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Assessment of Sanitation Facilities and Combating Health Issues in Rural Area: A Case Study of Polasara Block, Ganjam, Odisha

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Abstract: This paper aims to assess existing sanitation issues in Polosara, focusing on toilet infrastructure, service delivery, health impacts, and environmental consequences. Through primary surveys and stakeholder consultations, 200 samples were collected. The analysis compared behavioural patterns among three sub-groups: HTU (toilet users), HTNU (toilet owners but not using them), and those without toilets. The study derives an overall ranking index to identify factors influencing toilet usage and provides recommendations to address issues faced by vulnerable sub-groups in the village area.

Keywords: Sanitation, Public Health, Toilet users.

I. INTRODUCTION

By 2020, 54 percent of the world's population (4.2 billion people) use a securely managed sanitation services; 36% (26 billion people) use private sanitation facilities connected to wastewater treatment plants; twenty percent (1.6 billion people) used toilets or toilets where sewerage was safely disposed of in the area; and 78% of the work's population (6.1 billion people) use at least one basic sanitation service. Diarrhea is still a major killer but it is very protective but water, sanitation and hygiene can prevent the deaths of 29700 children under the age of five year.

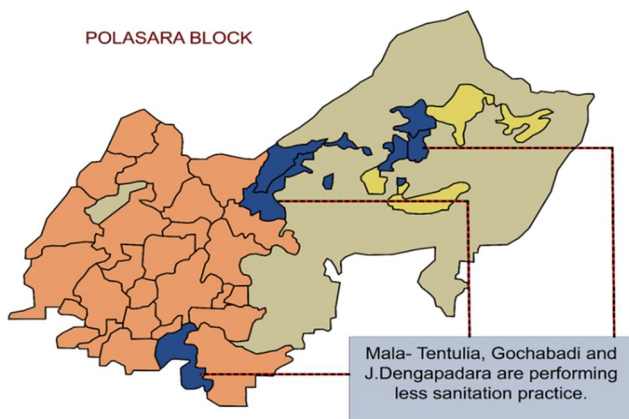
Open delivery fosters a vicious cycle of illness and poverty. In countries where open rebellion is more common, mortality rates for children under the age of five are high, malnutrition and poverty levels are high, and economic disparities are widening. According to the 2015 World Health Organization (WHO) Sanitation Update Report, about 1.3 billion people exercised in public, but in almost all developing regions, especially rural areas, an additional 2.6 billion people use sanitary equipment. Do not improve. It is also estimated that 663 million people worldwide are still using undeveloped drinking water sources, such as unsafe springs and surface water sources. Clean drinking water and sanitation are essential for maintaining human health.

2014 Under Swaacha Bharat Mission Government, government used IHHL for rural people to achieve 100% sanitation by 2030 in India. About 10,60,10,735 toilets are provided but most people do not benefit from them till date. While SBM took up the 2019 toilet coverage survey across the State and found that Odisha and Bihar are the lowest sanitation facilities compared to the other Indian provinces. Though Odisha is government is now focusing on the rural sanitation, by conducting campaigns. awareness programs and educating women's as well through SHG. Still rural people are in practice of open defecation.

The WASH survey of India's health care facilities by Water Aid in 2016 showed open urination (62%) and open urination (38%) at the health facility. According to SBM data, it has been reported that approximately 20% of schools and 52% of Anganwadi centers in Odisha lack toilet facilities. Ganjam is one of the largest districts of Odisha. The Ganjam region reaches 39.77% according to the IHHL, which places just above the state average of 39.16% as per SBM data. People in the economically disadvantaged category, who rely heavily on these water resources to spend the day, are the ones most affected by various vector borne and water borne diseases. Waterborne diseases such as diarrhea, cholera, typhoid and hepatitis are spreading in many areas. People were still seen loosening themselves on the sidewalks in Ganjam district. Some people who used to defecate in the open even though they had toilets in their houses some of the reasons are personal preference, malfunctioning of latrine, not clean/insufficient water, no super structure and so on where about 22.60% is for bad malfunctioning of latrine by the local staffs that are responsible for providing the incentives to registered one. Ganjam county tested a few years ago that monthly health cases in rural areas were reported to nearby hospitals and most of the patients found in the water were found. And the main reason was because of drinking or using unsafe water washes and do water work from ponds, open wells and damaged wells. Continue to use the same water and dispose of debris and household debris in it to make water contaminated. Then people become infected with various waterborne diseases and spread the disease to those people who do not use that water but are connected to it.

