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Unveiling the Nexus: Sanitation, Hygiene, and Livelihoods in the Pursuit of Sustainable Development Goals - A Bibliometric Exploration

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Abstract

In the United Nations 17 SDGs the sixth policy is clean water and sanitation. One of the most off-track millenniums sustainable goals is sanitation, still 1.7 million people lacks proper basic facility. Globally 3.5 billion people lack proper access to own sanitation, mean they have to open defecate or to depend on other public usage or their neighbours for their relief. Poor sanitation cost health and hygiene and impact the economy very badly. In the digital era, where smart cities and urbanization is happening, still our people defecate openly. The research follows a systematic literature review using VOSVIEWER for analysis and to identify the existing situation prevailing with respect to sanitation in India. The paper aims to address these issues. The database sourced is dimensions. The research takes the support of secondary data from reliable sources like Statista, WHO, UN data base to project the existing facilities obtained by Rural and Urban India. The review paper results that there is gap exist in addressing the sanitation and hygiene in India. Behavioral transformation is the key for the transformation, but people resist to change is one of the prime observations made. Ruthless data say men and women squat next to each other to defecate. To achieve the goal of Sustainable development our land, environment has to be preserved for future generation, where in it is the most crucial time to focus on our sanitation as India stands highest in population.

Keywords**:** *Health, Hygiene, Sanitation, Sustainable Development*.

1. Introduction

The global population is 8.1 billion, out of which only 4.6 billion people are using safe sanitation facilities in the last year (World Health Organization). Sanitation refers to health and hygiene condition, maintaining proper disposal of waste and sewage. Sanitation enhances the standard of living and act as a cause for a healthy life style. It improves the socio -economic condition of an economy leads to life expectancy. In the 21st century India ranks first in the population statistics is an overwhelming fact that people should have access to good

standard of living. One of the flagship programs launched by the Government of India is Swachh Bharat Mission (SBM) to eliminate open defecation in the country and improve solid and waste management practices. Sanitation is vital for everyone to have a healthy living and productive life style. It is the basic need of a human and having access to clean drinking water, proper latrine, solid waste disposal and inculcating waste management practices will be the essential characteristics of sanitation. A decade ago, the world remains off track in meeting the millennium development goal, where in the close to 15% of the population continued to defecate open. The initiative is to increase the number of people gaining access to improved sanitation facilities. Due to ever increase in population and poverty the sanitation in India is witnessed as very poor. Not only because of this, the country's cultural barriers, mindset, ignorance, lack of awareness, mindset, and superstitious beliefs post threat for the same. Lack of proper sanitation not only threatens the human life but also have impact over economic losses, insecurity and poor health and environmental damage. The objective of Swatch Bharath Abhiyan is to eliminate open defecation. One of the most integral policy initiatives of United Nations' is Sustainable Development Goal (SDG) 6 focus on sanitation and hygiene. To conquer it our mother land, environment has to be preserved for future generation, where in it is the most crucial time to focus on our sanitation as India stands highest in population. With the ever-increasing problem of poor sanitation holding the country's economy back, there should be a call to address these issues.

2. Literature Review

Rathnamala et al. (2023) introduces a health risk model that assesses the combined effect of various pollutants on rural households in Karnataka, India. The model, published in Water Science & Technology, considers water-borne, air-borne, and solid-waste-borne pollutants and evaluates how interactions among them impact health outcomes in rural communities. Data collected from 2,370 households helped in the building of a quantitative risk assessment model that relates exposures to pollutants and various health factors for creating a comprehensive profile of environmental health risks faced by such communities. Significant factors of concern identified through the research included the source and quality of drinking water, availability of drainage, practice related to waste management, and sources of fuel used in households. For instance, it indicated that health risks correlate highly with standing water at 0.71, toilets or availability of one at 0.83, and how frequently sanitation facilities are maintained at 0.83. It proved how critical infrastructure plays a role in rural health outcomes. With these correlations, the model can assist the local authority in prioritizing interventions in reducing risks-for example, increasing access to clean water and improving sanitation in waste disposal

Girmay et al. (2023) study titled Factors Influencing Access to Basic Water, Sanitation, and Hygiene (WASH) Services in Schools of Bishoftu Town, Ethiopia: A Cross-sectional Study, 2023, discusses the issues and challenges faced with WASH services in schools of Ethiopia. Such research goes in line with the global action plan referred to as the Sustainable Development Goal 6 where access to WASH is expected universally for achievement in the health, hygiene, and education sectors within the poorer countries of the world. Identify socioeconomic, geographic, and institutional factors that present a barrier to access WASH-an essential ingredient for information in policy for improvement of WASH in education. This particular study builds on previous ones where lack of WASH was documented as the main catalyst of public health issues in Ethiopia, just like other studies illustrating how inadequate water and sanitation facilities afflict infectious diseases and unemployment in Sub-Saharan Africa. The study may offer findings toward more focused intervention to improve the school WASH services thus making the environment safer and healthier for the students.

