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Mapping and Visualising the Digital Economy in The Context of Developing Countries: A Bibliometric Analysis

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Abstract

The digital economy wields profound transformative potential. This power is particularly evident in the context of developing countries. Yet, despite the potential there is a notable void in systematic and comprehensive knowledge of this specific domain. This paper offers the means to bridge the gap by conducting a bibliometric analysis of scholarly publications within the field of inquiry. Employing a combination of metadata aggregations and illustrative visualisations, this study scrutinises publication trends, research trajectories, keyword and terminology evolution, influential authors, research funding institutions, and prominent journals publishing research about the digital economy in developing countries. Furthermore, it identifies current research gaps and opportunities for future studies. This paper contributes significantly to the existing literature by providing a novel, encompassing overview of knowledge concerning the digital economy in developing countries between 2003 and 2023 by presenting the identified English-language research trends. The output also offers valuable insights and future research directions for policymakers, practitioners, and researchers who are interested in advancing the digital economy, thereby fostering digital transformation in developing nations.

Keywords: Digital Economy, Digital Transformation, Developing Countries, Developing Nations, Bibliometric Analysis, VOSviewer, Visualisation, Scoping Review.

1. Introduction

Bibliometric analysis is a quantitative methodology that employs mathematical and statistical techniques to assess the interconnectedness and impacts of publications, authors, institutions, and national contexts within a designated field of research – including business, management, and social science domains (Donthu et al., 2021).

The digital economy has emerged as a pervasive and transformative force that has brought substantial shifts in industries, economies, and societies at a global scale. Nevertheless, while a considerable body of research has scrutinised its effects on *developed nations*, a void persists concerning the intricacy of its dynamics within *developing nations* and *emerging markets*. This knowledge gap effectively hinders the development of strategies for sustainable growth and inclusive progress in these contexts. This research bias also has the potential to misguide or misdirect policymakers working in these contexts with evidence and advocacy that are inappropriate or even fundamentally incorrect. Save for a few research centres and researchers dedicated to studying the digital economy in the context of developing countries, like the Development Implications of Digital Economies (DIODE) network headed by Professor Richard Heeks (Heeks, n.d.), among others, the evidence of this research lacuna suggests a scarcity of empirical data that addresses essential aspects of the digital economy in developing countries that researchers would require to narrow down subsequent studies and to present viable policy options for decision makers. To rectify these current limitations and to push the field of inquiry forward, a bibliometric analysis is a suitable, even obvious, starting point.

1.1. Justification: Why the Digital Economy and Why Developing Countries?

The outcome of this current research will provide insights that address current information gaps and offer the groundwork for further robust scholarly discourse and informed decision-making. Specifically, this bibliometric analysis will identify underexplored research areas and knowledge gaps regarding the digital economy domain in developing countries. The outcome of this study is to enable future researchers to engage with themes and perspectives that require more comprehensive investigation. This approach will also empower researchers to focus their efforts on germane topics that are crucial for understanding and addressing the unique challenges faced by developing nations that are attempting to leverage information technology to build viable digital economies.

Mapping the scholarly landscape of the digital economy in developing countries also helps researchers to visualise the field of inquiry in relation to specific scholars and institutions. These visual representations show the influential nodes within the field and provides indicators for developing new partnerships and collaborations. Studying the emerging and current research trends also enables scholars to stay responsive in the evolving landscape.

Furthermore, since policymakers, governmental bodies, and development organisations rely on data-driven insights to formulate effective policies and strategies (van Ooijen et al., 2019). The outcome of this research provides empirical evidence that can inform policy decision-making regarding the digital economy in developing nations. By understanding the areas of research that are gaining traction and the ones that require more attention, policymakers can craft targeted interventions to support the fostering of innovation, economic growth, and digital inclusivity. By doing so, government agencies, developmental institutions, and funding partners will be assisted in making informed decisions to allocate resources strategically, including funding initiatives, grants, and research projects. In effect, this insight ensures that investments align with the areas that hold the most promise for advancing the digital economy in developing countries, resulting in the most optimal resource utilisation.

Finally, as justification for this paper itself, an initial exploration of the Scopus database yielded no ongoing or previously conducted bibliometric analyses published in the English language pertaining to the digital economy in the context of developing countries. This study, then, also addresses an obvious gap in the current research landscape. Be that as it may, the primary objective of this study is to discover the current research trends identifiable in scholarly papers published in the English language concerning the digital economy in developing countries spanning a period between 2003 and 2023, and shape the research narrative, going forward.

2. Research Questions

Considering the broad nature of the concepts, *digital economy*, and *developing countries*, respectively, the following research questions (RQ) were developed to specifically narrow the focus of this study into an achievable and realistic task:

RQ1: What are the current research trends identifiable in scientific papers published in the English language concerning the digital economy in developing countries?

To assist in answering the main question above, other related questions were developed. They are listed below:

RQ2: Which publisher produced the most papers in the English language regarding the digital economy in developing nations from 2003 to 2023?

RQ3: Which country has the highest number of research publications in the English language regarding the digital economy in developing nations from 2003 to 2023?

RQ4: Which organisations fund research into the digital economy in developing nations, and where are they domiciled?

RQ5: Who are the top contributing authors, and most cited authors relating to research published in the English language about the digital economy in developing nations?

RQ6: What are the most frequently used keywords and terminologies found in papers published in the English language regarding the digital economy in developing nations from 2003 to 2023?

3. Research Method

This section outlines the research methodology employed to conduct the bibliometric analysis. The bibliometric analysis method was utilised to quantify, aggregate, and evaluate the patterns of scholarly publication, citation, and collaboration, offering insights into the evolution and impact of research in this domain. Although thorough and robust, the scope of this study does not cover some bibliometric analysis techniques, such as co-authorship relationships, bibliographic coupling, and citation networks or mapping.

3.1. Data Collection

The data collection process involved retrieving scholarly literature from reputable sources. Consequently, and for expediency, the Scopus database was adopted due to its extensive coverage of journals, conference proceedings, and similar types of scientific research outputs spanning a wide range of disciplines. The search query was formulated to capture publications that discuss the digital economy within the context of developing countries and exclusively in the English language.

Although it is beyond the scope of this paper, the choice of Scopus as a source of data is a key decision point. Scopus provides a proxy layer of authority and quality control around the journals and authors identified. Scopus actively removes captured, hijacked and otherwise compromised journals. Even with these efforts, Retraction Watch, the influential website constantly tracking retractions in scholarly literature, continues to highlight the challenges faced by Scopus and other similar services. A counterpoint to this need for quality is the challenge for some authors to be able to publish in Scopus-indexed journals – particularly where the need for an open access fee payment is increasingly becoming the expected business model. The temptation may be for authors, particularly from the developing economies we are examining, with sound and articulate arguments but limited institutional budgets to explore publishing in non-Scopus journals for pragmatic reasons. Regardless, this evaluation is well beyond the scope of this paper or the current resources of the authors.

3.2. Inclusion and Exclusion Criteria

Publications included in the analysis are those that explicitly address the impact, trends, challenges, and opportunities of the digital economy within developing countries. The Scopus database was searched using the keyword phrases: “Digital Economy” AND “Developing country” and their common variations (Appendix 1 contains the full search string). Journal articles and conference papers were incorporated, while editorials, letters, and short communications were excluded. Non-English publications were also excluded to ensure consistency in the subsequent data analysis and interpretation phases, considering that the three researchers involved in this study only read and write in the English language, an acknowledged limitation of the current work. The time frame considered for data retrieval covers January 2003 to July 2023. A period of sufficient duration to ensure the coverage of trends and their evolution while also reasonably within a period when information technology had come into common public usage.

3.3. Data Processing and Analysis

The data extraction process involved collecting essential metadata for each publication, including author names, affiliations, publication year, keywords, citation counts, and references, among others. This data was then organised in a structured dataset to ensure that the subsequent analysis in Microsoft Excel and VOSviewer were seamless and accurate. Microsoft Excel was chosen because of its inherent and straightforward capability to record the count of publication entries in rows and columns, aggregate and return subsequent results in

pivot tables, and present the data in clear, simple visualisation charts and graphs to aid the assimilation of the insights derived. VOSviewer was chosen because of its programmable ability to quantify, aggregate, and identify not-so-obvious patterns inherent in the retrieved data.

The analysis encompassed several key dimensions:

- **Journal and Publication Patterns:** Preferred journals for publishing research in the English language related to the digital economy in developing countries were determined. This analysis revealed the preferred dissemination channels for scholarly output in this research domain.
- **Document Types and Subject Area Distribution:** The documents retrieved were analysed to determine the types of scholarly output researchers are publishing in the English language within the field, as well as the subject areas that they are focusing their work.
- **Geographical Distribution:** The geographic distribution of publications in the English language was examined to identify countries and regions with significant contributions to the field. This analysis highlights (Anglophonic) regions that play a pivotal role in shaping research discourse in the domain.
- **Publication and Author Impact and Trends:** An analysis was conducted to observe the progression of publications in the English language across time, thereby discerning prevailing patterns in research output. Concurrently, the scrutiny extended to discovering prominent authors and their corresponding citation volumes. This endeavour illuminates the extent of influence specific papers hold within the discourse surrounding the digital economy, thus effectively identifying the contributors who, by virtue of their publication frequency and citation impact, substantively shape the field.
- **Keyword and Term Co-occurrence Analyses:** Keywords and terms associated with publications in the English language were analysed to uncover prevailing research themes and shifts in focus over time. This analysis provides insights into the evolving topics within the digital economy domain.