A. Disease outbreak

Several cases of cholera were detected in the Polasara area of Ganjam district in Odisha in 2019, and continue to this day, with cases being reported monthly to a hospital near the town of Polosara. Health officials suspect the outbreak was caused by contaminated water. The outbreak, which started after a district festival in the Jakara Village, Polasara region of Ganjam, has now spread to the Jagannath prasad block and the town of Kabisuryanagar. Diarrhea is a water- and food-borne illness that can be caused by germs, gems, or parasites. It causes wet stools, stomach cramps, nausea, headaches, and loss of appetite.



Map 1: map showing villages performing less sanitation practices.



Map 2: Map showing Polasara Block.

II. STUDY AREA

A. Population

Polasara is a Notified Area Committee city in the Ganjam district, with a population of 136,703 people. The village is located at an average elevation of 66 meters and is surrounded by Khordha district, Asika, and Kabisuriyanagar. The total area of Polasara is 402 square kilometers, consisting of 390.28 square kilometers of rural area and 11.81 square kilometers of urban area.

B. Household Data

In terms of household data, there are approximately 29,297 houses in the Polasara block, including 4,806 urban houses and 24,491 rural houses. A significant portion of households in the rural area live in kutchha houses and hutments. The sex ratio in different areas of the village varies, with the highest being 1758 and the lowest being at Mahirakana. The average sex ratio in the study area is 990.

C. Population Projection

Population projection shows that the population in Polasara has experienced a decadal growth rate of 30.24% over the past 10 years. The projected population for the year 2041 is estimated to be 287,600, indicating a growth rate of 63.73%.

D. Site Justification

The justification for the selection of the study area lies in its status as a major exporter block, with increasing population and associated pressures on services. The sanitation condition in the area is deplorable, necessitating efforts to address sanitation issues and ensure a safe and healthy living environment. Various sanitation policies and programs have been implemented in recent years, but there is a need to focus on creating a hygienic and clean environment in Polasara to improve living conditions.

III. METHODOLOGY

To accomplish the study two types of techniques have been used for data collection and analysis.

A. Primary Survey

To evaluate the study area and its impact on addressing health issues. It involves gathering essential information and conducting observations to understand the current state of the study area and identify potential health concerns.

B. Secondary Survey

Involves gathering information and data from existing sources such as from offices (health department, government offices, institutions, NGOs etc.) and official websites (government websites, national and international health organisations, research institute and academic database).

IV. DATA COLLECTION & ANALYSIS

The primary survey analysis was divided in to Physical assessment and Social assessment. The parameter considered for physical assessment are infrastructure, health and environment for the parameter considered for social assessment are occupational status, education level, cultural beliefs/barrier. The survey took in 21 villages of 6 grama panchayat.

A. Trend Analysis Of Toilet Coverage From 2015-2020

The trend analysis of toilet coverage in Polasara block from 2015 to 2020 reveals some concerning patterns. Despite the construction of toilets, there is a low utilization rate, particularly among older toilets. This can be attributed to various factors, including discomfort among some men sharing toilets with women and a preference for open spaces. Additionally, there is a perception among some individuals that using fields for defecation is simpler.