Choukanpally and Kumar (2021) examines the issues in solid waste management and shortcomings in eight Urban Local Bodies (ULBs) of Hassan District in Karnataka, India, while working under the Swachh Bharat Mission SBM. The principal reasons for ineffectiveness in such processes are the unavailability of low infrastructure; equipment is insufficient to collect, transport, and then dispose of waste. Collection efficiency in these ULBs ranged between 79% and 95%, with significant variations in the physio-composition of wastes to be mostly organic or compostable. There is no doubt that open dumping has dominated because of weak infrastructure base and resource base. However, in some ULBs like Sakaleshapura decentralized processing was started but was discontinued due to operational problems. Recommendations are made on upgradation of collection fleet, sanitary landfill's establishment, and creation of compost pits for achieving alignment with SBM and SWM Rules, 2016. This would mandatorily demand integral infrastructure development and operational inputs toward achieving sustainable waste management practices in the district.

In Towards Open Defecation Free Vijayapura: A Communication Intervention, research study by (Abhilasha & Kakade, 2020) a focused communication approach to reduce open defecation in Vijayapura, India, was highlighted. It goes very well with India's Swachh Bharat Mission, which has fixed an ambitious target for the country to be open-defecation-free by the year 2019. SBM initiative has laid emphasis on the Information, Education, and Communication as the major bridging tools for bridging the gap between toilet construction and its consumption in particular at the rural level as one of the major health and hygiene issues through open defecation. Interventions that focus on hygiene behavior were assessed through communication. The reasons for such interventions are very urgently needed because the practice of open defecation will expose people to all kinds of health risks, including a higher rate of suffering from diarrheal diseases and malnutrition, not to mention more risks of sexual violence for women. Particularly of interest to the study is that adoption for sustainability requires social and behavioural change under the framework of SBM. It has been proved in studies done before that pure infrastructural solutions like toilets are not enough if community buy-in and behavior change do not happen under the framework of SBM. Therefore, in itself, the study adds up as evidence to how the efforts in effective communication can push well-designed sanitation practices and take one step closer to attainment of an Open Defecation Free status that a vulnerable area wants to attain. That, therefore, the communication-based sanitation is supplementary to the more structural efforts where this strategy clearly understands from such similar interventions that work best in trying to play around with complex social norms relating to open defecation.

3. Research Methods

Sanitation simply does not mean having a latrine facility at the house, it involves safe collection, transportation, treatment, and disposal of wastes. Developing countries like India, proper disposal is one of the crucial factors in raising the level of public health. The researcher has taken effort to carry out a bibliometric analysis which is one of the most preferred tools for systematic literature review. Through a systematic bibliometric analysis, we would evaluate the already published scientific articles on the proposed area of study. We have used VOS viewer software for the analysis, the database is from dimension.ai source to gather the documents.

3.1. Search Strategy & Software Used

We have searched the scientific papers from “DIMENSION” database, systematically using the most relevant key terms such as “Sanitation and Hygiene”, Sustainable Development Goals (SDGs), Sustainable Development Goals (SDGs) in India, Sanitation in India, Wash facilities in India. The below Fig.No.1 and Fig.No.2 which

are captured from the dimensions database, exhibits the total number of publications on the title on “Sanitation and Health” and “Sanitation and Health” in India is depicted. A very common observation is that out of total 25000 documents available in the year 2014, close to 18000, documents are from India which is published on the title “Sanitation and Health”. Further, around the globe and specific to India, the research studies focus on Sanitation and Health decline at present 2023, but it was at peak during the pandemic 2020 to 2022, research pertaining to sanitation during the covid outbreak has its greater significance.

