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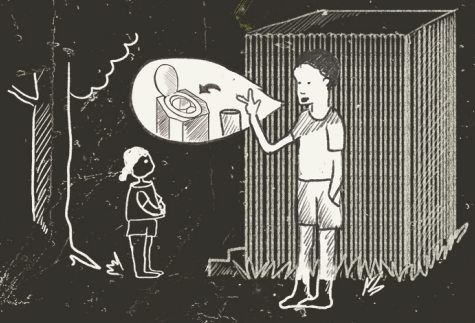
Rural Sanitation in Haiti

The ZANA Model of Container-Based Sanitation



Field note by: Ignacio A. Navarro

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ABBREVIATIONS

AMP	*Agence des Micro-Projets* (Micro Projects Agency)
AOG	*Asosyasyon Orijinè Granplenn* (Indigenous' Association of Grande Plaine)
CBS	Container-Based Sanitation
CAEPA	*Comité d'Approvisionnement en Eau Potable et d'Assainissement* (Drinking Water Supply and Sanitation Committee)
CEFREPADE	*Centre Francophone de Recherche Partenariale sur l'Assainissement, les Déchets et l'Environnement* (Francophone Center for Partner Research on Sanitation, Waste and the Environment)
DINEPA	*Direction Nationale de l'Eau Potable et de l'Assainissement* (National Directorate of Water and Sanitation)
HTG	Haitian Gourde (Haiti's currency)
JMP	Joint Monitoring Programme
NGO	Non-Governmental Organization
OREPA	*Office Régional d'Eau Potable et d'Assainissement* (Regional Potable Water and Sanitation Office)
SOIL	Sustainable Organic Integrated Livelihoods
TEPAC	*Technicien pour L'Eau Potable et l'Assainissement des Communes* (Drinking Water Technicians and Sanitation for Communes)
UNICEF	United Nations Children's Fund
URD	*Unité Rurale Départementale* (Departmental Rural Unit)
US$	United States of America Dollar
WASH	Water, Sanitation, and Hygiene
WSS	Water Supply and Sanitation Services
WHO	World Health Organization
ZANA	*Zanmi Lanati* (Friends of Nature)

EXECUTIVE SUMMARY

The United Nations' Sustainable Development Goals include eliminating open defecation by 2030. However, less than half of the countries with high rates of open defecation are on track to end the practice by the target date and about 673 million people continue to practice it, especially in rural areas. In this context, Contained Based Sanitation (CBS) has emerged during the last decade as a promising alternative in the portfolio of approaches to increase the provision of improved sanitation services for the most vulnerable populations. CBS consists of hygienically collecting excreta (feces and urine) in dry toilets equipped with removable containers that allow the user to safely transport them to a disposal area for treatment and transformation into a reusable material.

Building on the seminal study completed by the World Bank evaluating the potential of CBS approaches in urban settings around the world, this report presents an experience implementing a CBS system in a rural context by describing the ZANA (Friends of Nature) CBS approach, developed and implemented in rural Artibonite, Haiti.

Despite efforts to reorganize its water and sanitation sector, Haiti still faces major challenges in the provision of basic sanitation- especially in rural areas, where 83 percent of the country's extremely poor reside and 1 in 3 households still practice open defecation. Low levels of investment in rural sanitation and high reliance on external aid for Haiti's water and sanitation sector have resulted in short-termed and narrowly focused sanitation solutions for rural poor.

In this context, as part of his doctoral dissertation on dry toilets and composting, a local activist in the Gros-Morne region of the Artibonite department organized a CBS initiative with the dual purpose of reducing open defecation and increasing environmental awareness. The ZANA approach is centered on community organization efforts that engage and train households to implement their own collective CBS systems. ZANA's goal is not to provide a CBS service (like most documented CBS approaches entail) but to empower communities to implement their own self-sustaining CBS systems. To achieve this, ZANA developed a five-step community organizing model based on education, community readiness assessment and accountability. Households implementing ZANA pay for their toilets with the help of microcredits managed by a community-based organization and provide their own covering materials. Users also go through extensive training on how to maintain and disinfect the toilets and safely transport their waste to a community-run compost site.

The pilot initiative started with 25 households in the community of Grande Plaine in 2015. The World Bank got involved with ZANA in 2020 through the provision of educational materials and support for ZANA community organizing efforts. To date, ZANA has been replicated in five other communities in Haiti's Gros-Morne region and currently serves 444 individuals in 75 households. The community composting sites process around 17,800 kg of feces into 3,600 kg of compost per year. The financial investment per toilet for each family is 6,600 Haitian Gourdes (HTG) or an equivalent US$73 while ZANA's average cost for education, trainings, and follow-up adds to 4,720

HTG or US$52 per household. Thus, our estimates suggest the total financial annualized cost per household for a ZANA toilet (US$16).