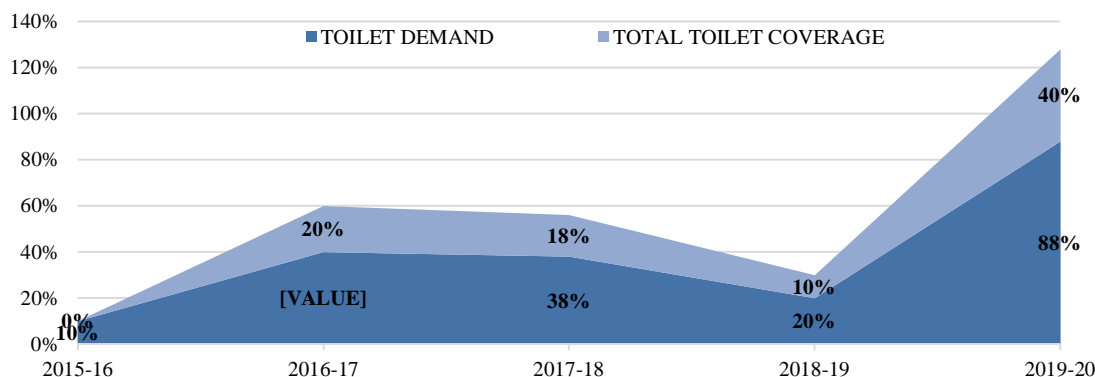


Fig.1: Graph showing the toilet coverage by IHHL and demand over the block

B. Toilet Coverage

In terms of toilet coverage, approximately 83% of the population in Polasara block resides in rural areas, where sanitation is not given adequate attention. Only a few gram panchayats have achieved 100% coverage, while others lag behind in sanitation provision.

C. Percentage Distribution Of Access To Toilets

The percentage distribution of access to toilets indicates that out of the total population, 53.99% have toilets in their homes or premises. However, due to various reasons, 23.20% of these individuals do not use their toilets, while 46.01% of the population does not have access to toilets at all. Furthermore, when considering different types of toilet users, there are three categories: those with their own toilets, those using shared toilets, and those relying on community toilets. It is important to address the needs of each user group to improve overall toilet coverage.

D. Condition Of Toilet

The condition of toilets is another significant concern. The quality of materials used in construction, coupled with inadequate maintenance, has resulted in deteriorating conditions. Issues such as water blockages leading to fungus growth on floors, damaged doors, and the presence of insects have created unhygienic conditions, which can have adverse effects on health.

To address these challenges, it is crucial to focus on improving toilet utilization rates, expanding coverage in underserved areas, and ensuring proper maintenance and hygiene practices. Efforts should be made to promote awareness about the importance of sanitation and provide necessary resources and support for toilet construction and maintenance.

E. Availability Of Water Sources

The availability of proper infrastructure components for toilets in Polasara block raises concerns about privacy and hygiene. Economically weaker sections of the population often lack adequate toilet facilities, leading to a lack of privacy and encouraging open defecation. Maintaining good hygiene is crucial to prevent the spread of diseases and infections. However, many individuals do not wash their hands after defecation, which can have health consequences. Improper flushing of toilets attracts flies, further contributing to health problems.

In terms of water availability, the Ministry of Housing and Urban Affairs has proposed standards of water supply per capita per day. However, in Ganjam district, the provision is only 40 liters per capita per day, which may be insufficient for various household needs. Most villages in Polasara block rely on tube wells, wells, ponds, and rivers for their water supply. Shockingly, even some individuals without toilets use the water supply for open defecation.

F. Electricity Supply To Toilets

Lack of electricity connections to rural toilets poses additional challenges. People who do not have access to electricity are more likely to engage in open defecation at night, putting them at risk of insect and wildlife attacks.

| | MATERIAL USED | HAVING TOILET & USING IT | HAVING TOILET BUT NOT USING IT |
|-------|-----------------|--------------------------|--------------------------------|
| ROOF | Cement concrete | 23% | 15% |
| | Iron tin roof | 35% | 60% |
| | Asbestos roof | 42% | 25% |
| FLOOR | Cement floor | 91% | 89% |
| DOOR | Iron tin door | 55% | 46% |
| | Aluminum door | 38% | 41% |
| | Wood | 7% | 13% |

G. Sanitation In Anganwadi

Sanitation in aganwadis (childcare centers) is also inadequate. Many aganwadis have insufficient toilet facilities, limited water availability, and inadequate handwashing facilities. Waste water often seeps into the surrounding areas, and there is a lack of separate toilets for women. Complaints about these issues are primarily made orally, highlighting the need for improved communication channels.

