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Unveiling the Nexus between Millets and Government Policies: A Bibliometric Mapping Approach

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Abstract

The Sustainable Development Goals (SDGs) consist of 17 interconnected objectives established by the United Nations (U.N.) to address critical global challenges. Aiming to eradicate poverty, protect the planet's ecosystems, and promote peaceful societies, the SDGs strive for these outcomes by 2030. Each goal targets specific issues, encouraging countries to collaborate toward creating a sustainable and equitable future for all. Millets have progressively become crucial for accomplishing these Sustainable Development Goals (SDGs) with their distinctive qualities and advantages. Given the evolving climatic conditions and prevailing hidden hunger, proficient research and developmental attention on millet is necessary to attain food, feed, and nutrition security. With their rich content of proteins, vitamins, and minerals, millets play a significant role in addressing hidden hunger, ensuring that the audience is well-informed and aware of this crucial aspect of food security. Henceforth, no substantial review is provided for an extensive millet and food security overview. To initiate a comprehensive bibliometric analysis of the corpus of contemporary literature, this work uses a VOS viewer and Bibliometric R-package in the area of the contribution of millets and Government. To achieve this, we examined 201 documents in detail from the Scopus database to further determine the publication activities in the relevant area. Examining the subjects dealt with in this field has revealed historical development in this discipline.

Keywords: - Bibliometric analysis, Millets, Government, Review, VOS viewer, Biblioshiny.

I. INTRODUCTION

The Sustainable Development Goals (SDGs), set to replace the Millennium Development Goals (MDGs) after 2015(de Jong & Vijge, 2021), have an ambitious 2030 target to end all forms of malnutrition (Hák et al., 2016). The UNGA resolution aims to increase global knowledge of millet health, nutritional, and climate resilience benefits (Antony Ceasar & Maharajan, 2022). To do this, measures are required to substitute very nutrient-dense cereals like millet for the diet's predominant amounts of rice, wheat, and maize (Kane-Potaka et al., 2021). Millets, a traditional crop grown largely in Asia and Africa (Devisetti et al., 2014), are not just a part of our past but also a beacon of hope for the future. They are regarded as the oldest cultivated crop still in use for feeding humans and animals (Anitha et al., 2024), and most millets thrive in farming conditions where other grains struggle to produce good yields (I. K. Das & Rakshit, 2016). By replacing less nutrient-dense grains with millet, we can enlighten the path to a malnutrition-free future.

Millets have long been essential in many agricultural and culinary cultures across the world (M. et al., 2023). In addition to being a smart food due to its health and nutritional value, millet is also environmentally friendly, and farmers cultivate it to be climate-smart (Anitha et al., 2021). Therefore, creating smart crops includes improved nutrition, resistance to climate change, and essential therapeutic qualities for the future review. Initiatives from national and international organizations are necessary to preserve the traditional landraces of millets, their cultural heritage, and ethnobotanical values to preserve the rights of tribal farmers (Saha et al., 2016). The Government of India, led by Prime Minister Narendra Modi's vision, spearheaded the United Nations General Assembly to bring up awareness of millets, create local and international demand,

and provide people with wholesome food. Resolution (UNGA) designating 2023 as the International Year of Millets because they are less dependent on outside inputs, drought-tolerant, and have a lower carbon footprint than other cereals (Antony Ceasar & Maharajan, 2022). Small millets have also caught the attention of growers and policy-makers in the current consequences of the adverse effects of climate change (Maitra et al., 2022). Climate changes are influencing natural resources, food production, agricultural productivity, and rural livelihoods (Poudel & Shaw, 2016). Countries with high average yields had the biggest anticipated yield losses, indicating that well-fertilized current seed varieties are more vulnerable to heat-related losses (Schlenker & Lobell, 2010a). For instance, the decrease in farmers has led to significant changes in the way food is produced (Tiwari et al., 2023). Millets are being revived with increasing attention both in India and throughout the world due to their nutritional value and resilience to extreme weather conditions (Kane-Potaka et al., 2021).