Households that have implemented ZANA CBS seem to be highly satisfied with their systems, as evidenced by the almost non-existent turnover. Yet, as a model, ZANA faces important scalability challenges on three fronts. First, ZANA relies heavily on the work of volunteer promotors and the institutional support of the local environmental NGO for marketing, trainings, and management of microloans. Replication of the model would require partnerships with similar organizations in the areas where ZANA wants to expand. Second, ZANA's capacity to expand is directly constrained by its availability of funds for microloans. Third, because the model is based on community self-sufficiency, it can only be successfully replicated on communities that are willing and able to commit to the process. This inherent characteristic explains the model's success but it also constraints its capacity for mass scalability.

Additional research and policy analyses would be required to make wide conclusions regarding the feasibility of CBS approaches as a widespread rural sanitation strategy. Nevertheless, promising early lessons from the ZANA experience demonstrate that CBS should be considered as a potential tool in the arsenal of innovative sanitation strategies to reduce open defecation in rural areas.

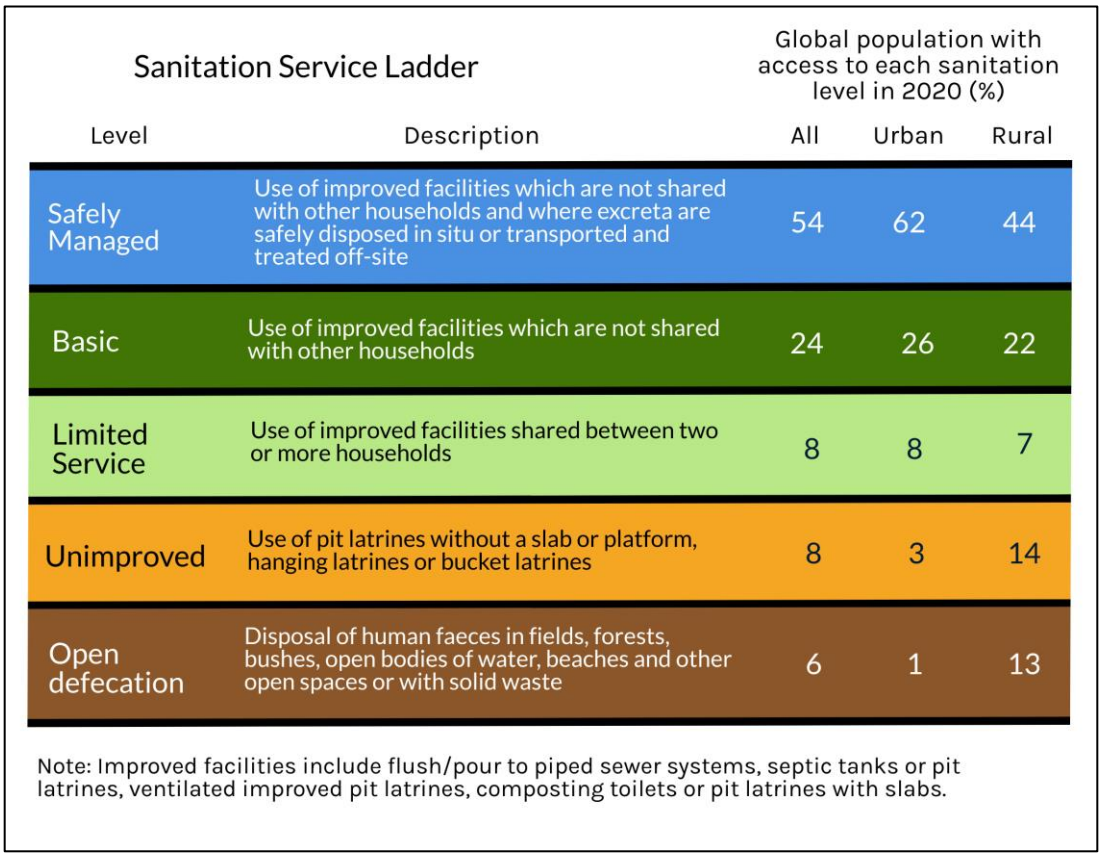
1. Introduction

The United Nations' Sustainable Development Goals include eliminating open defecation by 2030, However, about 673 million people continue to practice it (UNICEF-WHO Joint Monitoring Program (JMP), 2020). Data from the 2000-2017 period suggests that less than half of the countries with high rates of open defecation are on track to end the practice by 2030. Populations in countries still practicing open defecation remain at greater risk for disease due to environmental degradation and contamination of water sources. These health impacts can result in high economic costs due to financial and productivity losses (World Bank, 2019). Eliminating open defecation and increasing access to safely managed sanitation services are associated with cleaner environments and water sources, lower rates of disease, reduced child mortality and stunting, increased school attendance for girls and children with disabilities, and higher quality of life (JMP, 2020). In this context, developing approaches to help households move away from open defecation and other unimproved services to at least basic sanitation services (Figure 1) is urgently needed.