The household practices regarding safe disposal are crucial for preventing contamination of soil and water and reducing the risk of infections. In Polasara block, about 69% of households have single leach pit toilets. It is important to improve access to clean water, sanitation, and hygiene practices to prevent diarrhea-related childhood mortality.

H. Health Implications

There have been several diarrhea outbreaks in Polasara block, with a peak in 2018 followed by a slight increase in 2022. Waterborne diseases are a significant concern, especially since approximately 43% of people engage in water activities in ponds and rivers. Areas such as Gochabadi, Chirikipada Sasana, Nimina, Dhumkapada, Sadaka, Balichai, Jakara, and J. Dengapadara have experienced diarrhea outbreaks between 2016 and 2020. Sadaka and Chirikipada Sasana gram panchayats are particularly vulnerable.

The use of contaminated water has led to diarrhea-related illnesses in vulnerable areas. It is worth noting that people without toilets and those who have toilets but do not use them properly are at higher risk. The age group of 40-60 is particularly vulnerable to diseases due to open defecation practices.

However, there is potential for improvement as the younger generation becomes more aware of safe sanitation practices and the benefits of using toilets. Treating water bodies can help address water scarcity concerns. Open defecation also contributes to groundwater pollution and environmental damage. Personal hygiene practices, such as proper handwashing after defecation, are essential to prevent the spread of diseases.

Overall, addressing safe disposal practices, improving sanitation infrastructure, and promoting hygiene education are critical steps to reduce health implications and prevent waterborne disease outbreaks in Polasara block.

I. Accessibility To Toilets

The accessibility to toilets varies among different social groups in the study area. The majority of the population resides in rural areas with low literacy and awareness, particularly among young age tribal communities, who prefer open defecation. Cultural beliefs, particularly among the Hindu community, also discourage having toilets in or attached to homes, further contributing to open defecation practices.

On a gender basis, a higher percentage of males (76.03%) prefer open defecation compared to females. However, females show a relatively higher preference for using toilets. The working population in the study area faces high unemployment rates and low income, leading to a lack of basic sanitation infrastructure and increased reliance on open defecation. Marginal workers, in particular, struggle to find employment opportunities. The majority of people in the study area belong to below poverty line (BPL) categories and prefer open defecation despite having toilets at home. Homeless individuals who are illegally settled make up another category. Economically weaker sections typically live in kutchha houses and engage in agricultural activities or small-scale industries, making it difficult for them to afford the construction of toilets. Although the government provides incentives of 10,000 rupees, the installment process poses challenges.

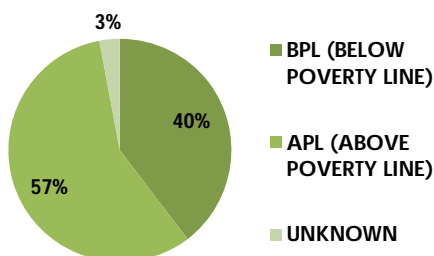


Fig.2: Chart showing the % of usage with respect to income groups.

J. Toilet use According to Occupation

Toilet usage patterns vary according to occupation, with primary and secondary sector occupants relying more on open defecation, while tertiary sector occupants tend to use toilets. The literacy rates in the gram panchayats range from 53.7% to 73.5%. Middle-aged and elderly people, due to their lower levels of formal education and strong adherence to customs and ancestral traditions, are more likely to engage in open defecation.

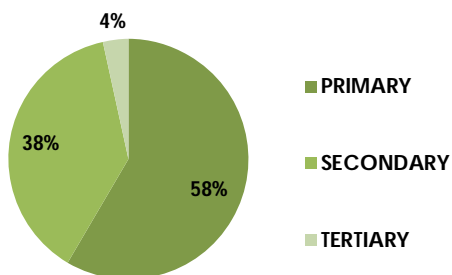


Fig.3: Chart showing the % of usage with respect to occupational status.

K. Literacy Rate

Challenges include lack of knowledge, financial constraints, and low income among the population. However, there is potential for improvement as the younger generation becomes educated about safe sanitation practices and the benefits of using toilets. Changing customs and engagement in sanitation development programs can also contribute to positive change.