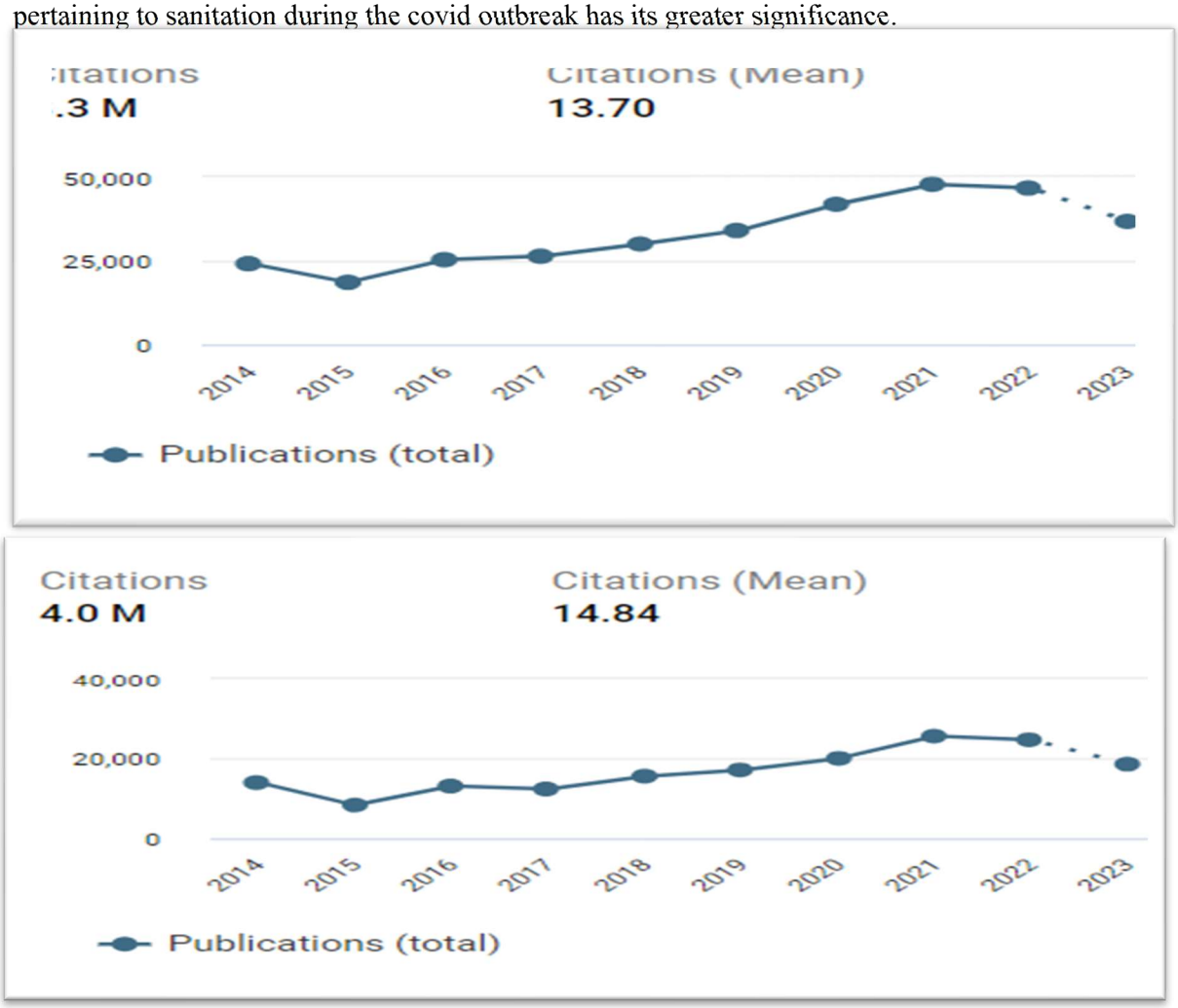

Fig.No.2: Number of Publication in India on Sanitation and Hygiene

The output images presented in the research paper is explored with the help of VOS viewer and MS Excel with the help of indicators in the software. Further we have used PRISMA flow diagram to finalize the number of documents to be supplied to create the maps. The screening strategy of the documents is explained hereunder with the help of PRISMA flow diagram.