3.4. Validity and Limitations

The validity of the findings is reinforced by the utilisation of a comprehensive and reputable database – Scopus. On the other hand, the analysis' limitations include potential database

biases, publication lag, the exclusion of non-English publications and biases in publishers' business models regarding open access. These limitations may present some restrictions on the generalisability of the findings.

3.5. Ethical Considerations

This study adhered to ethical guidelines by using publicly available data from reputable sources. Proper citation and acknowledgment of authors' contributions are maintained throughout the analysis. No primary data collection was undertaken or included in this work, thereby offering an avenue for future research and insight by targeting key "node" author and obtaining self-reflection on their role in shaping this topic.

3.6. Search Strategy

Figure 1 outlines the strategy adopted to retrieve the data from Scopus. The search was conducted on the 21st of August 2023. The search terms, "Digital Economy" and "Developing Countries" – and their respective variations, were used to trigger the database to produce all the papers that fit the inclusion criteria.

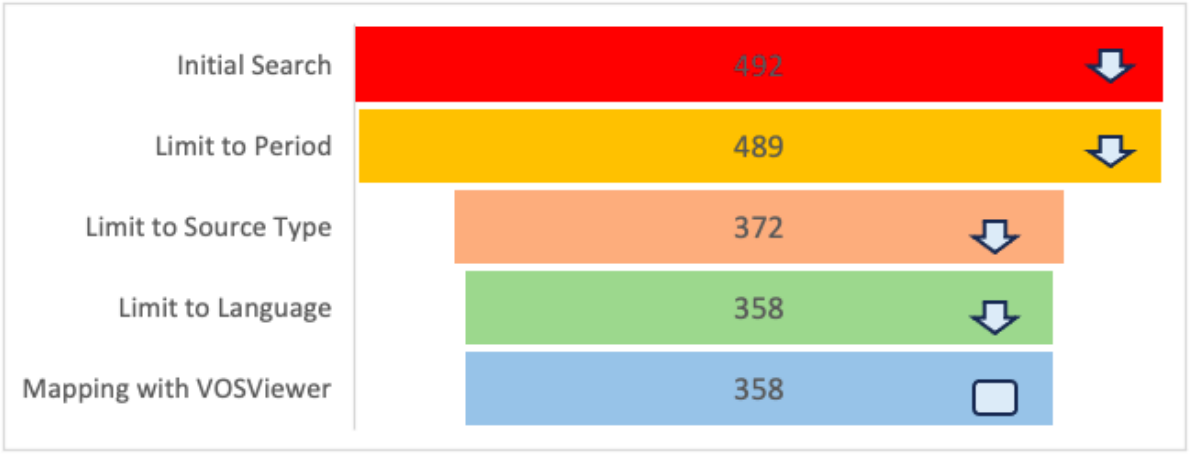

Figure 1: Bibliometric Analysis Search Strategy

4. Findings

From the search of Scopus, a total of 358 papers meeting the predefined inclusion criteria were identified and retrieved. Subsequently, a combination of digital tools, including Microsoft Excel, Scopus, SCImago Journal Ranking, and VOSviewer were employed to conduct an analysis of this retrieved dataset. Additionally, these tools were used to generate pertinent network maps and visualisations tailored to specific analytical requirements.

4.1. Annual Publication Trend in Scopus

Commencing in 2003, a consistent and noteworthy upward trajectory in the volume of relevant articles was observed. This encompassed both journal and conference papers published in the English language and dedicated to examining the impact of the digital economy on developing countries. In the inaugural year of the search window, 2003, a very modest tally of three papers marks the beginning of this developing scientific research agenda. Eventually this body of work blossoms, in 2019, with a more reassuring count of 48 articles published over a twelve-month span.

After what may be a COVID-related decline in 2020, this ascent continues in the following years, with the publication of 68 papers in both 2021 and 2022, respectively, showing that there is now a sustained and robust interest in this research domain. By 2023, 73 documents had already been published between January 1st and July 31st, indicating a continued momentum. The time series chart (Figure 2) gives a visual representation of this upward trajectory.

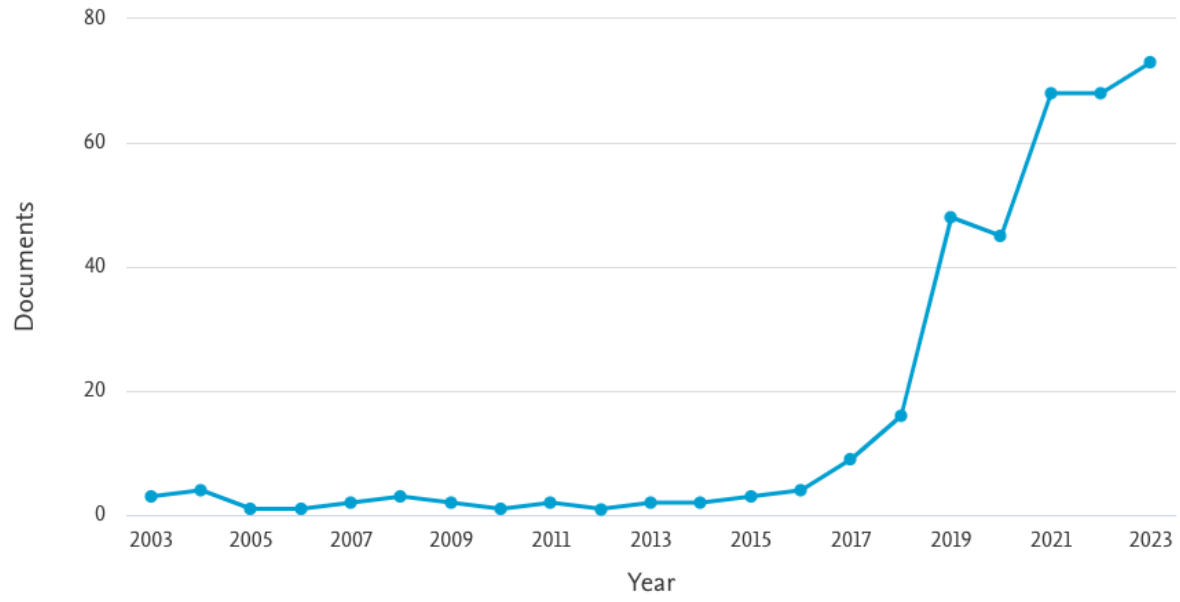

Figure 2: Document Publication Trend from 2003 to 2023

4.2. Document Types

Among the 358 documents obtained from the Scopus database, a significant proportion – 78.8%, or 282 papers – are journal articles. Only, 15.4% of the retrieved documents, totalling 55 papers, fall under the category of conference proceedings. This realisation may reflect a

quality control bias in Scopus as well as a general lack of themed conferences in this field – presumably the dearth of such important academic conferences in developing countries. Consequently, these two primary document classifications collectively account for over 90% of the total papers published in the English language identified as dedicated to investigating the digital economy in developing nations (Figure 3).

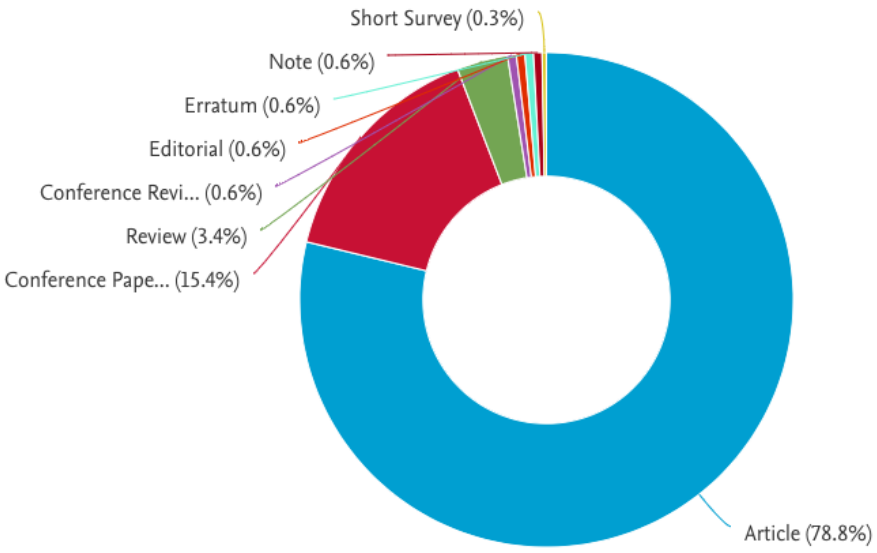

Figure 3: Types of Documents Published

4.3. Subject Area Distribution

The extracted data was subjected to a more granular examination based on subject area classifications, with the aim of gaining deeper insights and enhancing our understanding of the specific domains that the authors are inclined towards (Figure 4).

