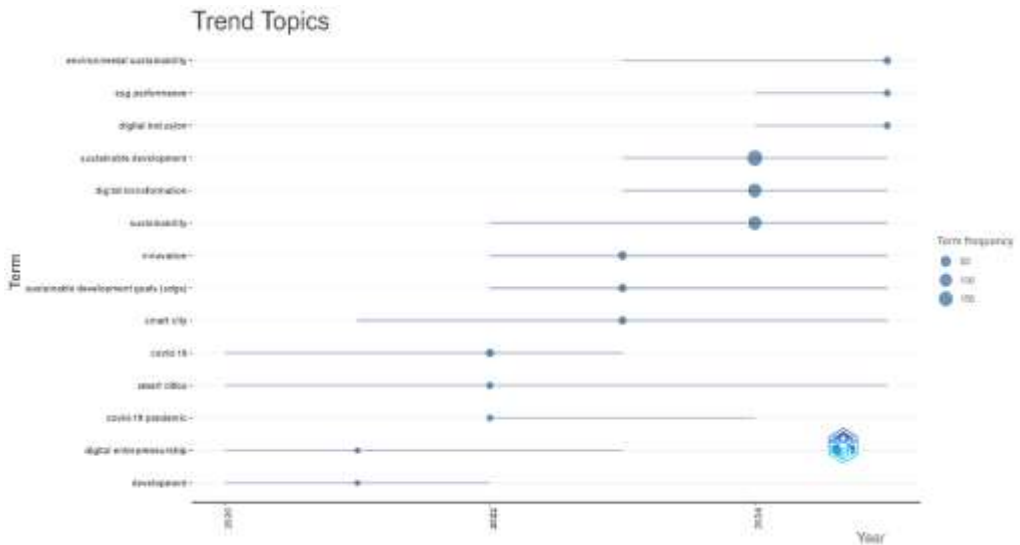


Figure 9. Trend Topics
 Source: Data processing from RStudio (Biblioshiny)

In Figure 9, trends in 2021, such as “development” and “digital entrepreneurship,” reflect broad and exploratory thinking, where digital tools were mainly viewed as drivers of economic growth. The prominence of “COVID-19,” “smart cities,” and related terms in 2022 signals a disruption that reshaped both research priorities and practical digital responses (Portillo et al., 2020). The shift in 2023 toward “sustainable development goals,” “innovation,” and “smart city” marks a return to longer-term policy and planning concerns, rather than crisis management (Rahmadian et al., 2023). In 2024, the dominance of “digital transformation” and “sustainability” suggests growing agreement on core concepts guiding the field. The emergence of “digital inclusion,” “ESG performance,” and “environmental sustainability” in 2025 reflects a stronger focus on governance, equity, and accountability, signalling increased relevance for policy design and organisational practice (Saxena et al., 2022).

3.5.2 Thematic Map

Figure 10 presents the thematic structure of research on digital technology adoption for sustainable development based on a co-word analysis of 250 author keywords. The thematic map is interpreted using centrality and density as indicators of relational importance and internal development.

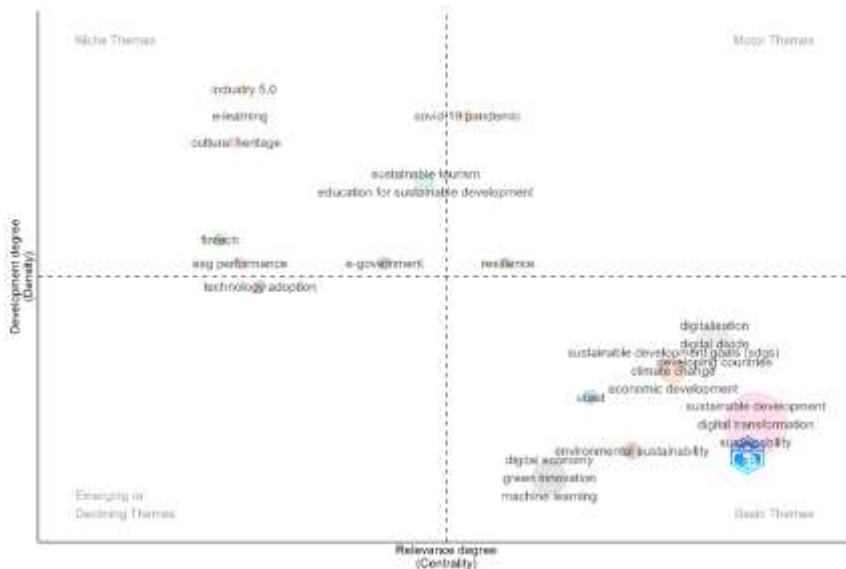


Figure 10. Thematic map

Source: Data processing from RStudio (Biblioshiny)