L. Toilet Assessment

1) In this the RCC roof which costs around Rs 10000 and the septic tank which is of Rs 25000 is excluded.

| | Cost |
|---|--------------|
| Excavation and Foundation | 3000 |
| Brick wall(Fly ash brick) – 112 Sqft. X 160 | 17920 |
| Plastering- 224 Sqft. X 30 | 6720 |
| Door | 1500 |
| Asbestos shed | 1500 |
| Tap | 200 |
| Pan | 600 |
| Cement Concrete Flooring | 2000 |
| Total | 33440 |

+ Accumulation of solid waste in open areas is an eyesore, diminishing values of water bodies, a breeding ground for insects and other vectors (rats and mice, wild and domesticated animals, as well as humans who may come in contact with contaminated wastes). Improper disposal of Solid Waste in open areas and landfills has a negative impact on the living conditions of human being as well as the overall environment. It results in spread of communicable and non-communicable diseases among human beings and animals thus affecting welfare, livelihood, and economics. Lack of primary collection of wastes is the first stage of sanitation and it means the collection of wastes through door-to-door collection service. Waterlogging and stagnation of water in low laying areas. These blocks don't have any drainage facility.

- a) Upgrading the existing drainage networks with the help of proper technologies.
 - b) Drains get blocked due to solid wastes dumped in them and their lack of capacity.
 - c) Inadequate capacity of drains to carry the storm water during heavy downpour.
 - d) The wastewater is directly discharged into the river, ponds.
 - e) The policy suggests four funding options:
 - Funds directly from central and state governments;
 - Funds through existing funding schemes;
 - Funds via public-private partnerships;
 - Funds from external funding agencies.
 - f) Disparity in water supply.
 - g) Lack of operation and maintenance system
 - h) The block does not have an adequate garbage collection and disposal system because of which municipal wastes generated from various sources are generally dumped either on the streets or into the storm water drains and canals.
 - i) Uncontrolled dumps generate a wide range of pollutants and pose serious threats to human health.
 - j) The block suffers badly from flooding and water logging mainly due to high water levels of the rivers. It gets inundated during heavy downpours due to inadequate drainage systems. There are also a number of lower pockets in the area, from where storm water does not get evacuated through the existing drainage system.
 - k) The presence of natural iron in ground water due to the rusting of pipes causes the growth of iron bacteria resulting in the contam
- l) In many cases it was found that there is back flow of floodwater to the villages.
- 2) At Policy Level Problems
- a) *Insufficient Government Funding:* The allocated amount of 10,000 rupees for constructing a toilet is not sufficient. It falls short of the minimum required amount of 30,000 rupees, making it challenging for people to afford the construction of toilets.

3) At Standard Level Problems

- a) *Lack of Basic Amenities:* There is a lack of proper electricity and water connections to the toilets. This hampers their functionality and convenience for the users.
- b) *Absence of Septic Tanks:* The absence of septic tanks leads to inadequate waste management and can contribute to environmental pollution and health hazards.

4) At Settlement Level Problems:

- a) *Accessibility:* Most of the toilets are located away from homes in the backyards, making it inconvenient for the residents to access them. In some houses, toilets are attached to homes, which provides better accessibility.
- b) *Density and Distribution:* The existing sanitation facilities in densely populated areas are insufficient to cater to the needs of the population. The high population density puts a strain on the available toilets, resulting in inadequate sanitation conditions.
- c) *Socio-economic Factors:* Affordability of toilets becomes a significant barrier in settlements with lower income groups. The cost of constructing toilets exceeds the financial capacity of many residents, preventing them from having access to proper sanitation facilities.

It is also found that in many cases to resolve such issues, citizens complain regarding different issues to the concerned office. More than 50% of the population has not filed any sort of complaint related to the sanitation issues of their area. And out of the total number of complaints filed by the people, only 30% of the issues have been resolved by the concerned authority and rest of the complaints have not been catered. The major problem faced during complaint filing is the lack of proper platform to register the complaint. People should be included in the decision-making process to decide the type and form of healthy environment that they want to have and the type of surrounding they want to live in. More than 80% of the population have not witnessed or have not been a part of any type public participation or community engagement program for improving the sanitation facilities of the area.