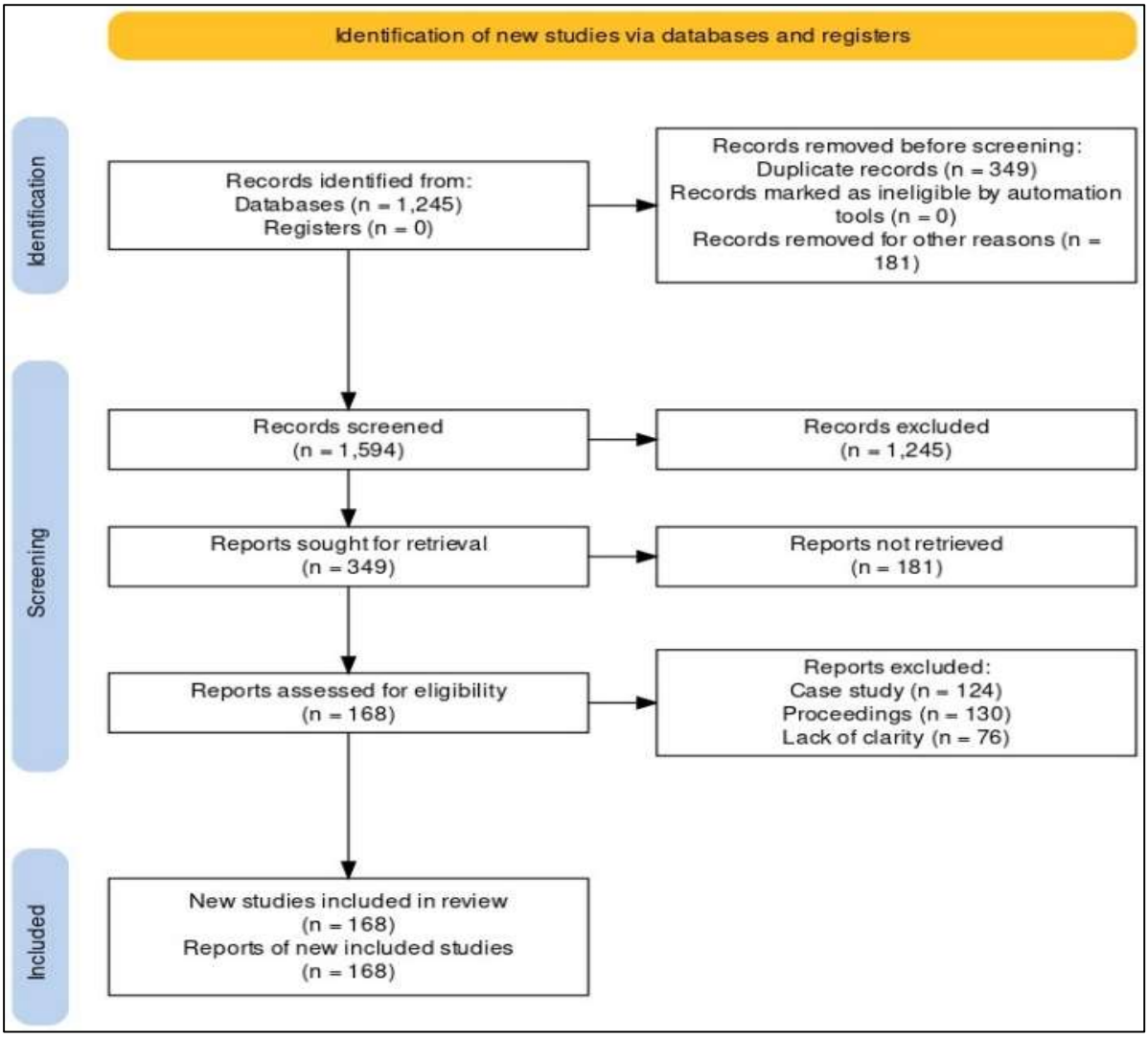

Fig.No.3: PRISMA Flow Diagram

4. Results & Discussion

4.1. Relationship Between Co-Authorship Vs Author

The research attempts to explore the relationship between co-authorship of authors for the source data identified from dimensions. With the full counting method, and authors up to 25 in number were selected. The rider should be an author must possess at least two as minimum number of documents and one citation. Out of the 696 authors in the file, only 45 met the threshold, and for those the total strength of the co-authorship links with the other author is calculated. The result is depicted in the Fig.No.2. From the analysis it is observed that the association strength with the largest set of connected items consists of 17 items, and grouped in to four cluster then it is regrouped as three cluster. The network visualization results that the authors Boisson, Sophie has the highest citation of 634, with a total strength link of 27, followed by Freeman and Mathew having 433 citations with a strength link of 26, then by the authors Garn and Joshua having 406 citations with a strength link of 20.

Further the authors discussed that effective sanitation practices and improved public health contributes for the SDGs goal largely (Whitley et al., 2019). Observed from the study that people who make a living are found to be following unsatisfactory sanitation and unappreciable hygiene, the risk of livelihood is at the promising line. Another challenging issue prevailing in the country is around 80% of the decision about sanitation and hygiene is by male participants as identified by (Routray et al., 2017) leads to low socio-economic status of the country.

Sl. No	Author	Citations	TLS	Sl. No	Country	Citations	TLS
1	Boisson, Sophie	05	634	27	United states	1481	47
2	Freeman, Matthew C.	06	433	26	United Kingdom	1489	34
3	Garn, Joshua V.	04	406	20	India	890	26
4	Routray, Paramita	05	313	18	Kenya	277	15
5	Sclar, Gloria D.	03	406	18	Australia	213	14
6	Clasen, Thomas	04	298	16	Switzerland	574	14
7	Alexander, Kelly T.	02	389	14	Bangladesh	094	13
8	Clasen, Thomas F.	02	389	14	Mozambique	101	12
9	Penakalapati, Gauthami	02	389	14	Germany	458	11
10	Rehfuess, Eva A.	02	389	14	Pakistan	091	11
11	Torondel, Belen	04	140	14	Spain	088	09
12	Majorin, Fiona	03	212	11	Nepal	086	08

Table.No.1: Co-Authorship of Authors and Co-Authorship of Countries

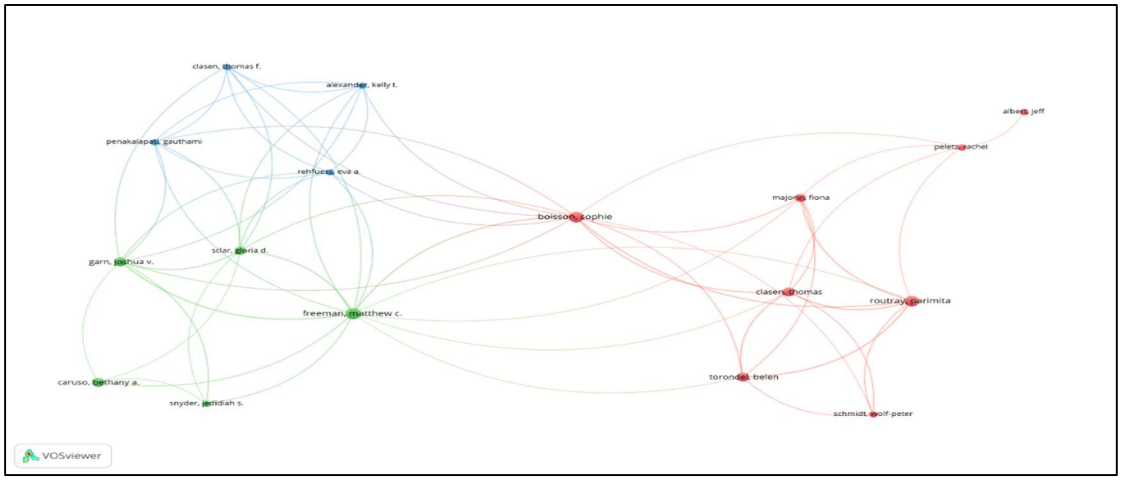

Fig.No.4: Network of Co-Authorship of Authors

4.2. Countries Vs No. of Documents

Out of the total number of final papers filtered for the analysis with the help of PRISMA framework, the greater number of documents on the title sanitation is published in India with 38, followed by United States and United Kingdom respectively, the least is Malawi with two documents.