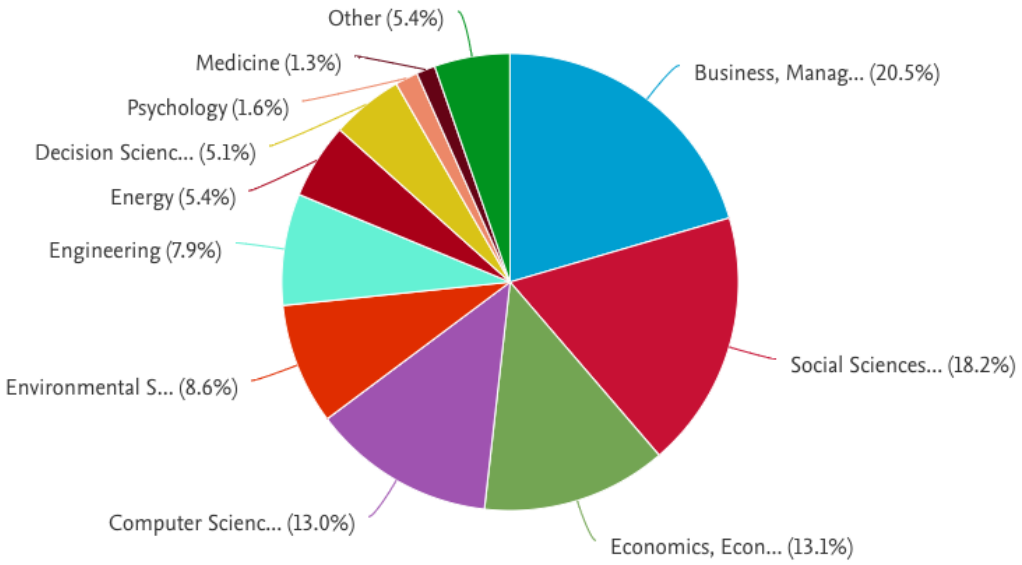

Figure 4: Subject Area Distribution of Published Papers

From the data, 64.8% of researchers in this field are clustered into just four areas.

- Business, Management, and Accounting, constituting 20.5%.
- Social Sciences, encompassing 18.2%.
- Economics, Econometrics, and Finance, accounting for 13.1%.
- Computer Science, comprising 13.0%.

These findings underscore the multidisciplinary nature of digital economy research in emerging markets, with a pronounced emphasis on subjects that are all broadly related to business and management.

4.4. Top Publication Sources

In alignment with the previously identified trend, there is a discernible surge in research and scholarly publications concerning the digital economy within the context of developing countries. As highlighted in Figure 5, the journal 'Sustainability (Switzerland)' serves as a notable example of this burgeoning interest.

Remarkably, there were no recorded matching publications in Sustainability (Switzerland) published by MDPI until the year 2019, when the journal featured three papers addressing this

subject matter. This trend, however, has shown remarkable growth, considering that the number of papers published in the journal surged to nine by July 31st, 2023, for that half-calendar year alone. In total, between 2019 and 2023, there have been 22 papers published in Sustainability (Switzerland) on this topic. This influence on the bibliometric analysis is not entirely unproblematic as the journal was removed from Norwegian national list of approved journals and was paused from Scopus indexing in early 2024. Sustainability has been criticised in academic forums, including Retraction Watch, as preying on the *publish or perish* culture associated with academic progression.

It is noteworthy that, of the 22 papers published in Sustainability (Switzerland) within this timeframe, a substantial portion, precisely 54%, or 12 papers, have centered their focus on the digital economy in China. Away from the controversy the journal attracts, this does appear to underscore the prominence of China within the discourse on the digital economy's role in developing countries.

While it is not a defence of Sustainability (Switzerland)'s practices, it is also important to acknowledge that several other journals have also contributed to the wider dissemination of research on this subject matter. These journals include, but are not limited to, the 'ACM International Conference Proceeding Series,' 'Technological Forecasting and Social Change,' and the 'International Journal for Quality Research' (Figure 5).

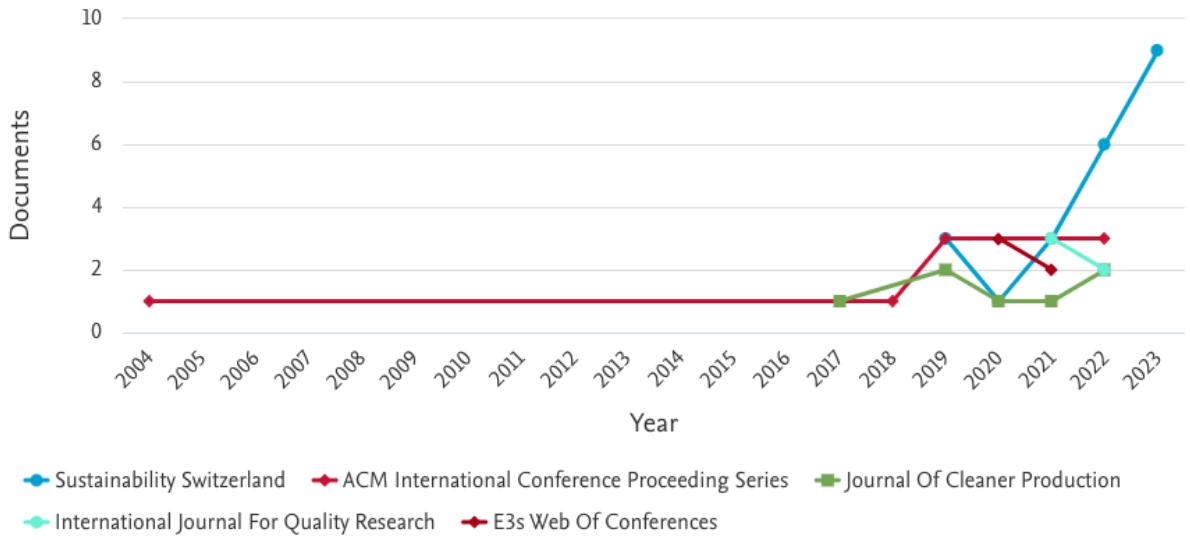

Figure 5: Journal Publication Trend Comparison

Subsequently, a SCImago Journal Rank (SJR) analysis was employed to assess the standing and potential impact of the journals and conference proceedings publishers through whom authors

disseminate their research in the English language. The SJR metric is an evaluative instrument, that offers indication of the influence of a journal and its papers through their citation patterns. The goal for this approach lies in providing a nuanced evaluation of a journal's prominence, differentiating itself from other metrics such as the Journal Impact Factor (JIF).

The calculation of the SJR indicator extends beyond a tally of citations attributed to a journal; it considers the calibre and relevance of the sources that cite articles in the journal. The SJR metric attempts to offer a lens to assess the interplay between a journal's own citation impact and the quality of the sources referencing it. This form of methodology is similar to that originally employed by Google and its PageRank algorithm. The top 10 journals and conference proceedings were subjected to this evaluation (Table 1). These entities are sorted and ranked based on the number of papers they have published in the domain under review, ranked in descending order from the highest to the lowest count. As an indication of the relative quality of journals based on SJR, scores under 1 indicate below average citation potential while a number over 1 indicates above average citation potential (thus indicative of higher quality).

S/N	Source	2022 SCImago Journal Rank (SJR)	Country of Publication	Number of Papers Published
1	Sustainability Switzerland	0.664	Switzerland	22
2	ACM International Conference Proceeding Series	0.209	United States of America	8
3	Journal Of Cleaner Production	1.981	United Kingdom	7
4	Technological Forecasting and Social Change	2.644	United States of America	7
5	E3s Web of Conferences	0.182	France	5
6	International Journal for Quality Research	0.296	Serbia	5

7	International Journal of Trade and Global Markets	0.218	Switzerland	5
8	Journal of Business Research	2.895	United States of America	4
9	Management Of Environmental Quality	0.906	United Kingdom	4
10	Bulletin For International Taxation	0.141	Netherlands	3

Table 1: Journal Ranking on The SCImago Scale

Notably, discourse concerning the digital economy within the context of developing nations predominantly gravitates towards publication outlets hosted in developed countries. However, there is one exception with the 'International Journal for Quality Research' being headquartered in Serbia – a nation generally categorised as 'developing.'

To facilitate a succinct overview of the prestige and potential impact of the leading five journals in this field of research, a comparative representation was calculated (Figure 6). The analytical criterion rests upon the most current SJR scores (at the time of researching and writing) attributed to the respective publishing entities. The trend line shows that the Journal of Business Research, published in the USA, with an SJR score of 2.895, tended to be the most impactful among the journals used for conducting this analysis and that only the top three of these sources sit above 1 in SJR scoring.