V. RECOMMENDATIONS & PROPOSALS

A. Policy Based Recommendation to rural People for Better Sanitation Healthy Environment

Toilets should be seen as a status symbol, clean, colourful, and odour-free, to encourage their usage. Change the vocabulary to make the conversation more accessible, replacing terms like "open defecation" with "faeces outside." "Emphasize the health benefits and risks associated with open defecation to promote investment in toilets. Implement a community-led approach to ensure real community learning and behaviour change. Focus on communities that do not practice open defecation rather than just counting the number of toilets. Advocate for sanitation as a priority for governments, donors, development banks, and NGOs to influence government priorities. Promote systematic handwashing with soap or ash and highlight its importance in hygiene messages. Acknowledge the role of the private sector but emphasize the need for public investment in sanitation.

Teach the value of faeces as a resource, motivating people to dispose of it properly and promoting hygiene. Emptying full toilet bowls is crucial to sustain toilet usage and prevent the continued practice of open defecation.

B. Cost Effective Double pit Toilets for Economically Weaker Section

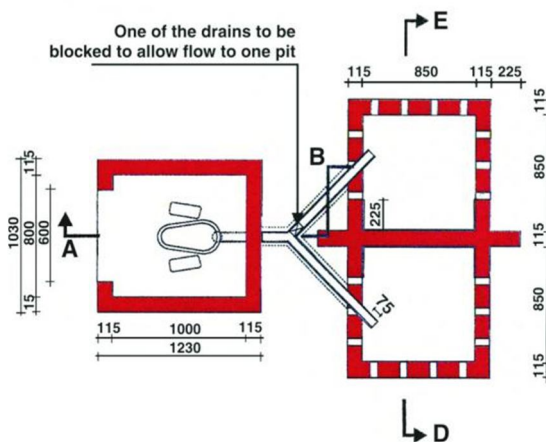


Fig.4: Plan of Double pit toilet.

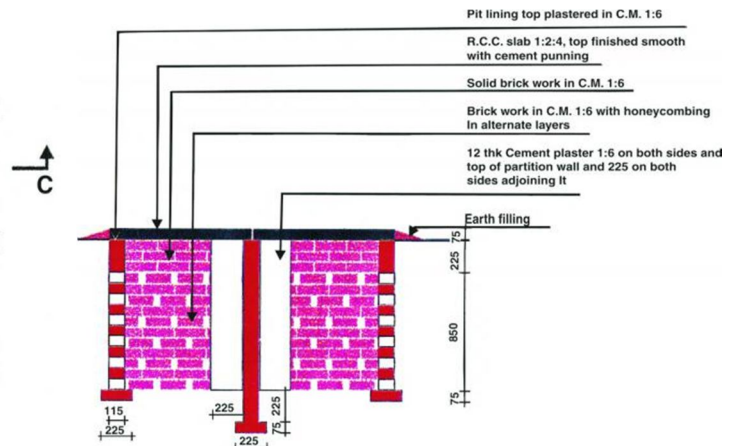


Fig.5: Section of Double pit toilet.

- The cost-effective double pit toilets, also known as Ecosan toilets, are designed for economically weaker sections and water-scarce areas. These toilets aim to provide sanitation solutions while promoting ecological sustainability. The Sulabh toilet system utilizes a double pit system for on-site composting of waste, allowing for decomposition into fertilizer. The Ecosan toilet system, on the other hand, separates human excrement and urine and processes them safely, producing organic resources for agriculture.
- The cost estimation for constructing an Ecosan toilet includes various components such as hollow block stones, cement, sand, roofing slab, door, PVC pipe materials, mason wages, material transportation, and beneficiary contributions. The total cost is estimated at Rs. 12,555.
- While the Ecosan toilets have demonstrated success in various regions of India, there are challenges to overcome. The construction cost may be a barrier for the target users, and there are concerns about pathogen destruction and user acceptance. However, the benefits of Ecosan toilets are significant. They promote sustainable practices, recycle nutrients, save water and electricity, reduce the demand for irrigation water, and eliminate the need for sewage treatment plants.
- To address the challenges and enhance the adoption of Ecosan toilets, it is crucial to explore cost reduction measures, prioritize public health benefits, and educate communities about their benefits and usage. By doing so, these toilets can provide cost-effective and sustainable sanitation solutions for economically weaker sections and water-scarce areas.