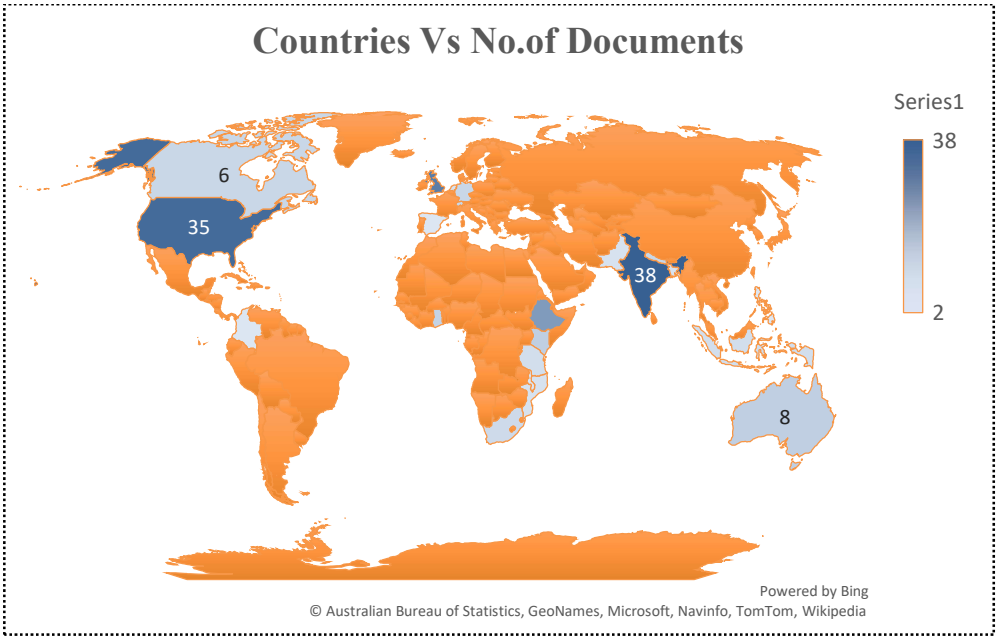

Fig.No.5: Countries Vs No. of Documents Published

Further the researcher is interested to understand the relationship between number of documents published and maintaining good sanitation practices, but the evidence is insignificant. Malawi is one of the poorest, densely populated countries in the southeastern Africa, with only 25% rural access to basic sanitation services with a population of nearly 18.62 million. It is observed that around the globe one of the astounding threats is the call to address the improper sanitation practices and cause towards addressing public health.

4.3. Co-Authorship Vs Countries

Followed by the output diagram of exploring the relationship between co-authorship with countries as unit of analysis, the publication from India in terms of sanitation and sustainable development goals is more from India. Indian sanitation index ranks 120 in 2021, and observed that it is very critical for the country to address its ever-increasing population linking with achieving sustainable development goals, keeping sanitation and hygiene as its prime concern.

