Internet of Things systems and Big data analytics for Smart Agriculture: A bibliometric analysis*

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Abstract

By giving farmers access to real-time data on crop yields, soil moisture, and weather patterns, the Internet of Things (IoT) has grown in importance and transformed the agricultural sector. The goal of this study is to present a bibliometric analysis of the most recent advancements in Scopus-based research on IoT for smart agriculture during the previous several years. The study's findings may offer insightful information to academics, professionals, policymakers, and funding agencies that want a thorough understanding of the goals and trends going forward in this field. The findings of this research can offer great chances for collaboration and make it easier to get current information on smart agriculture.

Keywords

Internet of things, Smart agriculture, IoT systems, Big Data Analytics, Sustainability

1. Introduction

The current high supply of food is being sustained by a fast growing demand for food production. The agriculture industry is under a great deal of stress [1-3]. The agriculture industry is facing increased difficulties as a result of conventional methods, traditional farming practices, environmental changes brought on by rising global temperatures and altered climatic circumstances [4-7].

To lessen these difficulties, the agriculture sector must use contemporary technology and techniques [8-11]. IoT is one of the most innovative technologies in wireless communications today. IoT is essentially a massive internet-based network that links devices for improved productivity [12-15]. Modern farming techniques are changing dramatically as a result of the application of the IoT in the agriculture industry [16-23].

Thus, the goal of this systematic review is to locate literature on the advancement of IoT in agriculture that has been scientifically proven, with a focus on the points raised.

2. Methodology

A three-phased literature review process proposed by Webster and Watson (2002) [24] was used to identify studies. Initially, the databases and keywords for the basic search were chosen by conducting a search of the existing literature reviews. After that, a backward search was conducted to look through the chosen papers' references, and lastly, a forward search was used to look through the chosen papers in order to increase their amount. Following the screening process, the papers were categorized based on their substance.

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In order to situate the current literature review in relation to what is currently known about the topic of IoT and smart agriculture and to investigate prior research in this domain, the literature review publications from 2021 to 2024 [25-26] are examined. The main goals of these papers were to define the Internet of Things' characteristics in an agricultural setting and to discuss the latest IoT-based technologies and how the agriculture industry uses them.

The terms "Internet of Things", “Big data” and "smart agriculture" were used to search the Scopus database for articles that had been published in peer-reviewed journals. The chosen articles weren't restricted to any one time frame. The review did not cover books, book chapters, conference proceedings, technical reports, or working papers. Lastly, only articles published were written in English.

There were 133 articles published, due to language restrictions and publication source. 108 articles that were pertinent to the purpose of this work were found after their titles were skimmed. After looking over their abstracts, 60 were approved. Many of the studies were disqualified because it was unable to obtain their entire text. To confirm these, a fast investigation was carried out. This second synopsis made it clear that each one had to be mentioned. Thus, 44 papers were reviewed in their entirety. A total of 47 articles were revealed after 3 more articles from the forward and backward searches were added (Figure 1).

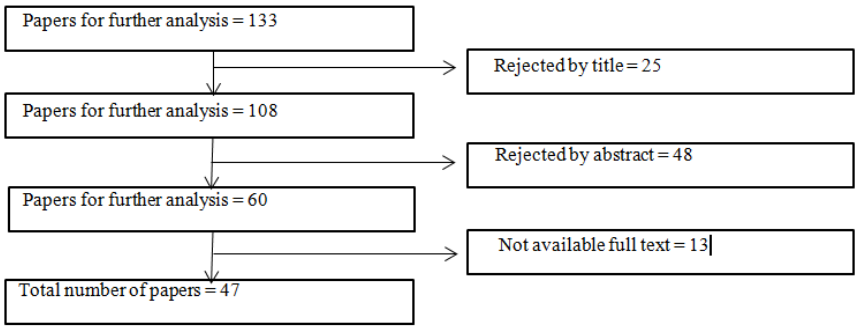

Figure 1: Article selection process

The authors, amount of citations, publication year, and keywords were used to categorize the papers [27].