In Figure 10, the lower-right quadrant (basic themes) contains highly central but weakly developed concepts such as “sustainable development,” “digital transformation,” “digital technologies,” “artificial intelligence,” “circular economy,” and “UTAUT.” This suggests that while these ideas shape most studies, researchers still struggle to integrate them into cohesive frameworks (Sovacool & Hess, 2017). For practice, this gap limits the translation of theory into consistent policy tools. Further, motor themes in the upper-right quadrant, notably “COVID-19” and “resilience,” reflect a temporally bounded but internally cohesive research stream that gained prominence due to external shocks rather than long-term conceptual dominance (Pagán et al., 2020). The upper-left quadrant captures niche themes (e.g., “industry 5.0,” “ESG performance,” “sustainable tourism”), indicating specialised but weakly connected research fronts. Finally, the lower-left quadrant includes emerging or declining themes such as “technology adoption,” suggesting underexplored conceptual integration, particularly in development-focused contexts (Fan et al., 2023).

3.5.3 Thematic Evolution

Figure 11 shows the thematic evolution of author keywords, capturing how dominant research themes have shifted and recombined over time.

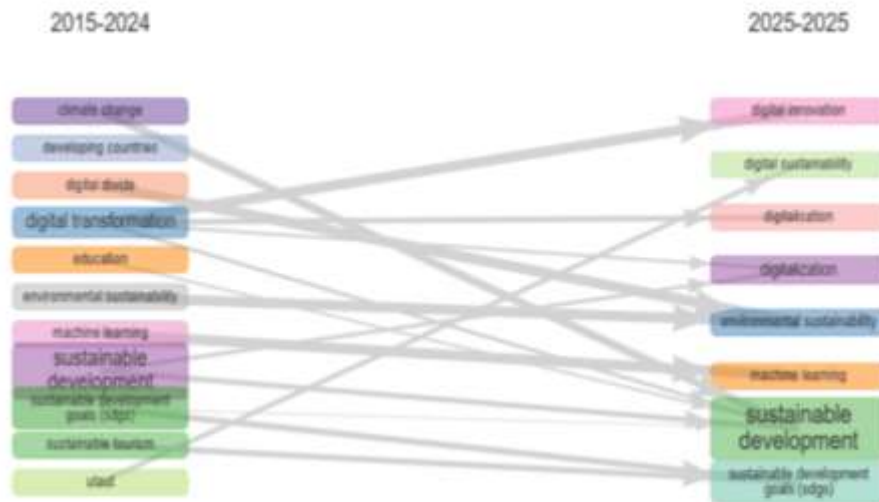


Figure 11. Thematic evolution
Source: Data processing from RStudio (Biblioshiny)

During the 2015 to 2024 period, concepts such as “sustainable development,” “sustainable development goals,” and “digital transformation” occupied central positions, indicating an exploratory phase focused on aligning digitalisation with sustainability agendas. These themes functioned as conceptual anchors rather than fully differentiated research streams. In the most recent period (2025), the evolution map shows a reconfiguration toward more specialised and application-oriented themes, including “digitalisation,” “digital innovation,” and “environmental sustainability.” This evolution signals growing relevance for policymakers and practitioners seeking evidence-based digital strategies (Ahad et al., 2020). The presence of “UTAUT” within evolving thematic pathways suggests increasing interest in behavioural and acceptance frameworks, now increasingly integrated within digitally enabled sustainability systems (Mansoori et al., 2018).

4. Discussion

This section interprets the key findings related to publication trends, collaboration patterns, keyword structures, and thematic evolution in research on digital technology adoption for sustainable development. Given the interdisciplinary and rapidly evolving nature of the field, the discussion focuses on explaining observed patterns and situating them in relation to existing empirical and conceptual studies, rather than establishing causal relationships.