One of these emerging approaches providing households with improved sanitation services is Container-Based Sanitation (CBS). CBS consists of hygienically collecting excreta (feces and urine) in dry toilets equipped with removable containers that allow the user to safely transport them to a disposal area for treatment and transformation into a reusable material (World Bank 2019a). The emerging literature on CBS initiatives, implemented in several countries since 2010, points to challenges and opportunities in urban areas. Even though nine out of 10 people in rural areas practice open defecation, CBS experiences in rural areas are still rare compared the other sanitation solutions.

In this context, the purpose of this report is to build on the World Bank's efforts to evaluate the potential of CBS sanitation alternatives by describing the implementation of a CBS system in a rural setting. Specifically, this report describes the implementation of the ZANA model, a homegrown CBS initiative developed and implemented in rural Haiti since 2015. The report focuses on describing the model's main components, its preliminary outcomes in terms of community adoption and potential challenges for scalability and sustainability. While the scope of this report is limited and it is early to assess the feasibility of ZANA's model as a widespread sanitation strategy for rural areas, early lessons from this experience are promising and highlight important avenues for future research regarding the unique challenges and opportunities that rural settings present for CBS initiatives as viable options for rural sanitation.

Figure 1: UNICEF/WHO JMP Sanitation Service Ladder



Sanitation Service Ladder

Level	Description	Global population with access to each sanitation level in 2020 (%) All	Urban	Rural
Safely Managed	Use of improved facilities which are not shared with other households and where excreta are safely disposed in situ or transported and treated off-site	54	62	44
Basic	Use of improved facilities which are not shared with other households	24	26	22
Limited Service	Use of improved facilities shared between two or more households	8	8	7
Unimproved	Use of pit latrines without a slab or platform, hanging latrines or bucket latrines	8	3	14
Open defecation	Disposal of human faeces in fields, forests, bushes, open bodies of water, beaches and other open spaces or with solid waste	6	1	13

Note: Improved facilities include flush/pour to piped sewer systems, septic tanks or pit latrines, ventilated improved pit latrines, composting toilets or pit latrines with slabs.

Source: UNICEF/WHO JMP. www.washdata.org/monitoring/sanitation

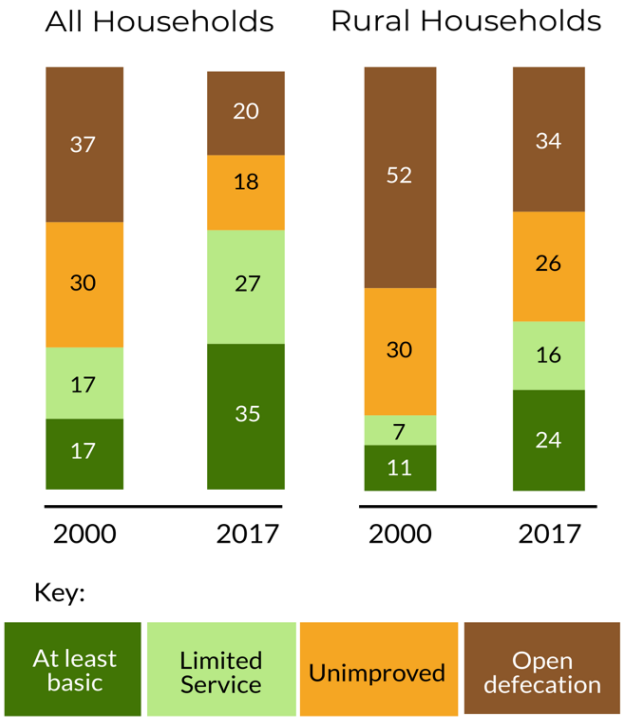
The report is organized in five sections. The second section describes the implementation context in rural Haiti, specifically in the Grande Plaine region of Haiti's Artibonite department. The third section describes the opportunities and challenges of CBS implementation relying on the World Bank's recent findings on evaluating CBS systems in urban centers. The fourth section explains the specifics of the ZANA model while the last section details some of the preliminary outcomes and provides some early lessons learned from the experience.