This paper is dedicated to conducting a comprehensive and innovative bibliometric analysis, with the clear objective of identifying a specific research gap in the existing literature on millets and their role in food security. By employing a Systematic Literature Review, we will systematically evaluate the current body of research, highlight trends, and uncover underemployed areas that warrant further investigation in this critical field. Through this meticulous approach, we aim to contribute valuable insights that can guide future studies and inform policy decisions related to agriculture and food security. To accomplish this primary objective, we need to focus on clear strategies that align our efforts and resources effectively. It is essential to set measurable goals and maintain consistent communication throughout the process. The study addresses the following research questions:

- How are current publication trends on millets and government shaping journals, authors, countries, and research areas, and what impact do they have on the field?
- What theoretical foundations have been provided as the basis for developing and expanding research on millets and government?
- What is the essential keyword used in millets and Government?
- What are the future research areas for millets and Government initiatives?

This study uses bibliometric methodologies to accomplish this, which combines a diverse range of quantitative tools capable of handling large datasets associated with the literature. The bibliometric evaluation of the existing literature then evaluates the current condition of the subject. It identifies areas of study and academic bases of sectors where the use of Millets and Government is examined, and frameworks for additional research are provided. The study has addressed the following issues using the bibliometric analysis technique. Millet has a wide range of applications and is very important to food security. It has gotten significant attention internationally. However, no analysis has yet offered a thorough overview of millets and government.

II. REVIEW OF LITERATURE

2.1. Millets

Millet is a perfect choice because of the strength of its short growing season and great adaptability (Chandra et al., 2020). Compared to many other crops, millets can provide noticeably greater yields on marginal soils with low fertility and minimal input agricultural systems. (S. Das et al., 2019). The government has acknowledged the crop's significance in supplying the public with its nutritional needs. Pearl millet and Finger millet are the most popular millets of food and feed (Hassan et al., 2021). The varietal development should be improved by increasing investment in minor millets. Customers are aware of the importance of millet in their diet and recent fast food habits. Therefore, it might be promoted through various extension activities (Anbukkani et al., 2017). Since they are abundant in many essential nutrients, they offer a further benefit in the fight against nutrient deficits in third-world nations (Hassan et al., 2021). It is a small-seeded cereal crop farmed for food, feed, forage, and fuel. Millets come in around 20 different species. Millets are cultivated all over the world, with India, Nigeria, Niger, China, Mali, and Burkina Faso making significant contributions (S. Das et al., 2019). One of the best crops for sustainable agriculture and long-term food security is millet due to its short growing season and extensive adaptability to many environmental conditions (Sharma et al., 2021).

Millet grains are incredibly versatile and may be processed to create high-quality, gluten-free foods and beverages (Mohod et al., 2023). Several diet-related initiatives are presently popularizing the usage and consumption of small millet in various ways (Lydia Pramitha et al., 2023). Promote research and development on significant crops while ignoring smaller crops of regional significance (Vetriventhan et al., 2020).

III. METHODOLOGY

One of the best methods for determining the caliber of scholarly production is the analysis of bibliographic data using bibliometric methods (Szomszor et al., 2021). This study utilizes bibliometric analysis, which is a quantitative method for measuring extensive databases To achieve this goal, we intend to collect data on millets in the context of government research by examining publication trends related to authors, articles, institutions, and countries. The publication trends in terms of authors, articles, institutions, and countries. The outlook of millets has wide applications in today's competitive world, particularly in the development of innovative value-added products. Data was retrieved from Scopus in October 2024 to gather data for the study. Initially, an extensive search for information was performed in Scopus, utilizing keywords developed through careful examination of publications related to millet and government. Scopus is the world's largest searchable citation and abstract database, which is constantly enlarged and updated (Aghaei Chadegani et al., 2013). Although it would alone be sufficient to employ Scopus, we believe the primary reason is the evident immaturity of the field. We decided to broaden our search for relevant literature since the area is still expanding. Search terms include ("millet" and