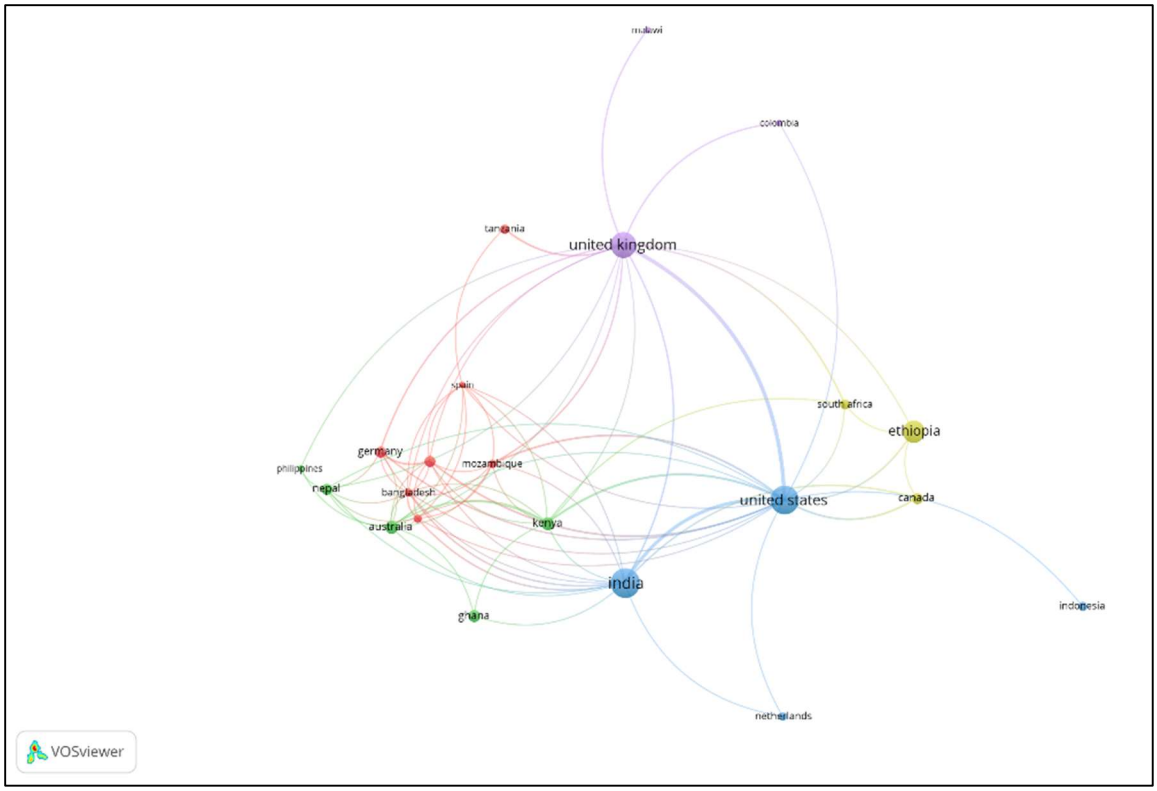

Fig.No.6: Co-Authorship vs Countries

An Exhaustive Study by (Malan et al., 2023) authors from India and Canada results that improper drainage SLWM solid and liquid waste management is significantly associated with increased risk of disease with the help of adjusted logistic regression model, and unimproved latrine in the household premises impacts children at a higher proportionate than the adults. In line with the study by (Augsburg & Rodríguez-Lesmes, 2018) on sanitation and child health results that the indispensable requisite is good health, sanitation has a positive significance over child height most particularly for girls. Based on the same context the researcher suggested to have an increased, wide sanitation coverage in a better context than the existing one, which would result in linear growth.

4.4. Documents Citation

The overlay visualization of the citation of the documents is presented in the Fig.No.7, For the document's citation, the threshold value is set as ten, the document should have a minimum of ten citation The citation link is generated for a total of 45 items which have link connected to each other is observed. The output diagram gives a total of 10 clusters with minimum of three documents in each cluster and spread over a period of seven years from 2014 to 2020.

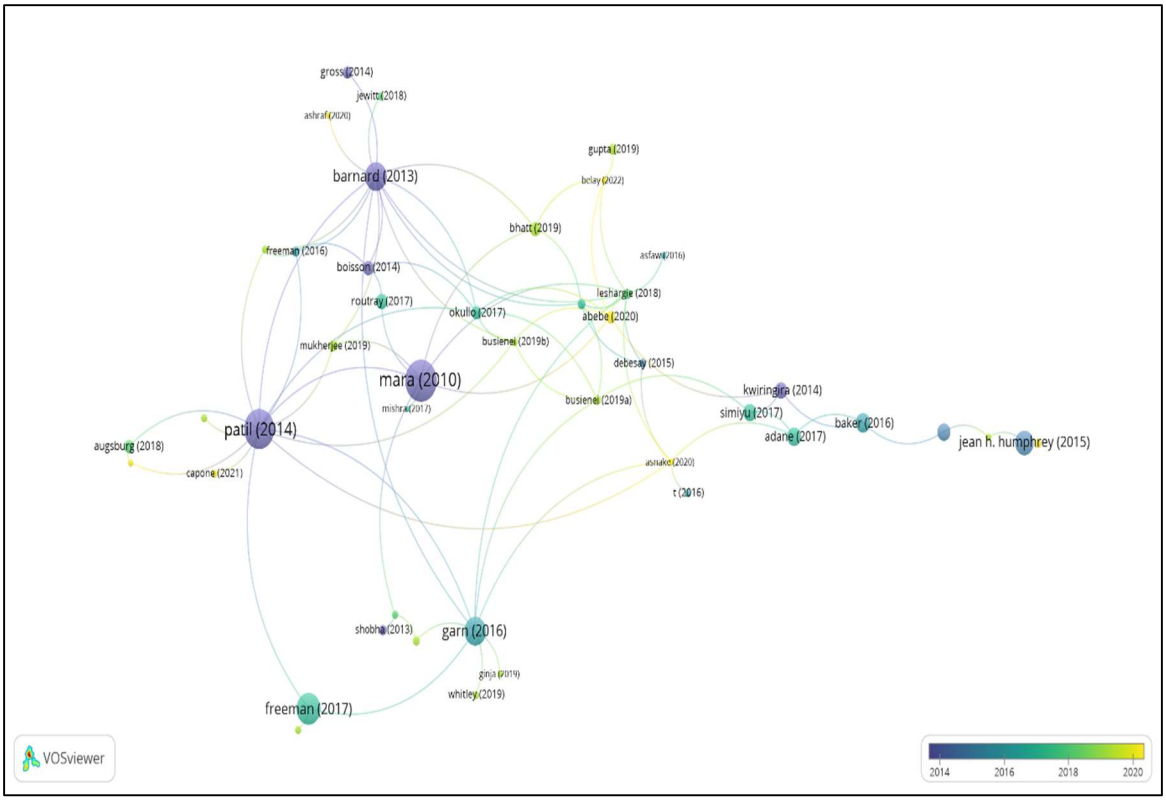

Fig.No.7: Overlay Network Visualization for Citation of the Documents

The maximum number of citations for the document is present in the first cluster 2014, which was published in 2010 having 370 citation as total and recent citation of 74 with a field citation ratio 66, for the paper published in PLOS on the title "Sanitation and Health" observed from the document (Mara et al., 2010) that Unsafe disposal causing global disease burden but people should be more responsible enough to change their behaviour when it comes to sanitation. In developing countries improved sanitation has a significant impact on health and socio-economic development too. Health sector has a very greater part to play with the government support on policy development and sanitation programmes. It is hard but reality to accept that the behavioural transformation on proper use of the constructed latrine helps in addressing these issues in a constructive way. Number of government schemes persisting under Ministry of Jal Shakthi, Rural development, Urban development, health, and welfare which will be more efficient when the people are also equally responsible.