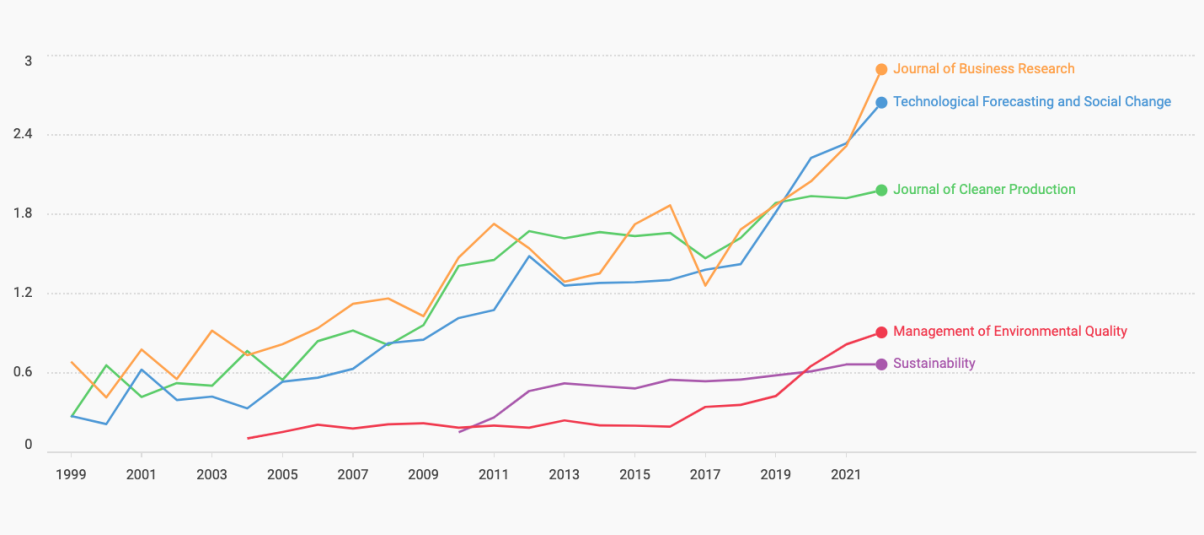

Figure 6: SCImago Journal Rank Scores and Trends of the Top Five Best Scored Journals

4.5. Country or Territory with the Highest Number of Research Publications

Analysis of the documents extracted from the database included a segmentation based on the institutional affiliation of the lead authors. This segment aims to identify the country or territory responsible for the highest volume of scientific publications concerning the digital economy within the context of developing nations. Figure 7 shows the top 10 countries where these lead authors were based at the time of publication. This chart not only serves as an indicator of the regions contributing significantly to the scholarly discourse but also sheds some potential light on where primary data collection and empirical investigations have been conducted. This offers some indication as to the national and cultural influences on the conclusions and advocacy being made in the papers. It is worthy to note, also, that there is a risk that the specific challenges of a single nation or culture being observed in respective papers may be assumed to speak for all developing countries, regions or continents. That may not be the case, given the varied geographic, cultural, political, and economic nuances of various developing nations around the world.

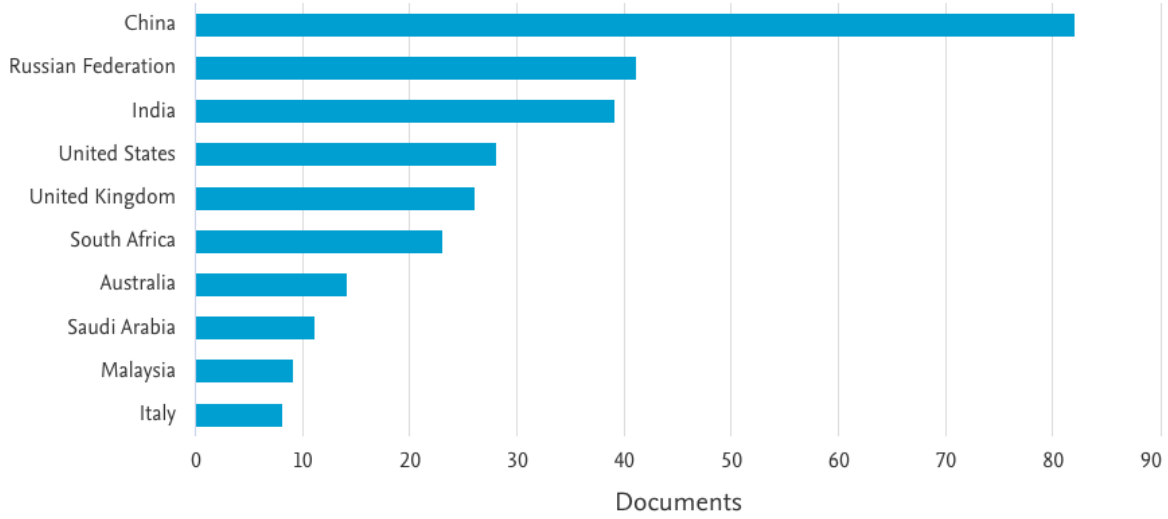

Figure 7: Country or Territory with the Most Research Publications

China emerges as the foremost contributor in this domain, with a notable total of 83 documents. This figure slightly surpasses the combined contributions of the following two leading nations, namely Russia (41 documents) and India (39 documents). Occupying the remaining top five positions are the United States and the United Kingdom, with 28 and 26 documents, respectively. These results show some interesting outcomes. China and Russia predominantly speak and write in Chinese Mandarin and Russian, respectively, yet they produce more papers published in the English language than other English-speaking developing countries, like India, for example. It is also notable that Spanish speaking nations are not represented in this top ten and this speculatively may reflect a more robust and confident academic publishing culture in the Spanish language.

4.6. Regional Distribution of Publications

The extracted data underwent further scrutiny, with a country-level analysis aimed at identifying the geographic regions and count of countries of respective regions where empirical research pertaining to the digital economy in developing nations has been actively conducted. Figure 8 provides an overview of the cumulative regional contributions to the body of knowledge in this field.

The chart reveals that the majority of authors engaged in this research area are from countries situated within Europe (25 countries) Asia, (24), and Africa (14), respectively. In contrast, Oceania exhibits the lowest number of participating countries, represented by only 2 countries.

North America and South America exhibit relatively similar patterns, represented by 4 and 5 of the total countries, respectively (and again, this result is potentially influenced by a strong Spanish-language publishing culture).

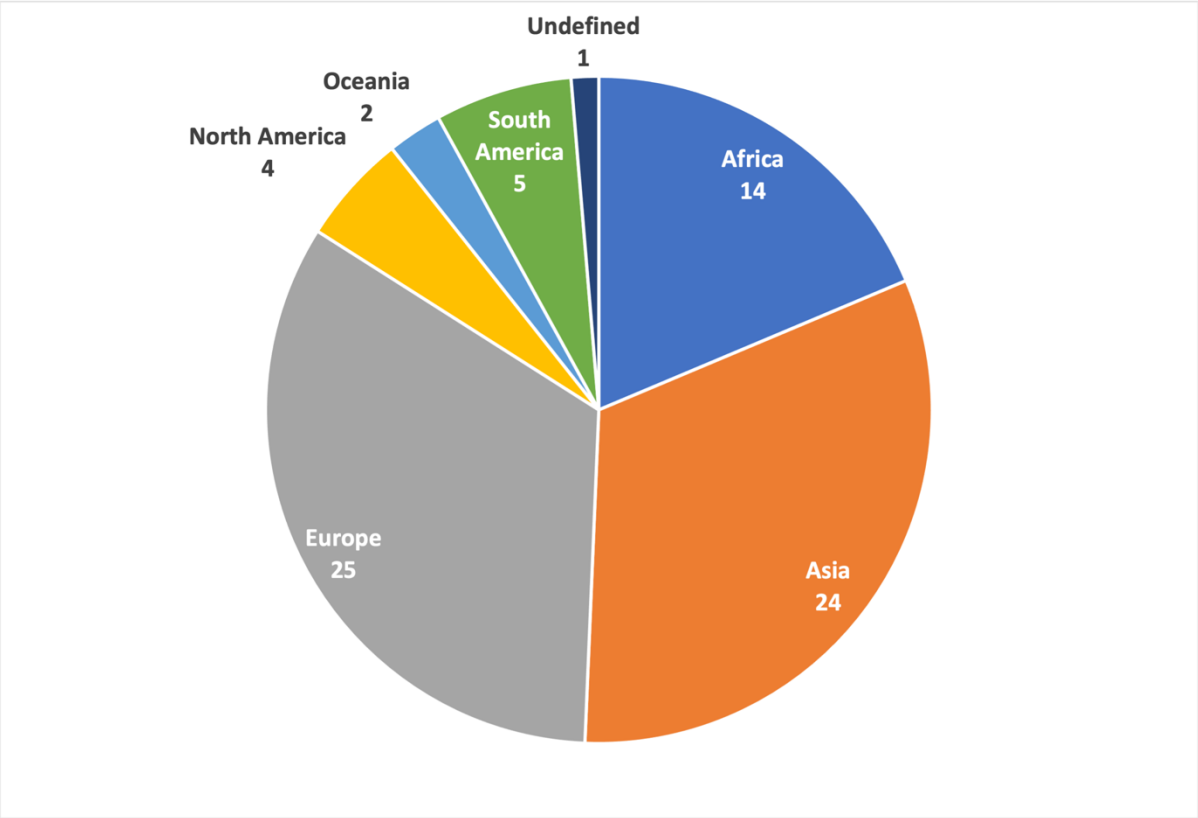

Figure 8: Geographic Regions and Count of Countries with Publications

Additionally, an analysis of the regions with the most significant influence in terms of the aggregate volume of papers published throughout the reviewed period was developed. Figure 9 shows the percentage distribution of published papers categorised by continental regions. It is important to acknowledge that higher volumes of empirical research translate into a more extensive reservoir of data that enriches comprehension of the intricate interplay between the digital economy and the diverse developmental factors and challenges encountered by respective regions.