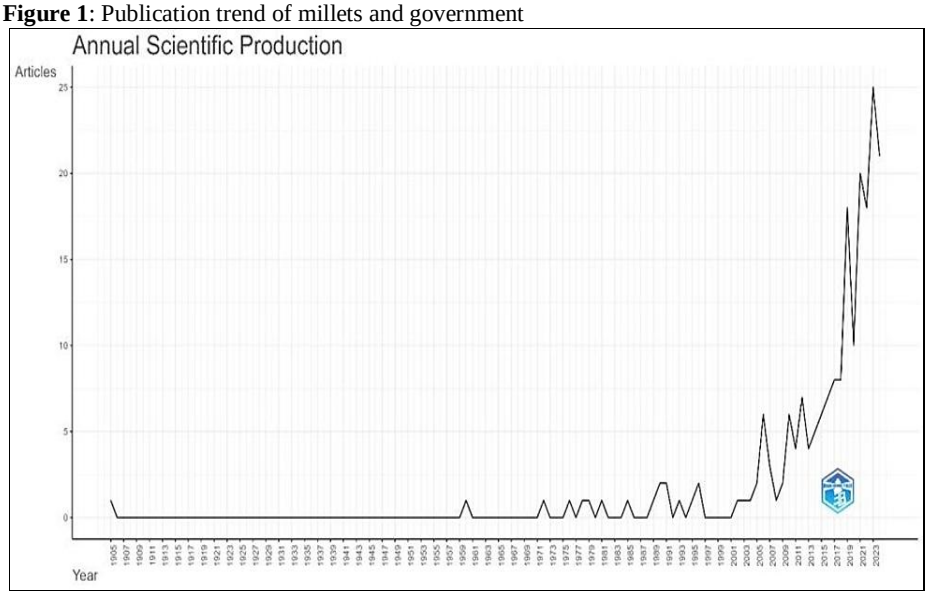
"government") for measuring titles, abstracts, and keywords. It is restricted to English-language and research articles published in the fields of agriculture and biological sciences, environmental science, social science, economics, econometrics, finance, arts and humanities, as well as business management and accounting disciplines.

There are about 201 articles in the final data for conducting bibliometric analysis. The analysis of data conducted using VOS viewer and the R software package enables the creation and visualization of bibliometric networks. These networks can represent relationships between journals, researchers, or publications based on citations, bibliographic coupling, or co-authorship connections. VOS viewer also provides text mining tools that can be used to create and visualize networks of terms that co-occur in a body of scientific literature. The Bibliometric R-package software provides citation-related and publication-related metrics, identifying the most influential authors, publications, sources, and countries based on total citations and the total number of publications. Based on the keywords used in the studies, the Bibliometrix R-package is utilized for keyword analysis, highlighting the trending topics in the area. Besides, to understand the publication activities related to food security and millets, methods such as citation analysis, cooccurrence are used.

IV. RESULTS AND DISCUSSION

4.1. Publication trend of millets and government

Figure 1: Publication trend of millets and government



The figure depicts that the use of millets and different government is relatively new, having begun in 1971. However, it has been steadily increasing in after 2001. The most important years of this publication activities are 2022 (18 articles), followed by 2023 (25 articles), and 2024 (21 articles).

4.2 Top authors, journals of government and millets

Table 1. Top authors and journals in the field of millet and government

Author	TC	Journals	TC
Se graff M	363	New Phytologist	363
Fu X	318	Geoderma	318
Peterson G.A Eliazer Nelson	242	Journal Of Production Agriculture	242
A.R.I	194	Journal Of Ethnic Foods	194
Sarath G	118	Planta	173
Gubbi S	101	Biological Conservation	101
Kerr.R,B	95	Annals Of The Association Of American Geographers	95
Kansanga.M	89	Environmental Research Letters	93
Faye.B	72	International Journal Of Sustainable Development And World Ecology	89
Tralamazza.S.M	68	Agricultural Economics	75

Table 1 presents the citations related to government through millet publications, categorized by authors and journals. Based on citation volume, the leading authors in millet research focused on government are Se Graff M with 363 citations, and Fu X, with 318 citations and displays that the top journal that published millets and government was New Phytologist, with 363 citations, followed by Geoderma, with 318, respectively.

4.3 Co-authorship by countries

Different authors did co-authorship by countries. Out of 52 countries, 37 meet the threshold with a minimum of 1 documents for a country. United States emerges as the leading country in this area, having garnered 1726 citations along with a total of 45 documents, as illustrated in Table 2.It is followed by the India, which has 804 citations and has published 77 documents.