4.5. Co-Citation Vs Cited Authors Density Cluster Plot

The density cluster plot of co-citation of cited authors in the database is presented hereunder. The output has grouped into four cluster with a minimum of three citation per document, out of 2735 authors found the total strength link of the co-citation with other authors will be selected and the maximum number of authors is restricted to 50. Author Classen and Thomas, having a maximum Total link strength of 6554 with 199 citations as the highest citation derived for the density plot outlay.

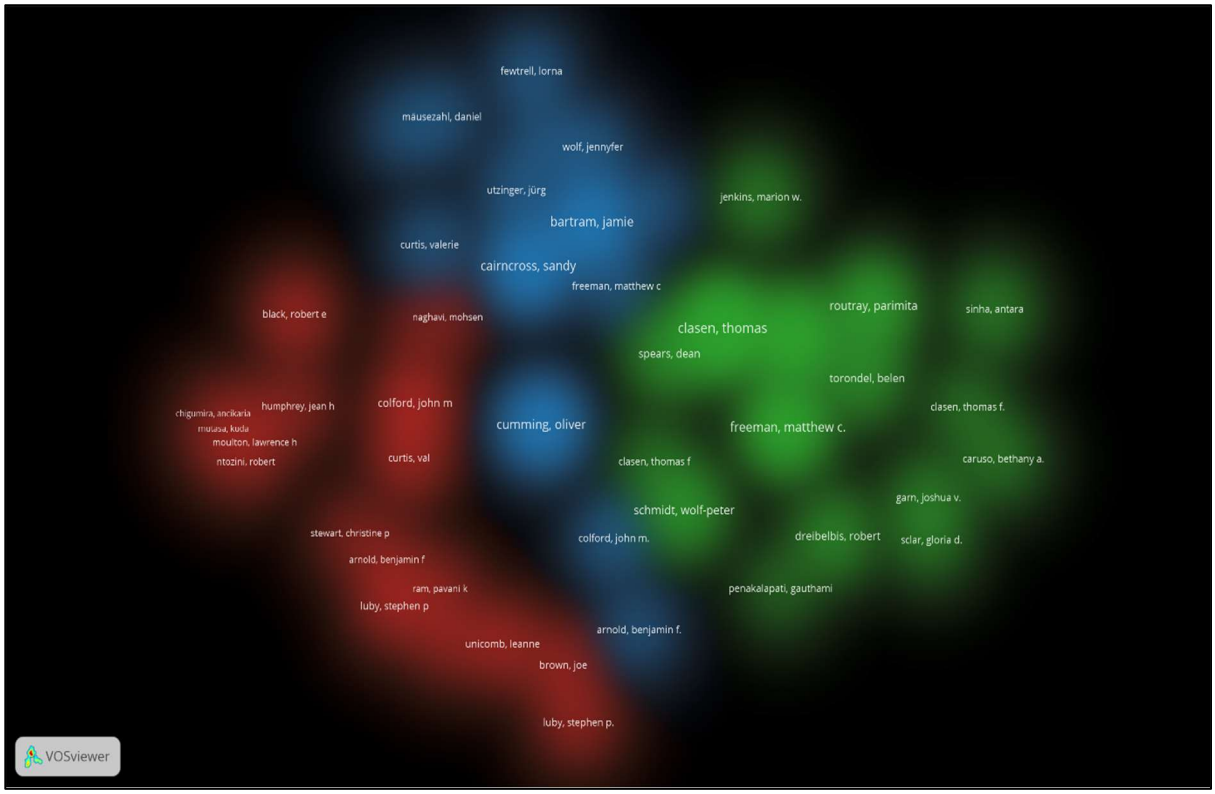

Fig.No.8: Co-Citation Vs Cited Authors Density Cluster Plot

Access to WASH services is directly linked to the health of individuals and communities (Desye et al., 2023). Insufficient access to Clean Water, Sanitation, and Hygiene (WASH) lead to increase in the environmental issue, hygiene and health of the public, lacuna in the education will impact economy and employment, decrease economic productivity, (Manisha, 2015).

In coherence with the findings of (Malan et al., 2023) that improper waste disposal leads to increased disease and risk among the households. In Phase, it was claimed that our country has achieved ODF status in 2019. Phase II (2020-2025) aims to achieve open defecation free plus village. Nearly 2.96 lakh villages declare as ODF plus villages putting the country on track to reach its SBM-G phase II targets by 2024-2025. The top performing states in terms of ODF plus status are Telangana (100), Karnataka (99.5) and Tamilnadu (97.8). But the concern is more about the mental state of the people in these villages following hygiene practices and proper solid waste management disposal.