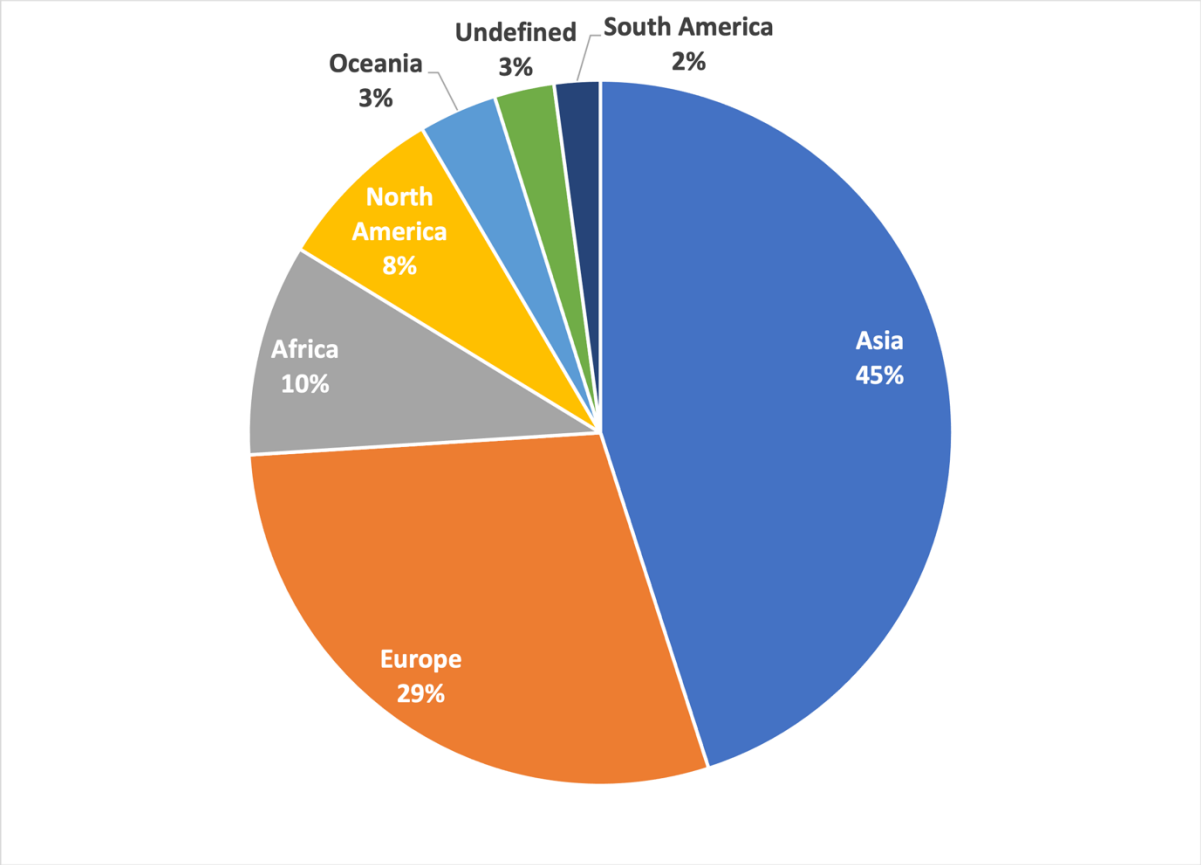

Figure 9: Regional Distribution of Aggregated Volume of Published Papers

Asia emerges as the dominant contributor to the discourse, accounting for 45% of all publications between 2003 and 2023. Europe follows closely, albeit with a much lower share of publications, at 29%. Africa registers a comparatively small contribution at 10%. North America, Oceania, and South America collectively exhibit fewer publications, constituting 8%, 3%, and 2%, respectively, indicating a lesser research focus on this topic within these regions.

In summary, with respect to regional spread, Asia leads in both the volume of publications and the assortment of countries involved, underscoring its prominence as a key region in terms of research output in the domain. Europe also maintains a relatively high volume of publications. Africa, despite consisting of over 50 countries, about half of which are recognised as English-speaking, and the vast majority classified as developing countries, it exhibits a smaller representation in publication count.

4.7. Top Contributing Authors

Examination of the digital economy within the framework of developing countries has attracted scholarly attention from individual authors and collaborative co-authorship teams. To ascertain

the author(s) wielding the most impact within this field, an analysis of documents published in the English language sourced from the Scopus database was conducted, categorising them by author names. The findings revealed that Bogoviz Aleksei V., an independent researcher from Moscow, Russia, has emerged as the most prolific contributor, having authored the highest number of articles – four in total. Notably, three of these papers were published in the year 2021 alone, with an additional one published in 2023. Specifically, the author engaged in collaborative efforts, co-authoring three papers (Alekseev et al., 2021; Bogoviz et al., 2021; Popkova et al., 2023), and singlehandedly authored one (Bogoviz, 2021). This outcome suggests a strong impact on the domain. Figure 10 illustrates the top 10 contributors (without any authorship weighting for co-authored papers).

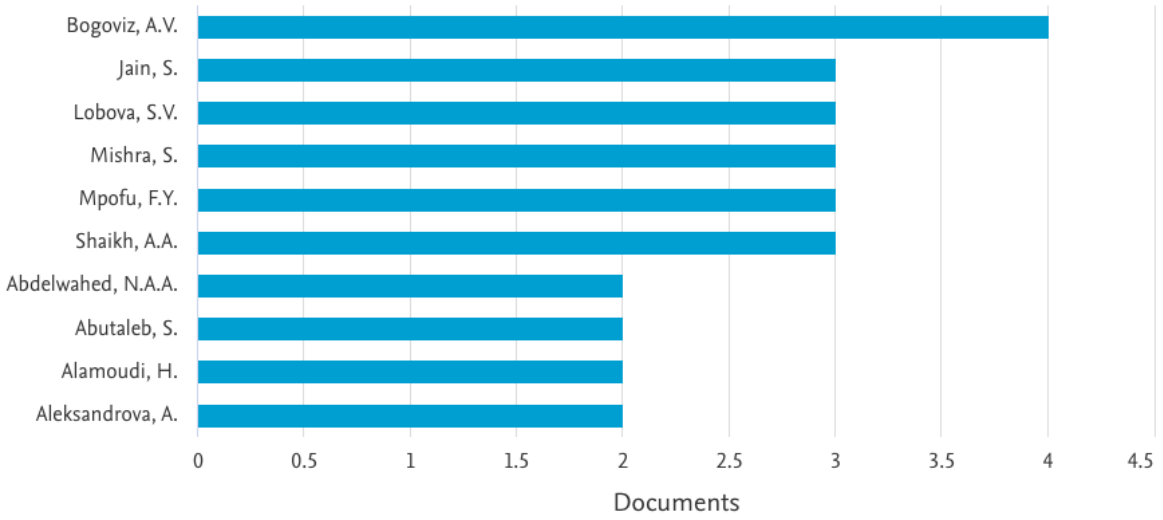

Figure 10: Top Ten Contributing Authors

4.8. Most Cited Publications

Taking consideration of individual authors further, the analysis also looked at whose paper(s) had the highest number of citations. Although it is somewhat misapplied in Google Scholar where most authors will encounter this score, Bihari et al. (2023) argues that the h-index is a reliable indicator of an author's impact within their specific domain of expertise, shedding light on the influence that their work has exerted in the scholarly community. Regardless, it is a relatively simple metric, i.e., a count of the number of papers that have had the equivalent number of citations or higher. For example, a score of 5 indicates that an author has had at least five papers all cited more than five times. H-index scores have value in de-prioritising low cited papers and ignoring a single or small numbers of "shooting star" papers.

The analysis unveiled that the paper authored by Kumar et al. (2018) has garnered a remarkable 240 citations, underscoring their significant impact within the field of inquiry. Of the others, it is noteworthy that out of the 358 documents considered, only 24, or 6.7% of the total, have crossed the threshold of obtaining 50 or more citations, pointing to a small set of noteworthy papers. The top 10 most cited publications (Table 2), offer a succinct overview of the contributions that have attracted substantial recognition within the literature. The variable quality of different journals is also confirmed in this list with SJR-ranked journals which scored greater than 1 appearing here. The table is sorted from highest to lowest.