C. EcoSan Toilet

In water-scarce areas, Ecological Sanitation (EcoSan) offers innovative toilet solutions that minimize water consumption while maintaining high standards of hygiene. EcoSan has developed toilet designs that eliminate the need for flushing, thus significantly reducing water usage. These dry compost toilets are specifically designed to separate human excrement and urine, ensuring safe processing without causing harm to the environment. The waste is then efficiently decomposed, transforming into valuable organic resources that can be utilized in agriculture.

- 1) EcoSan toilets are designed with two pits, one dedicated for usage while the other is intended for composting, with separate outlets for urine and anal wash water diversion.
- 2) These pits are engineered to meet the requirements of a five-member family for a period of 5-6 months. After this duration, the second pit is utilized, allowing the excreta in the first pit to decompose naturally.
- 3) To facilitate waste decomposition by microorganisms into nutrient-rich fertilizer containing potash and nitrogen, a handful of ash is recommended to be sprinkled over the excreta after each toilet use.
- 4) Urine and wastewater, which are rich in ammonia, are collected in a separate chamber and can be utilized for nurturing vegetable and flower beds.
- 5) Successful implementations of these dry composting toilets can be witnessed in various regions, including Gujarat, Karnataka, Maharashtra, Andhra Pradesh, Kerala, Odisha, Bihar, and Ladakh.

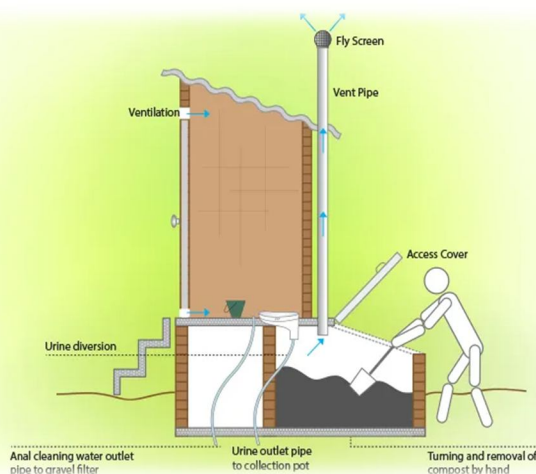


Fig.6: Detail Working of Ecosan toilet.

D. Bio-toilet

Bio-toilet is a mechanized toilet system that utilizes specific bacteria to decompose human waste, converting it into methane gas, carbon dioxide gas, and water. It offers several benefits such as water conservation, eco-friendly waste decomposition, and odor control. Additionally, bio-toilets generate biogas, which can be used for household purposes. However, there are certain disadvantages to consider. Regular handling and removal of waste is necessary, which can be a drawback for some users. The cost of a bio-toilet system is around Rs 40,000, which may not be considered cost-effective for everyone. The use of routine cleaning chemicals does not harm the bio-toilet system. Bio-toilets are primarily required in specific circumstances such as the Indian railways and army, and their implementation can divert attention from the broader goal of sanitation in India. The working process involves three compartments in the bio-toilet tank, where degradation occurs gradually until the water is excavated for gardening or groundwater use.