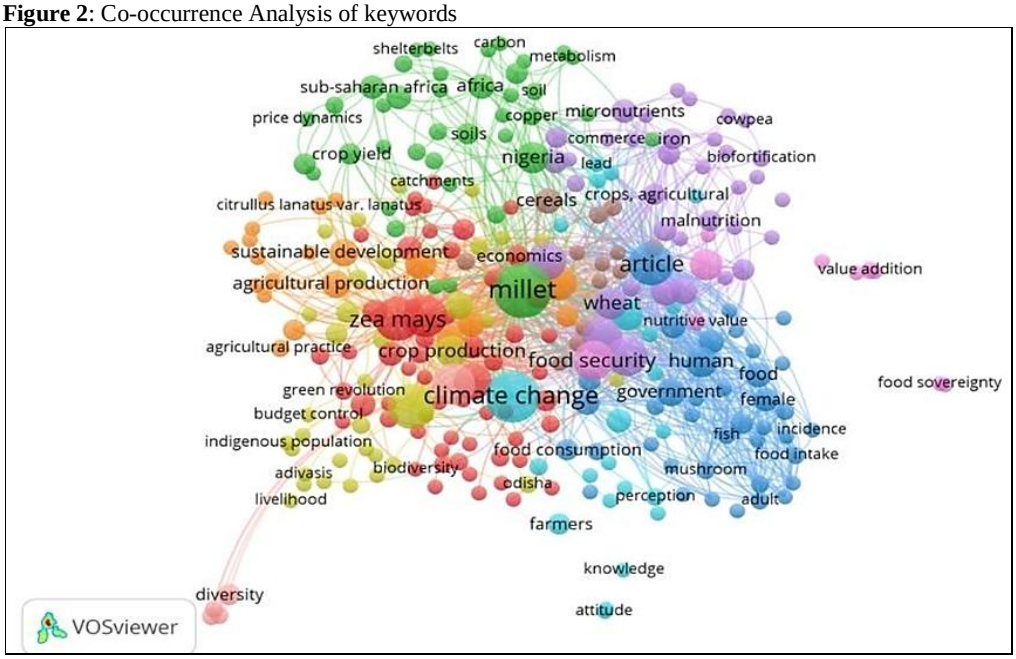
Table 2. Leading nations for study on government role in millet promotion

Country	TP	TC
United States	45	1726
India	77	804
China	13	486
Germany	5	153
France	5	145
Norway	2	139
United Kingdom	6	121
Saudi Arabia	2	117
Canada	3	104
Burkina Faso	2	94

4.4 Co-occurrence analysis.

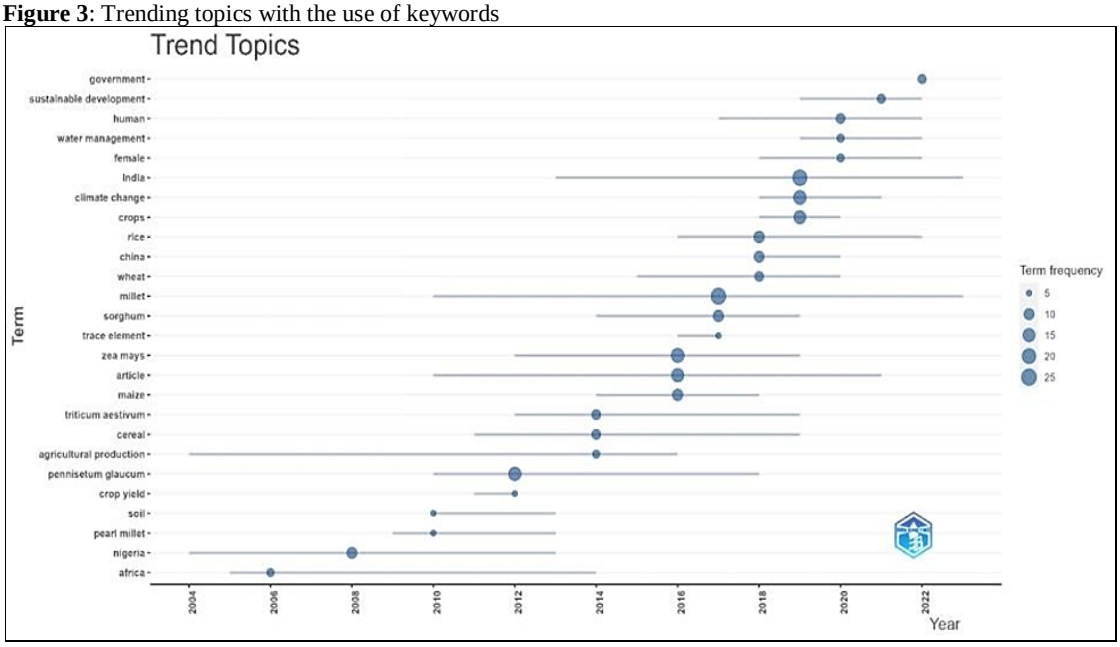
Co-occurrence analysis involves examining keywords to explain concepts. This method highlights the key themes present in studies about the impacts of millet and government, based on the keywords used by the authors in their publications. In total, there were 1570 keywords identified across 201 articles. Among these, 285 keywords met the threshold of appearing at least two times, as illustrated in Figure 2. The figure highlights that "Millet", "Climate change," and "India" have a significant impact on the network. Notably, millet was the most frequently examined concept in relation to climate change and millets, as discussed by the authors in various articles.