3. Results

Around 2022, as researchers began looking at IoT technologies that could have an impact on smart agriculture after realizing how important this sector was, the strong practice of IoT in smart agriculture emerged. Such a discovery emphasizes the field's significance as well as its ongoing advancement (Figure 2).

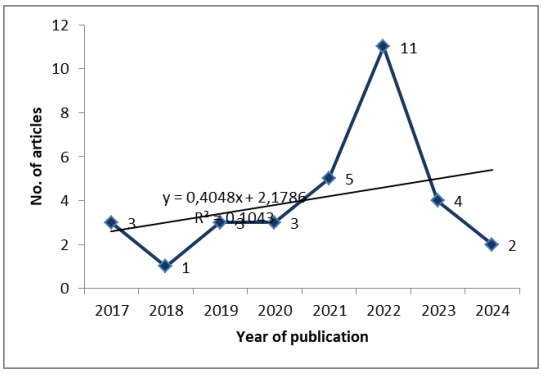

Figure 2: Number of papers per year

Twenty-four peer-reviewed journals have published the papers. Agronomy and Sustainability have each published two papers, while IEEE Access has published three papers. The distribution of publications according to journals is shown in Table 1.

Table 1
Leading journals

Journal name	Cite score	Publisher
IEEE Access	9	IEEE
Agronomy	4.3	Wiley
Sustainability	5.8	MDPI

The most frequently cited articles in the field of smart agriculture are included in Table 2 of this dataset. We obtained the total number of citations for each of these works using Scopus. Next, the year of publication for each work was taken out of the present year (2024) to determine its age.

Table 2
Top cited papers

Title of paper	Number of citations (Retrieved from Scopus)	Age of the paper (in years)
Internet-of-Things (IoT)-based smart agriculture: Toward making the fields talk	613	7
Internet of things for smart agriculture: Technologies, practices and future direction	340	8
Internet of Things for the Future of Smart Agriculture: A Comprehensive Survey of Emerging Technologies	276	3
Recent advancements and challenges of Internet of Things in smart agriculture: A survey	267	2
Review of the internet of things communication technologies in smart agriculture and challenges	98	3

The 47 papers' most popular keywords and the connections between them were shown using VOSviewer. Figure 3 displays the network visualization that illustrates the relationship between the keywords, while Figure 4 displays the heat map. The three most popular keywords are "agricultural robots," "smart agriculture," and "internet of things" and are located in the yellow area. Additional terms like "data storage," "drones," "blockchain," and "wireless communication".