This study shows a clear expansion of research activity after 2020. Consistent with prior bibliometric studies in digital governance and sustainability (Lubis et al., 2025; Youssef & Mejri, 2023), the COVID-19 pandemic acted as an immediate catalyst by accelerating digital adoption across sectors. However, unlike studies that characterise this growth as mainly crisis-driven, the sustained increase in publications beyond 2022 points to more structural drivers (Taneja & Bharti, 2022). These include the institutionalisation of the Sustainable Development Goals, the diffusion of ESG reporting frameworks, and the integration of digital tools into governance and policy processes (Saxena et al., 2022). Importantly, the most influential publications in the field by Dwivedi et al. (2022), Ghobakhloo et al. (2021), and Ahad et al. (2020) primarily focus on policy framing, technological pathways, and strategic challenges. This suggests that the literature has prioritised agenda-setting and conceptual guidance, while long-term behavioural evidence and theory-testing studies remain comparatively limited.

Further, the authorship and collaboration patterns reinforce the problem-oriented nature of this research domain. The high level of co-authorship and international collaboration aligns with earlier findings in sustainability and innovation research, where complex societal challenges require interdisciplinary perspectives (Kim et al., 2019). In contrast to earlier bibliometric studies dominated by institutions in Europe and North America (Wang et al., 2021; Obi et al., 2025), this analysis highlights the growing contribution of institutions from emerging economies, particularly in Asia and Africa. This shift likely reflects the practical relevance of digital technologies for addressing development-related sustainability challenges in these regions, such as infrastructure gaps, service delivery, and inclusive growth (Sakib et al., 2025).

Furthermore, the co-occurrence analysis indicates increasing conceptual integration between digital innovation and sustainability agendas. For example, core themes such as digital transformation, sustainable development, and sustainability remain central, confirming their foundational role in structuring the field (Ghobakhloo et al., 2021). At the same time, the close association of artificial intelligence, digital economy, and e-government with governance and environmental performance terms suggests a move away from purely technology-centred adoption studies. Instead, the literature increasingly frames digital technologies as part of broader socio-technical systems that support sustainability transitions, consistent with arguments advanced by Pigola et al. (2021).

Moreover, the thematic map and evolution analyses show how the field has shifted over time. Early research focused on general digitalisation and crisis-driven responses, particularly during the COVID-19 period (Saxena et

al., 2022). More recent studies emphasise governance mechanisms, behavioural acceptance models, and measurable sustainability outcomes. The growing visibility of ESG performance, digital inclusion, and UTAUT reflects increasing interest in behavioural and institutional drivers of sustained digital adoption (Fan et al., 2023; Taneja & Bharti, 2022). From a practical perspective, these findings suggest that policymakers can use acceptance-based insights to anticipate adoption barriers when designing digital sustainability policies, while organisations can better align digital transformation initiatives with ESG objectives by addressing behavioural, institutional, and infrastructural conditions highlighted in the literature.

4.1. Conceptual Framework: Sustainability-Oriented UTAUT modification

Based on the patterns identified in the bibliometric analysis, this study outlines a sustainability-oriented extension of the UTAUT model to support future research on digital technology adoption in sustainability contexts (Figure 12). The modified model does not emerge from statistical associations or keyword frequencies alone but reflects a qualitative synthesis of recurring themes observed across influential and emerging research streams. Therefore, the model is presented as a conceptual organising framework rather than a validated theoretical model.