S/N	Document Title	Author(s) and Year of Publication	Source	Number of Citations
1	A strategic framework for a profitable business model in the sharing economy	Kumar et al. (2018)	Industrial Marketing Management	240
2	Ride-hailing, travel behaviour and sustainable mobility: an international review	Tirachini (2020)	Transportation	149
3	Innovation in emerging economies: Research on the digital economy driving high-quality green development	Ma and Zhu (2022)	Journal of Business Research	135
4	The Global Platform Economy: A New Offshoring Institution Enabling Emerging-Economy Microproviders	Lehdonvirta et al. (2019)	Journal of Management	127
5	Upsides and downsides of the sharing economy: Collaborative consumption business models' stakeholder value impacts and their relationship to context	Dreyer et al. (2017)	Technological Forecasting and Social Change	117

6	First-mover firms in the transition towards the sharing economy in metallic natural resource-intensive industries: Implications for the circular economy and emerging industry 4.0 technologies	Chiappetta Jabbour et al. (2020)	Resources Policy	85
7	Rapid expansion of international new ventures across institutional distance	Deng et al. (2018)	Journal of International Business Studies	85
8	Chinese travelers' behavioral intentions toward room-sharing platforms: The influence of motivations, perceived trust, and past experience	Wu et al. (2017)	International Journal of Contemporary Hospitality Management	83
9	Determinants of consumers' participation in the sharing economy: A social exchange perspective within an emerging economy context	Boateng et al. (2019)	International Journal of Contemporary Hospitality Management	75
10	Chinese culture and e-commerce: An exploratory study	Efendioglu and Yip (2004)	Interacting with Computers	74

Table 2: Top 10 Most Cited Authors and Their Publication Titles

4.9. Top Funding Sponsors

In a similar manner to the examination of influential authors and impactful papers concerning the digital economy within the context of developing countries, examination of the funding sponsor(s) that have played a significant role in facilitating research endeavours was conducted. The outcomes (Table 3), ranked in descending order based on the number of publications they have supported, reveal that the 'National Natural Science Foundation of China' emerges as the preeminent funding sponsor, having commissioned or supported the research and publication

of 24 documents in just seven years, from 2017 to 2023. It is also noteworthy that, among the top 10 funding sponsors, institutions based in China occupy the top four positions (and 5 of the 10 positions overall).

S/N	Funding Sponsor	Country of Sponsor	Number of Publications
1	National Natural Science Foundation of China	China	24
2	National Office for Philosophy and Social Sciences	China	12
3	Fundamental Research Funds for the Central Universities	China	9
4	Ministry of Education of the People's Republic of China	China	5
5	Deanship of Scientific Research, King Saud University	Saudi Arabia	3
6	Economic and Social Research Council	United Kingdom	3
7	European Commission	Belgium	3
8	Australian Research Council	Australia	2
9	China Postdoctoral Science Foundation	China	2
10	Commonwealth Scientific and Industrial Research Organisation	Australia	2

Table 3: Top 10 Funding Sponsors and Their Domicile

To provide a more contextual understanding, a tree map analysis was also completed (Figure 11) to ascertain the collective number of publications commissioned on national levels by the top 10 funding sponsors. This was done by aggregating the funding sponsors by their respective country-domiciles as single entities. The outcome of this analysis indicates that research funding sponsors situated in China, in combination, commissioned a total of 52 documents.

This figure completely surpasses the cumulative total of the next four countries, combined, with a ratio four times greater. This result clearly underscores the substantial lead that China-based funding sponsors have in terms of their research support for this domain. This should also be considered in light of the country's major means of oral and written communication being Mandarin, and not English language. While there is encouragement for scientific publications to be in English it is impossible to quantify within the scope of this study the volume of additional work in other languages that this funding sponsorship has also supported.

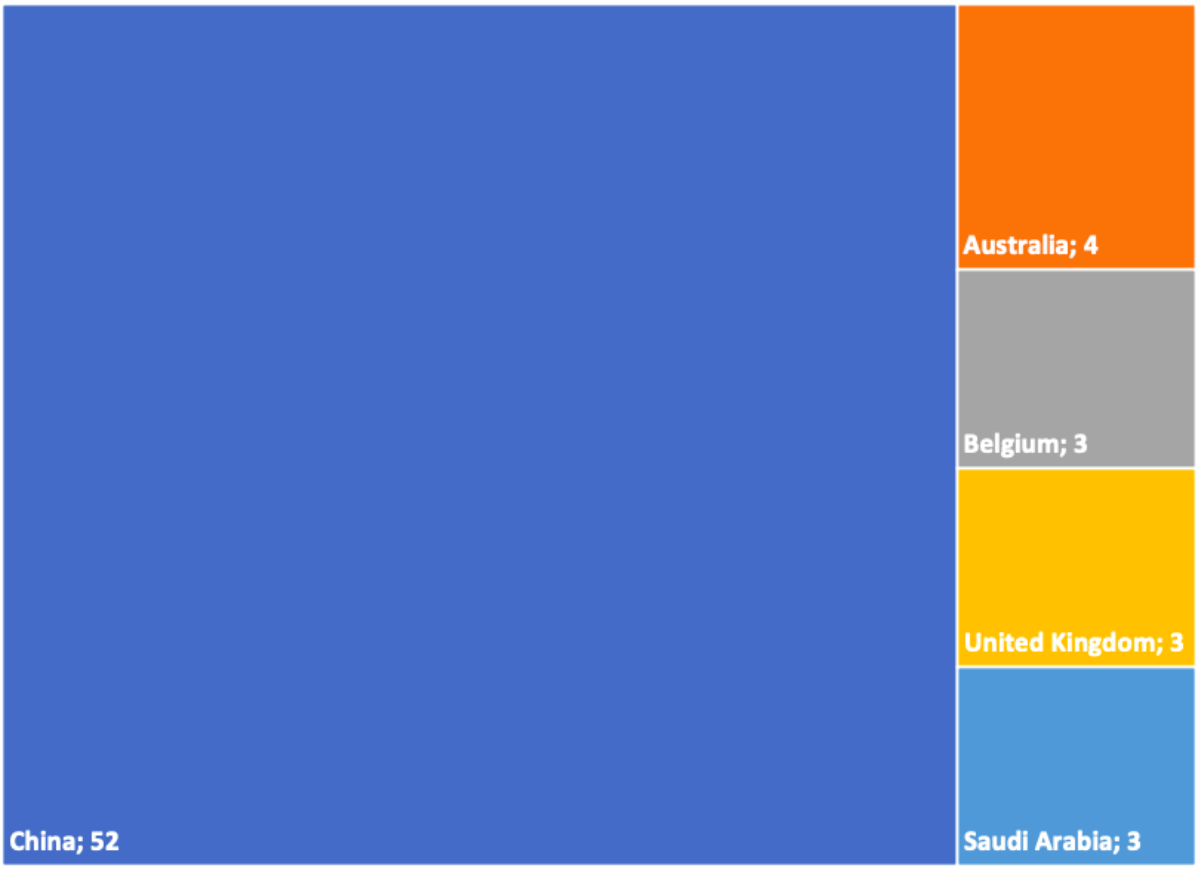

Figure 11: Country-Analysis of Aggregate Count of Papers Commissioned by Funding Sponsors

4.10. Keyword Co-occurrence Map

In order to visualise the prevalent author keywords and index keywords chosen by authors and publishers, respectively, and to delineate the interrelationships between them, a keyword co-occurrence analysis was undertaken. This analysis not only offers insights into the prevailing trends in keyword selection but also sheds light on the evolving popularity of specific keywords within this field.

For the purpose of this analysis, a minimum threshold was set to focus on keywords that appeared at least 5 times across the 358 papers downloaded. Out of the 2,096 identified keywords, only 82 met this threshold (Figure 12). The colour scheme employed in presenting these results using the VOSviewer software signifies that keywords and phrases shaded in purple and blue are waning in popularity, while those tinted green and yellow are gaining prominence among authors in this domain.