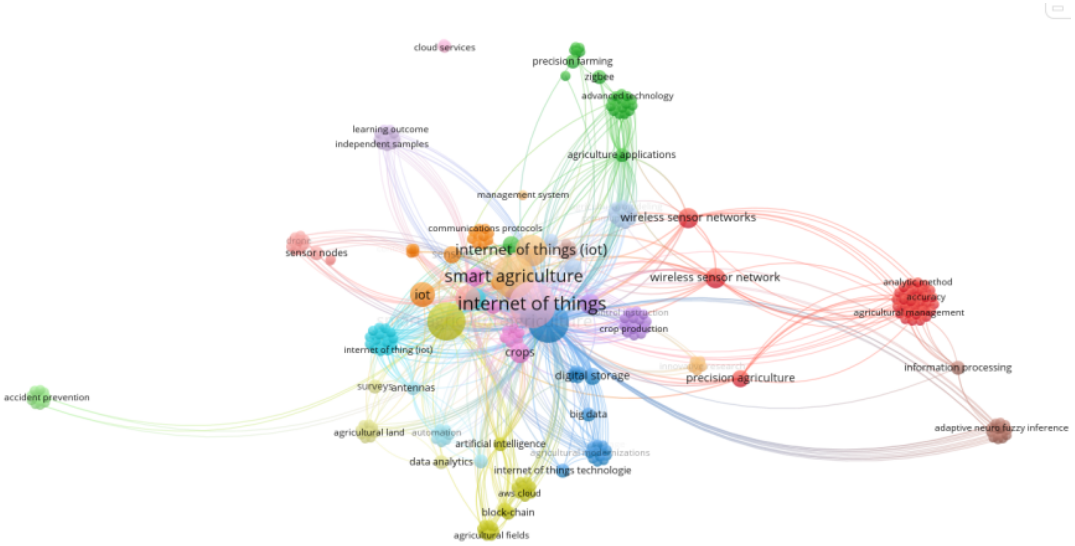

Figure 3: Co-keyword network

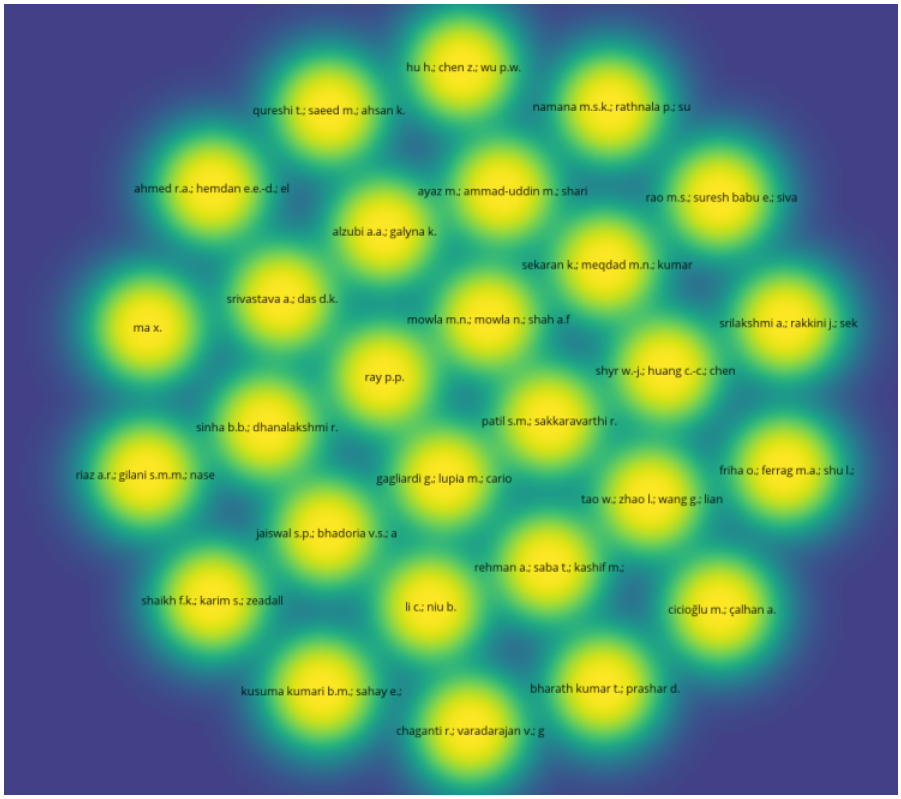

Figure 4: Heat map

4. Conclusions

The following list of limitations pertains to this paper. First, the terms "Internet of Things" and "smart agriculture" must appear in the paper's title and abstract in order for the article to be found in a database. There are undoubtedly publications that concentrate on the topic of IoT in smart agriculture but do not include these keywords in their title. Additionally, the dataset only contained articles from peer-reviewed journals; yet, relevant papers from conference proceedings and book chapters are also present. Another drawback is that the search was limited to English publications, potentially omitting publications written in other languages. The most cited papers, the most active researchers, or the most active institutions may therefore yield different results when using journals or publications from other sources.

In terms of theoretical implications, this paper is a bibliometric analysis that offers a broad overview of a field of study, its development, and the relationships between studies in order to serve as a foundation for further research by highlighting problems across the research domains of smart agriculture strategies. This literature study could be expanded upon by future scholars, who could also include more bibliometric analyses, such co-author or co-citation.

Declaration on Generative AI

The author(s) have not employed any Generative AI tools.

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