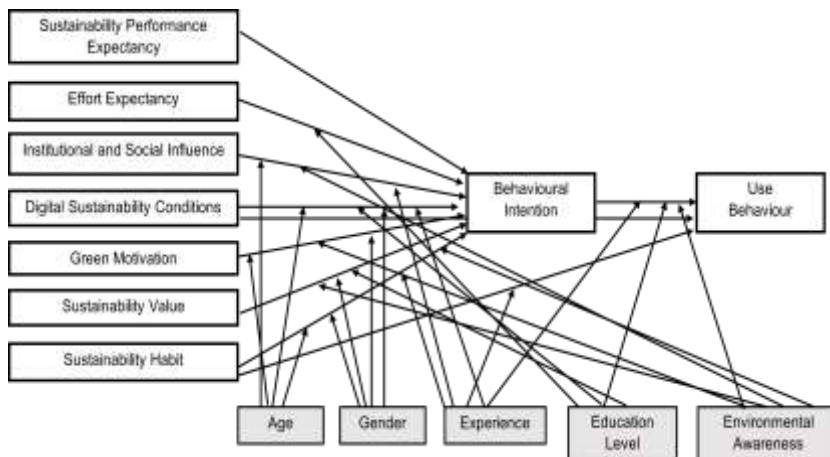


Figure 12: Modified UTAUT model
Source: Created by the author

Consistent with UTAUT’s core premise that contextual perceptions shape behavioural intention and use behaviour (Venkatesh et al., 2003), the framework retains its foundational logic while adapting selected constructs to reflect sustainability-oriented decision-making. This adjustment responds directly to the literature’s shift from short-term efficiency concerns toward

longer-term environmental, institutional, and governance considerations identified in the thematic analyses (Tzima et al., 2020).

Within this framework, sustainability performance expectancy captures perceptions of how digital technologies contribute to environmental and development outcomes, reflecting growing empirical attention to environmental performance as an adoption driver (Abbasi et al., 2021; Fan et al., 2023). Institutional and social influence extends the original construct by incorporating regulatory pressures, governance mechanisms, and societal norms that frequently appear in sustainability-focused studies (Xu et al., 2022). Digital sustainability conditions represent infrastructural and organisational enablers that support environmentally aligned digital engagement, a recurring concern in implementation-oriented research (Dash et al., 2023).

Green motivation and sustainability value reflect the increasing integration of pro-environmental motivations and ESG-oriented value assessments in digital adoption research (Fan et al., 2023; Zhao et al., 2023), while sustainability habit acknowledges the role of routinised digital behaviours in supporting long-term adoption outcomes (Liao et al., 2024). Collectively, the framework synthesises behavioural, institutional, and value-based dimensions identified in the literature and offers a structured basis for future hypothesis development and empirical testing.

However, several limitations of this study should be acknowledged. First, bibliometric analysis relies on publication metadata and keyword structures, which reflect patterns of scholarly attention rather than empirical consensus or causal relationships. Second, the focus on English-language publications may exclude relevant regional or locally grounded studies. Despite these limitations, the study offers a structured overview of how research on digital technology adoption for sustainable development has evolved and highlights consistent thematic directions in the literature. The proposed sustainability-oriented UTAUT framework therefore serves as a conceptual guide to support future empirical research and theory testing, rather than as a definitive model.

5. Conclusion

This study aimed to systematically examine how research on digital technology adoption for sustainable development has evolved and what this body of work reveals about the field's current direction. The results show a clear shift from fragmented and technology-focused studies toward a more consolidated research space that increasingly connects digital adoption with governance, sustainability goals, and ESG-related priorities. The publication trends and thematic patterns indicate that digital technologies are no longer discussed as neutral tools but as drivers of institutional change and sustainability outcomes. At the same time, the results reveal an important

imbalance. Particularly, behavioural approaches, such as the UTAUT, are gaining visibility, yet they remain weakly linked to sustainability-specific concerns and policy contexts. This suggests that the field is expanding faster than its theoretical integration. In response, this paper contributes by proposing a sustainability-oriented extension of the UTAUT framework. Rather than claiming empirical validation, the model is grounded in recurring patterns observed across the literature. Its value lies in bringing together behavioural intention, institutional pressures, and sustainability value creation within a single conceptual structure. This helps clarify where the field currently stands and where it needs to move next.

The findings also offer clear implications for both theory and practice. For researchers, the study provides a structured basis for developing more integrated models that link digital adoption behaviour with sustainability outcomes and governance conditions. For policymakers, development agencies, and sustainability practitioners, the results underscore the importance of designing digital initiatives that go beyond technical deployment and address institutional capacity, inclusion, and long-term impact. The proposed framework can support actors working in areas such as smart governance, digital public services, environmental management, and sustainable innovation. However, this study has limitations. The bibliometric approach reflects patterns of research attention rather than theoretical agreement, and citation time-lag effects remain, given the dominance of recent publications. In addition, the analysis relies solely on Scopus-indexed, English-language documents, which may underrepresent regional or empirically grounded research. Nevertheless, this approach is appropriate for identifying broad trends and structural gaps in a rapidly growing field. Future research should extend this work using multiple databases and empirically test the proposed framework across sectors and regions with larger and more diverse datasets.

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