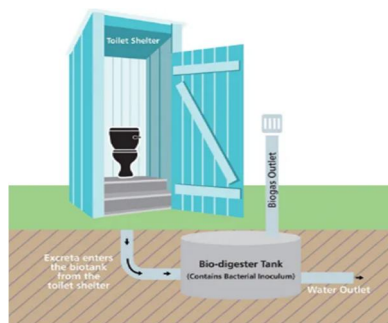


Fig.7: Bio-Toilet Process

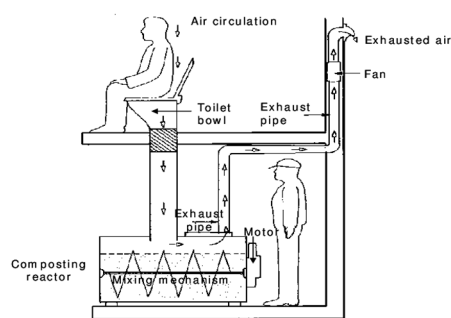


Fig.8: Section of Bio-Toilet

E. Proposals for Small Children

- **Innovative Idea:** The "Peepoo Bag" developed by a Swedish company is a self-sterilizing, fully biodegradable disposable toilet specifically designed for small children. It prevents feces from contaminating the surrounding areas and ecosystem.
- **How it Works:** The Peepoo Bag is a slim biodegradable bag with an inner layer that unfolds to form a wide funnel. It is designed for single-use by one person. After use, the bag can be sealed and disposed of safely. The bag is made from degradable bioplastic lined with urea, ensuring cleanliness and odor control for at least 24 hours.
- **Cost of the Product/Material:** The Peepoo Bag is expected to cost around Rs. 2.61 per bag.

1) Toilet Bags

- Cost: 50 bags for Rs. 200

2) Bucket Toilets and Urine Diversion:

- Cost: Portable bucket toilet for Rs. 200, upgrade with urine diversion for Rs. 1000.
- These proposals provide cost-effective and portable solutions for small children's sanitation needs, promoting hygiene and preventing contamination. Supplying the PHCs that the government has already developed (location, building, equipment, and supplies).



Fig.9: Use of Peepoo bags

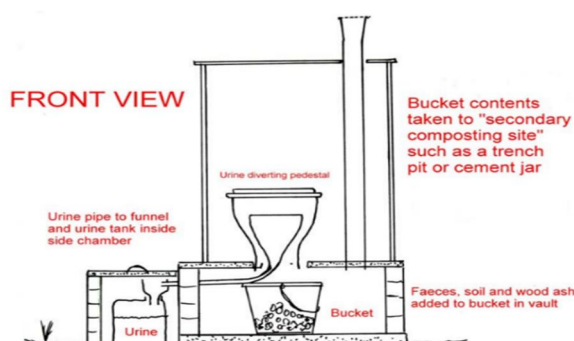


Fig.10: Detail Drawing of bucket toilet and urine diversion

F. Proposal Mapping

1) Faecal Sludge And Septage Management

The proposal aims to implement a mapping strategy for Faecal Sludge and Septage Management (FSSM), focusing on safe collection, transportation, treatment, and reuse of human waste. It aims to provide a low-cost and scalable solution for effective sanitation practices, minimizing pollution and health risks associated with improper waste management.

2) Steps To Improve Rural Sanitation

Steps to improve rural sanitation include building political will, conducting demonstrations and providing technical assistance, large-scale rollout, awareness campaigns, and capacity building. These efforts aim to create sustainable sanitation practices through policy development, implementation guidelines, and strengthening government institutions.

VI. CONCLUSION

In conclusion, the study highlights the persistent gaps in sanitation coverage and utilization in Polasara, emphasizing the need for improved infrastructure, behavior change, and awareness campaigns. The findings underscore the detrimental impact of inadequate sanitation on public health and the environment. Effective collaboration among stakeholders, increased funding, and innovative approaches are crucial for sustainable sanitation solutions. Addressing these challenges will enhance public health, create a safer environment, and inform policy and interventions in similar rural areas.

REFERENCES

- [1] https://www.ysdindia.org/wp-content/uploads/2018/10/Summary_Citizen-Report-Card_Rural-Sanitation-in-Ganjam_final.pdf
- [2] https://jalshakti-ddws.gov.in/sites/default/files/Final_QCI_report_2017.pdf
- [3] https://suaiswachhsangraha.gov.in/sites/default/files/Sanitation_CATS_lessons_learned-Report_Odisha.pdf
- [4] <https://www.theeigc.org/wp-content/uploads/2017/07/coffey-et-al-2016-workingpaper.pdf>
- [5] https://jalshakti-ddws.gov.in/sites/default/files/Rural_Sanitation_Strategy_Report.pdf
- [6] https://niti.gov.in/planningcommission.gov.in/docs/plans/planrel/fiveyr/10th/volum_e2/v2_ch5_5.pdf
- [7] <https://www.who.int/publications/i/item/9789241514705>



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