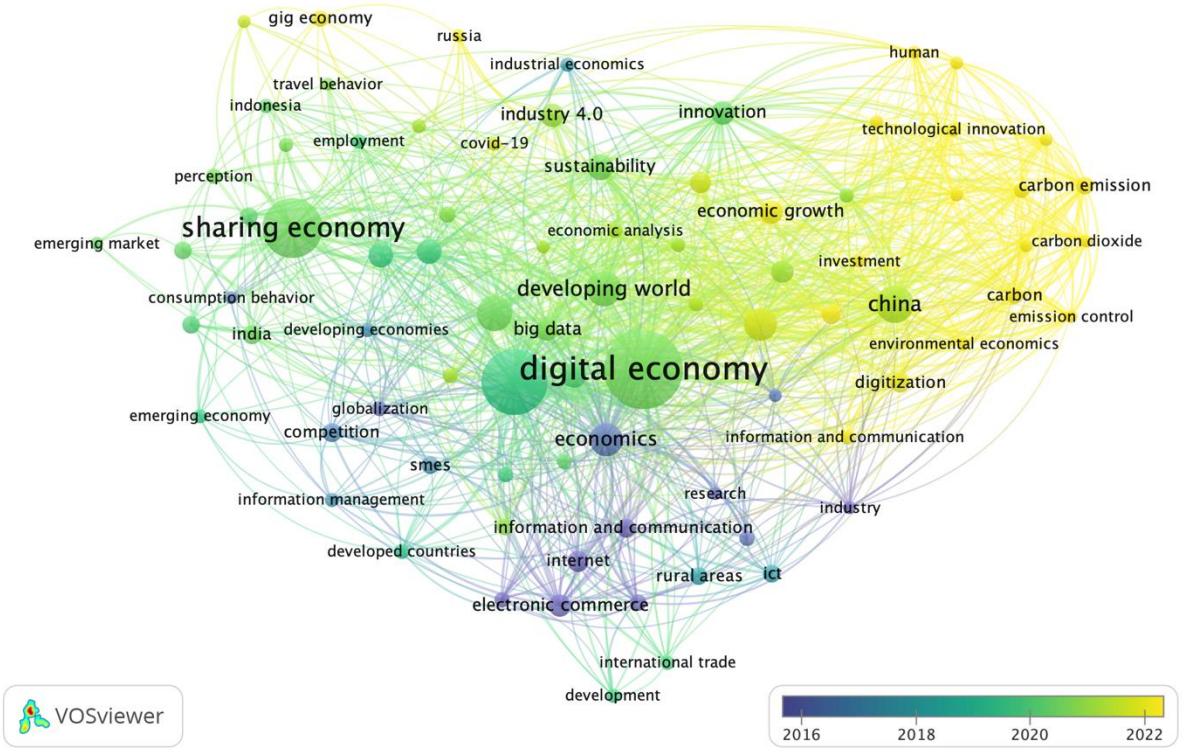

Figure 12: Keyword Co-occurrence Map

The findings from the analysis indicate a substantial interest in research at the intersection of the digital economy and sustainability. Keywords and phrases highlighted in yellow, such as ‘carbon,’ ‘environmental economics,’ ‘emission control,’ ‘digitisation,’ and ‘gig economy,’ among others, are indicative of the growing areas of focus for researchers in the years 2020-22 and beyond. Conversely, keywords and phrases like ‘competition,’ ‘SMEs,’ and ‘electronic commerce,’ among others, which were more prevalent before 2017, now appear to be waning in overall popularity.

Table 4 shows the most frequently occurring keywords, along with the number of times they appear in the titles and/or abstracts of the 358 papers sourced from the search results. While

the first two keywords are unsurprising given the context. The prevalence of China is again apparent. Nonetheless, it is worthy to note that the influence of the journal, Sustainability (Switzerland), in the examined outputs may be distorting the country name (China) as a keyword in the corpus of works, considering the volume of works published in the journal by researchers from and in that country.

S/N	Keyword	Number of Occurrences
1	Digital economy	118
2	Developing countries	87
3	Sharing economy	75
4	China	33
5	Developing world	30
6	Sustainable development	30
7	Economics	27
8	Economic development	26
9	Sustainability	17
10	Economic and social effects	16

Table 4: Count of the Most Frequently Occurring Keywords

4.11. Term Co-occurrence Map

Furthermore, a term co-occurrence map was developed (Figure 13), which is a visual aid to facilitate the comprehension of the prevailing themes appearing in the authors' titles and abstracts, and the interconnections between them. To ensure a focused representation, a minimum threshold for term inclusion was established. This means only terms that appeared at least 10 times within the 358 documents extracted were considered. Out of the 8,723 identified terms only 209 met this threshold. Notably, the VOSviewer software, by default, incorporates 60% of the most pertinent terms into the visualisation, thus ensuring optimal visibility and legibility for human observers. Consequently, the software analysed a total of 125 terms.

This analysis shows the thematic trends characterising research into the digital economy within the context of developing nations. The colour scheme employed segregates the terms into distinct clusters. The weight (defined as the degree to which the term is mostly used), as determined by the VOSviewer software, serves as the unit of analysis. A higher weight, tending towards 1.4, signifies that the given word or phrase is becoming more common in the texts. As such, terms coloured green and yellow represent emerging themes that authors are increasingly embracing. Noteworthy themes emerging from this analysis include 'panel data,' 'technological innovation,' 'effect,' 'platform,' 'China,' 'sustainability,' and 'sharing economy,' reflecting the locus for contemporary research. Words and phrases shaded in purple and blue with weights leaning towards 0.6, such as 'education,' 'competitiveness,' 'transition,' and 'infrastructure,' among others, may exhibit a declining trend, although they continue to hold relevance.

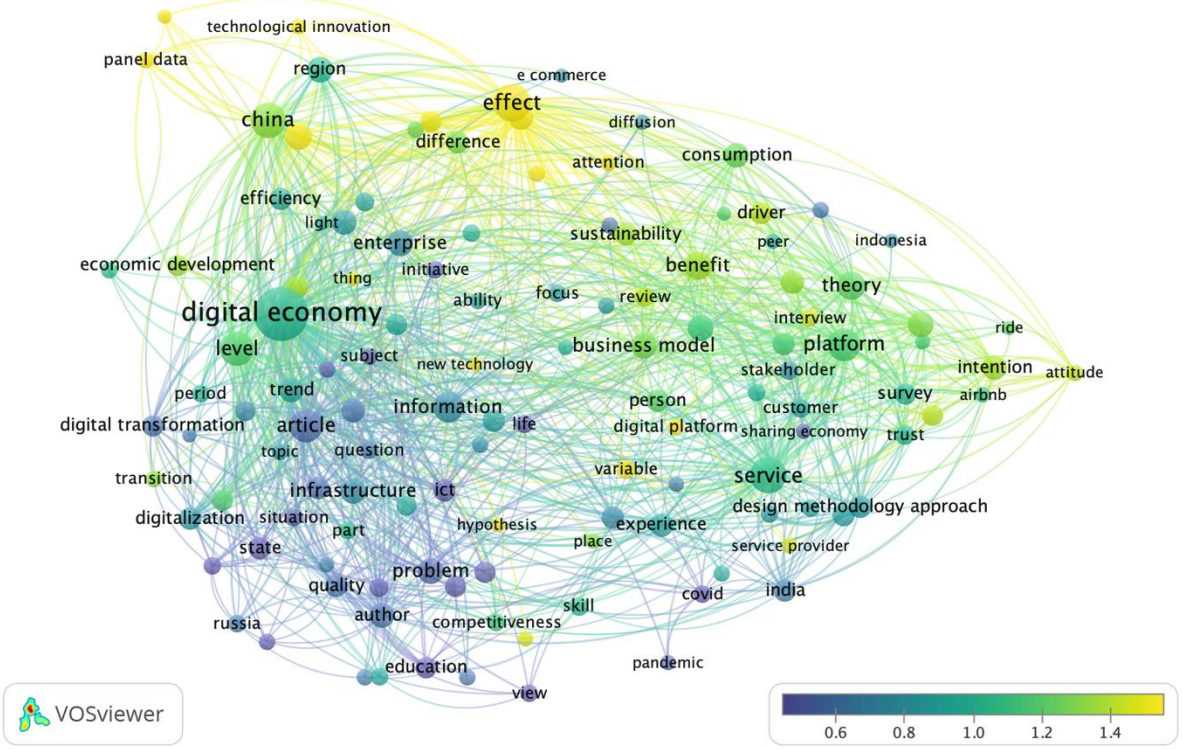

Figure 13: Term Co-occurrence Map

5. Discussion

This study conducted a comprehensive bibliometric analysis of scientific publications in the English language related to the digital economy within the context of developing countries, yielding several noteworthy insights and implications for researchers, policymakers, and practitioners.

The analysis illuminated the relatively young but rapidly evolving nature of research in this domain, with a significant surge in publications from 2019 onwards. The dominance of journal articles (78%) over and above conference proceedings papers (15%) suggests a preference for disseminating research outcomes through academic journals notwithstanding the systemic bias that may exist with the Scopus system. This outcome potentially indicates limited avenues for collaborative discussions and open forums regarding the digital economy in the framework of developing nations. Furthermore, the analysis revealed that researchers predominantly approach the digital economy in developing countries through the lenses of business and management, demonstrating a clear understanding of the profound relationship between digital technologies and society at large. However, even in this observation there is a risk that the wider and more holistic processes and technical interoperability required for successful digital transformation may be overlooked or undervalued in discussions.

A further observation is that the most productive and influential authors, institutions, and journals primarily originate from developed countries in the Global North, including the USA, UK, and Switzerland, with China being a notable exception. This highlights the imperative for greater involvement and contributions from researchers in developing countries who possess firsthand knowledge of local contexts and challenges. This is also an invocation of the need for Global North authors to collaborate with authors elsewhere to bring out the full nuance and complexity of the challenges faced in this domain. Furthermore, this accentuates the call to action for funding sponsors, governmental and development bodies, universities, and research institutions to allocate resources for data-driven empirical fieldwork that can deepen our understanding of the interplay between digital technologies, societal constructs, labour dynamics, and economic growth.

The study also shed light on funding sponsors in this domain, revealing a prominent role played by China-based institutions, with sponsorship of 14.5%, or 52 of the 358 publications

examined. This mirrors China's ambition around the development of digital technology as a key enabler in its own continued national economic growth.

The study identified prevalent keywords and topics within the field, highlighting the importance of subjects like innovation, carbon emissions, environmental economics, and investment. Nevertheless, it drew attention to underexplored areas requiring equal consideration, including the digital divide, the need for literacy, clear policy and governance, ethical approaches, inclusion, and cyber security. These less developed topics are crucial for ensuring an equitable distribution of benefits emerging from a mature digital economy and the mitigation of potential risks as developing countries aim to make the most of digital technology.