Figure 2: Co-occurrence Analysis of keywords



4.5 Trending topics

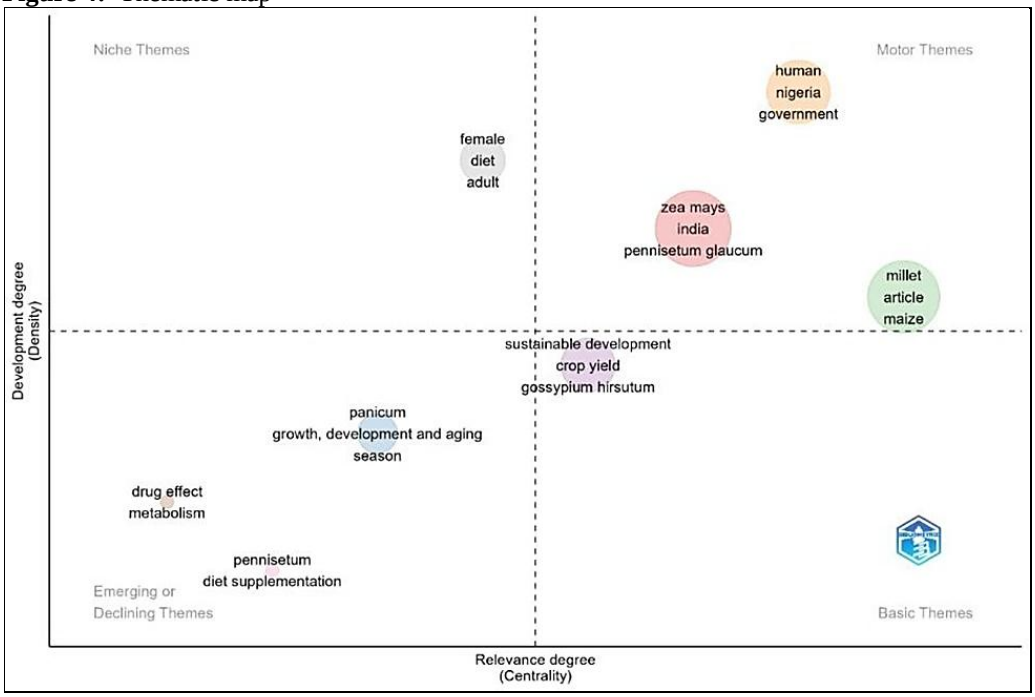
Figure 3: Trending topics with the use of keywords



Analysing the keywords used in articles is a major technique for identifying developing issues and the writers' attention on the subject. The current popular topics in this area, as shown in Figure 3 based on the authors' keyword usage, include government and sustainable development. In 2006 the major studies were in Africa, and in 2012 focus move to pennisatumglaucum. In 2014 the studies on the topic of cereal was trending, then Zea mays in 2016 in 2017 focused on millets. In 2019, the most trending topic was India. In 2018 Indian government celebrated the national year of millets. In 2022 the focus move to sustainable development by different governments. The table displays the top 20 keywords frequently used in millet research and food security. Besides "millets" and "food security," the most prominent keywords include "climate change" and "food supply."