4.6. Major Discussion from the Top Ten Cited Papers on Sanitation and Hygiene

Research by Malan et al., identified that maintaining good sanitation and hygiene reduce health related issues. Open defecation is closely associated with bone related disease and water contamination, reducing the quality of water directly leads to increased mortality rates (Mara 2017). The author resulted that it is so hard to say that people are not interested to answer the questions pertaining to OD, it is so hard to monitor the sanitation and hygiene of every household. (Girmay et al., 2023) has given insights to address the existing gaps in maintaining WASH services, which needs to be improved at grass root level. (Ghosh & Cairncross., 2014) The traditional

behaviour of OD has a neglected impact in the sanitation coverage of rural India, another reason is the low awareness among the people. Sanitation has a wide impact on health, economy, growth, development, empowerment, and efficiency also impacts GDP, therefore higher level of intervention is required at individual levels to educate them on the water treatment methods and good sanitation practices (Kuberan et al., 2015). Although support from government bodies exist, to witness the improved outcomes of such initiatives; there is a nevertheless dire need for personal hygiene (Water Aid., 2013; Jenkins et al., 2014, Mara et al., 2010) and sanitary education. It is very true from the study that, not the lack of facilities leads to sanitation problem but the irresponsible behaviour pattern of the individuals concerning self-hygiene and environmental hygiene. Therefore, among the community immediate awareness needs to be created (Swain& Pathela., 2016) for effective sanitation facilities. There is a significant relation exist between sanitation and hygiene on health, based on the decent number of papers reviewed it is observed that there should be self-discipline hygiene practices has to followed by individual to rule out the issue persisting in the globe.

4.6.1. Fact observed form the Review

- People must be educated intensively to ensure that they understand the importance of safe sanitation and its effects on environment.
- Awareness campaign can be executed apart from rural level reaching out to schools and colleges in the rural villages.
- Children of age less than five were the victims for the disease spread due to improper sanitation practices.
- A good number of government initiatives is there to support the communities, but improper maintenance and unfair behavior and attitude degrade everything badly.
- There is no evidence to Promote good Hygiene practices among the people of the country.
- One of the pressing challenges of limited drainage system and lack of water preservation presence in India leads to improper sanitation and from fully integrating sanitation into rural areas.
- Sanitation and hygiene relate to the availability of water supply and proper management techniques. Water supply is the cornerstone of sanitation system in any country, lacking in India.
- The preference of open defecation is practiced by the community due to their mental and societal reasons. Behavioral transformation is required badly to address this issue.

5. Conclusion

In the United Nations 17 SDGs the sixth policy is clean water and sanitation. One of the most off-track millennium sustainable goal is sanitation, still 1.7 million people lacks proper basic facility. Globally 3.5 billion people lack proper access to own sanitation, mean they have to open defecate or to depend on other public usage or their neighbor for their relief. Poor sanitation cost health and hygiene to any country and impact the economy very badly. In the digital era, where smart cities and urbanization is happening, still our people defecate openly. Ruthless data say men and women squat next to each other to defecate. In conclusion, the bibliometric review underscores the imperative for intensive education on safe sanitation, emphasizing its environmental implications. The vulnerability of children under five to diseases arising from inadequate sanitation necessitates targeted interventions. The absence of conclusive evidence in certain areas signals a need for further research and data collection to inform more effective policies. Active promotion of good hygiene practices is identified as a crucial component in the quest for enhanced sanitation. Challenges stemming from limited drainage systems

and insufficient water preservation are highlighted, particularly in rural India. Furthermore, the persistence of open defecation due to cultural and societal reasons emphasizes the urgent need for behavioral transformation. Addressing these key observations will be paramount in achieving meaningful progress in sanitation and hygiene practices, particularly in the context of rural communities. To achieve the goal of Sustainable development our land, environment must be preserved for future generation, where in it is the most crucial time to focus on our sanitation as India stands highest in population. With the ever-increasing problem of poor sanitation holding the country's economy back, there should be a call to address these issues. For the future days to come, the developing economies is expecting sustainable, cost optimised, regenerative water and sanitation technologies (Bond et al., 2013). The substantial effort of every one and radical measures of government would help nation to reach the SDGs in the foreseeable future.

6. Future Implications & Limitations

Is sanitation a problem of the poor or insufficient resources, or improper administration and management. But, considering the societal challenges people at the bottom level of the pyramid is affected the most with health issues, due to poor practices of hygiene and sanitation. Non-Governmental Organizations are also giving supportive hands to deliver clean hygiene and sanitation across rural India. WaterAid (Jal Seva Charitable Foundation) an NGO registered which ensures that clean water, decent toilets, and good hygiene for everyone, everywhere. Since 1986, they reached out to 2,60,383 individuals with water, 2.39,533 with sanitation and 3,41,485 with hygiene services. Similar support can help in achieving the goal of SDGs. As of August 2023, only 70% of the villages in India are ODF Plus villages status, but the fact to understand is that how many of them are still have good practices. As because, though after the launch of Clean India Mission, i.e., Swachh Bharath Mission, sanitation coverage has increased close to 60%, yet open defecation continues in India in large numbers. Launching this mission will not only be enough, follow-up is the requisite for a healthy society.

As the nature of this article is a bibliometric review, which would help the readers, researchers, and policy formulators to address this issue by giving prior importance. An empirical paper on the same domain might have a greater milage in understand the prevalent problems in the 21st century. Future researchers can explore the maintenance of ODF plus achieved villages, regarding the existence of hygiene sanitation practices. Further their behavioural intention can be studied, to understand the social stigma prevailing in the countries and the extent to which people are not aware of the impact of sanitation practices and hygiene system. The review also prompts consideration for the behavioral aspects associated with sanitation practices. Future empirical research could delve into the maintenance of ODF Plus status in villages, exploring the existence of hygiene practices and societal attitudes. In essence, this bibliometric review serves as a foundation for future research and policy formulation, urging a holistic understanding of the challenges posed by inadequate sanitation and hygiene practices in the 21st Century.

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