The term co-occurrence analysis showcased the evolution of research themes, from an early emphasis on information management and consumption behaviour to contemporary exploration of topics such as digital transformation, innovation, sustainability, and energy efficiency. Geographical analysis pointed to an uneven distribution of publications across different regions, broadly, and developing nations, specifically, potentially exacerbating disparities in research capacity, funding, infrastructure, national policy, and cultural appropriateness. To address this, there is a pressing need for more inclusive and balanced research that caters to the specific needs and contexts of different regions and countries.

Finally, the low citation impact and visibility of numerous publications and journals that have been revealed within this field suggests several influencing factors swaying this research agenda. This includes a current lack of recognition as a crucial domain of research, a potential lack of quality journals supporting this field, as well as a possible deficit in awareness and recognition of the research contributions and implications of the digital economy within the context of developing nations. Considering the pivotal role that digital technologies can play in the economic development of developing nations, identifying these issues presents a compelling need for research that not only adheres to rigorous academic standards but also addresses pertinent issues of relevance.

In conclusion, this bibliometric analysis offers valuable insights into the dynamic landscape of research published in the English language on the digital economy in developing countries, highlighting opportunities for more equitable and impactful research, collaboration, and dissemination of knowledge. Consequently, the field would benefit from more robust research that aligns with the expectations of the wider academic community. This would also ensure

better dissemination and communication of research findings and recommendations to key stakeholders and beneficiaries.

6. Limitations of The Study

This study possesses several limitations that not only merit acknowledgment, but more importantly, serve as avenues for further exploration in future research endeavours.

Firstly, this study exclusively relied on Scopus as the primary data source for conducting the bibliometric analysis. While Scopus represents one of the most comprehensive and widely utilised databases for scientific publications, it may not encompass the entirety of publications in the English language or journals within the field of digital economy in developing countries. Future research efforts may seek to broaden the scope by incorporating other databases or sources, including but not limited to Web of Science, ProQuest, Google Scholar, and regional or localised databases, to complement and cross-verify the outcomes presented here. A technology-driven solution to crawl for papers held in institutional repositories may even be necessary to locate work of relevance which have not been able to get the funding support to be published through open access models.

Secondly, this study employs a predetermined set of keywords and search terms (Appendix 1) to identify publications associated with the digital economy in developing countries. However, it is worth recognising that these keywords and search terms may not encompass all conceivable variations or synonyms pertaining to the digital economy concept nor do they capture the diverse definitions of the phrase, *developing countries*. Subsequent research efforts may explore alternative or supplementary keywords and search terms to refine or expand the scope of investigation.

Thirdly, the analysis within this study leverages a blend of metadata aggregation and qualitative methods and techniques for data analysis and visualisation. Consequently, there is a need to acknowledge the potential limitations or biases that may arise concerning data quality, validity, reliability, accuracy, or interpretation inherent to these methods and techniques. Future research initiatives might consider alternative or additional approaches to corroborate and augment the analysis and visualisation of retrieved data.

Fourthly, this study utilises the VOSviewer software for keyword and term occurrence analyses only. As such, it does not focus on co-authorship, co-occurrence, co-citation, or bibliographic

coupling analyses often executed using the tool. Subsequent researchers could focus on these other dimensions, potentially conducting meta-analyses to offer further depth and richness to scholarship in this domain.

Lastly, the study exclusively considers research papers published in the English language. This limitation is significant, given that several regions of the planet where developing countries are domiciled often communicate in languages other than English. For instance, South America predominantly employs Spanish and Portuguese, while a good number of African countries communicate in Swahili, French, Portuguese, Arabic, and other languages. As a result, the study may have overlooked relevant papers published in languages other than English. Consequently, future research works should consider robust multilingual approaches to ensure a more comprehensive exploration of the subject matter.

7. Future Research Direction

Building upon the findings and implications elucidated within this study, there arises several avenues for prospective research inquiries. These directions are intended to contribute to a more nuanced and comprehensive understanding of this multifaceted domain.

Firstly, forthcoming research should embark on a thorough and more extensive exploration of the underexplored or burgeoning topics identified in this investigation. Notably, areas such as digital inclusion, digital divide, digital literacy, digital policy, digital governance, digital ethics, and digital security merit heightened attention and scrutiny. Probing these subjects with depth and breadth is crucial for grasping the intricacies and addressing the opportunities and challenges inherent in the digital economy within developing countries.

Secondly, future studies should embrace a diverse array of innovative theoretical frameworks and perspectives to dissect and explain phenomena and issues pertinent to the digital economy in developing nations. The adoption of multifaceted frameworks, such as institutional theory, stakeholder theory, resource-based view, dynamic capabilities, social network theory, social capital theory, sociotechnical framework, diffusion of innovations theory, technology acceptance models, technology-organisation-environment frameworks, or other relevant theories and models, can facilitate a more comprehensive examination of the influences exerted by various factors or actors and their reciprocating impact.

Thirdly, forthcoming research should employ other rigorous and robust empirical methodologies and techniques to collect and analyse data connected to the digital economy in developing countries. The application of versatile methodologies, such as mixed methods, systematic literature review approaches, case studies, surveys, experiments, interviews, focus groups, observations, and other methods and techniques, should be harnessed to build a better base of quantitative and qualitative data gleaned from diverse sources and stakeholders.

Fourthly, prospective research endeavours should examine the contextual and comparative facets of the digital economy within developing countries. For instance, comparative analyses between different regions or countries within the developing world, or between developing and developed nations, can unveil commonalities and disparities in terms of opportunities, challenges, strategies, policies, practices, outcomes, and impacts of the digital economy.

Lastly, future research should intensify its engagement with practitioners and policymakers directly involved in the sphere of the digital economy within developing countries. Collaborative efforts with industry partners, governmental agencies, development organisations, and civil society groups hold promise for co-creating knowledge and devising solutions to advance and enhance the digital economy's landscape in developing nations. This synergy between academia and the field can foster practical, real-world impact, and facilitate the translation of research insights into actionable strategies and policies for the benefit of these regions and respective developing countries.

8. Conclusion

This paper presents a novel bibliometric analysis of the digital economy in the context of developing countries, using data from the Scopus database. The paper applies various metadata aggregation methods to evaluate and assess diverse aspects of scientific publications, revealing the trends, patterns, themes, gaps, and keyword network structure of the field, as well as the most productive and influential authors, institutions, journals, and countries. The paper has also provided some visual representations of the research landscape, using various tools and techniques such as trend analysis, top publication sources, authors, and funding sponsors, among others.

To address Research Question 1 (RQ1), the findings underscore a discernible shift in research focus towards long term environmental and economic concerns within the field. Evidently, researchers are displaying an increasing interest in probing and comprehending how digital

technology can foster sustainable economic growth in developing nations while avoiding significant environmental harm.

For RQ2, RQ3, and RQ4, respectively, the study's outcomes illuminate several key facets: Sustainability (Switzerland) emerges for a variety of complex reasons (beyond the scope of this paper) as a journal of choice among authors, the majority of papers published within the reviewed timeframe originate from China, and the National Natural Science Foundation of China turns out to be the foremost funding sponsor in this domain.

Furthermore, the investigation reveals that Bogoviz Aleksei V. has made the most substantial contribution in terms of the number of papers published, firmly addressing RQ5. Notably also, is that Kumar et al. (2018) emerges as the most cited author(s) in the field.

In addressing RQ6, the study identifies prevalent keywords and recurring themes. Prominent keywords include ‘sharing economy,’ ‘China,’ and ‘sustainable development,’ while recurrent themes include ‘technological innovation,’ ‘efficiency,’ ‘digital platforms,’ and ‘sustainability.’ These insights encapsulate the evolving landscape of research within the review period.

The paper further discussed the implications of the results and proposed directions for future research, such as establishing more collaborations and partnerships with researchers and institutions in respective developing countries, and addressing the crucial identified topics that are essential for ensuring the equitable distribution and mitigation of the risks of the digital economy, among others. The paper contributes to the literature by providing an overview of the current state of knowledge about the digital economy in developing countries, specifically focusing on papers published in the English language. It also offers valuable insights for policymakers, practitioners, and researchers who are interested in advancing the digital economy and fostering digital transformation in developing nations. The paper is significant, relevant, and timely as it addresses a crucial topic that has profound implications for economic development, social inclusion, and environmental sustainability in this era of rapid and sustained digitalisation.

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Appendix

1. Bibliometric Analysis Search String (Scopus Database)

(TITLE-ABS-KEY ("digital economy") OR TITLE-ABS-KEY ("network* economy") OR TITLE-ABS-KEY ("sharing economy") OR TITLE-ABS-KEY ("platform economy") OR TITLE-ABS-KEY ("gig economy") AND TITLE-ABS-KEY ("developing countr*") OR TITLE-ABS-KEY ("developing nation*") OR TITLE-ABS-KEY ("emerging econom*") OR TITLE-ABS-KEY ("emerging market*")) AND PUBYEAR > 2002 AND PUBYEAR < 2024 AND (LIMIT-TO (SRCTYPE , "j") OR LIMIT-TO (SRCTYPE , "p")) AND (LIMIT-TO (LANGUAGE , "English"))