4.6 Thematic Map

Figure 4: Thematic map



The thematic map of millet and farmers shown in Figure 4 is another analysis done with the keywords using the Bibliometric R-package. An analysis of the field's current state and prospects for sustainability is the goal of a thematic map. This analysis helps educate researchers and stakeholders about the possibility of establishing new thematic research topics within a discipline (Agbo et al., 2021). The density and centrality measures determine whether the topics are well developed and their significance, respectively. Each circle's size reflects how many articles have used that particular term. A thematic map has four quadrants. The quadrants are explicated as below.

- The upper-right quadrant reflects the driving/motor themes in Millet and Government. This quadrant contains four clusters, each of which is quite different from the others and is connected by a large number of keywords. It shows that the driving themes in this field are Zea mays, India, Pennisetum, glacum, human, Nigeria and millet and its effect on different governments.
- The basic concepts in the field are shown in the lower-right quadrant. There is only one cluster in this quadrant, and it is on the theme of sustainable development and it is supported by crop yield and gossypium hirsutum.
- Themes in the lower-left quadrant are either emerging or declining themes. There are 3 clusters in this theme are pancium growth, development and aging season, drug effect, metabolism, pennisetum, and diet supplementation. Diet supplementation business has good scope in this era. Pancium growth and development and aging season are important theme to be studied, but it is not well developed yet.
- The upper-left quadrant depicts the niche themes that are studied in millet and government. There is only one cluster in this theme and that is diet policies among adult and females. There should be more effort put into developing the concept of diet plans in millet promotion.

V. THEORETICAL AND PRACTICAL IMPLICATIONS

This work significantly affects the body of literature that already exists in several ways. With the help of a bibliometric network based on analysis of 201 publications published in the millets and food security, this study first examines the theoretical foundations and key aspects of millets. This understanding of the subject's significance can thus be used in the development of future value-added millet products. This study first explores the theoretical underpinnings and key areas of different countries that gave attention to millets. This insight into the subject's importance can thus be applied to the development of upcoming value-added millet products. They require significantly fewer input costs for cultivation, are naturally tolerant to most pesticides, and have additional health benefits and stresses that are biotic and abiotic (Bandyopadhyay et al., 2017). This study is the first to address the research gap using a bibliometric approach, identifying key authors, journals, and, importantly, future research areas in this field. As the study suggests, there is ample opportunity for further research to be conducted in this field. Government

is an area that focuses on sustainable development goals. This study has highlighted the necessity for research to enhance millet cereals as a whole, noting the scarcity of work conducted on individual sub-sectors. This study's main goal is to give academics a deeper understanding of the topic by elucidating its conceptual framework. Next, the findings demonstrate the significant contributions made by the key on this topic. The purpose of this work is to discuss the growing importance of this using a thorough review of the literature on government and millet papers. Millets were found to have a significant potential to contribute to India's food and nutritional security. As a result, we were able to communicate with people who had an understanding of Soon there would be interest in this field as a potential study area.

VI. CONCLUSION

To conduct a bibliometric analysis and identify gaps in research on government and millets is the main objective of this study. To achieve our objective, we conducted a quantitative bibliometric analysis using 201 papers sourced from the Scopus database. To the best of our knowledge, no comprehensive quantitative bibliometric studies have been published.

This effort aims to fill this knowledge gap and establish a foundation for further research in the subject area, promoting its continuous expansion. Additionally, the researchers believe that the findings of this study will serve as a cornerstone for future investigations. This enabled them to discover the existing scientific foundations of current trends and the contributions of millets to food security. These coarse cereals are currently being reassessed as "Nutri-cereals" in light of their nutritional value and composition (Maitra et al., 2022)

VII. LIMITATIONS AND FUTURE RESEARCH DIRECTION

While the paper makes significant contributions, some issues still need to be addressed. One is the choice to retrieve data from a single database as opposed to several sources. Using multiple databases will give the subject broader coverage even though the authors of this study believe that Scopus contains a representative selection of papers from the entire field. The inclusion criteria did not apply to unpublished working papers, doctoral theses, textbooks, or conference proceedings. Furthermore, because the study only considered English-language publications, the importance of research conducted in other languages was disregarded.

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