2. The ZANA Model Implementation Context

2.1 Haiti's Sanitation Challenge

Haiti remains the poorest country in the Latin American and Caribbean region and is among the poorest in the world, ranking 170 (out of 189) in the Human Development Index and 122 (out of 155) in the Human Capital Index (World Bank, 2021).[1] The latest official poverty estimates indicate about 6 million Haitians, approximately 60 percent of the population, live below the poverty line of US$2.41 per day, and more than 2.5 million lived below the extreme poverty line of US$1.12 per day (World Bank, 2014). Poverty and extreme poverty are highest in rural areas, where most Haitians live, with 67 percent of the poor and 83 percent of the extremely poor (Work Bank, 2018).[2] Though Haiti made progress in increasing access to improved water and sanitation since 1990, it failed to achieve the 2015 Millennium Development Goals' progress benchmarks, stressing the need to accelerate efforts towards the Sustainable Development Goals and universal access by 2030.

Figure 2*:* Sanitation levels in Haiti 2000-2017



Source: JMP WASH data. www.washdata.org

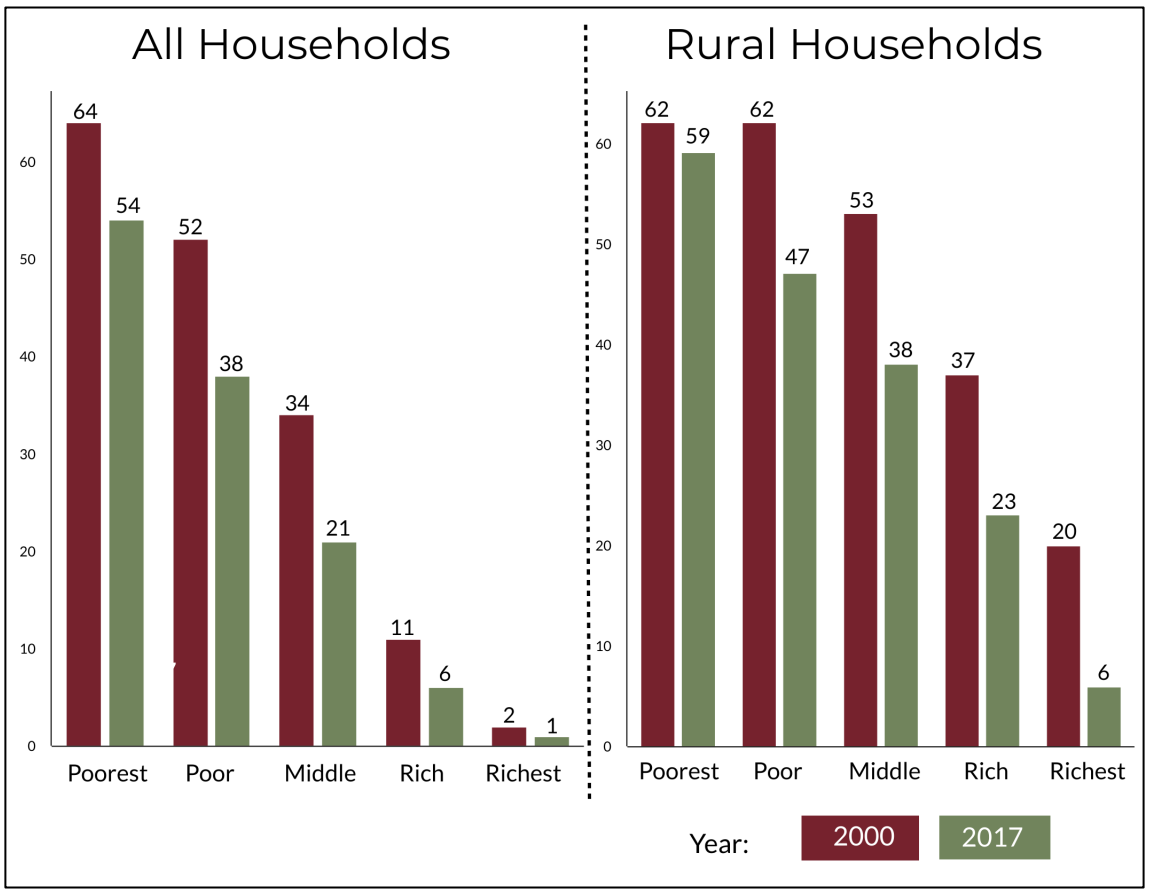
According to estimates from the UNICEF-WHO Joint Monitoring Program (JMP), between 2000 and 2017, the percentage of households with access to improved sanitation services (at least basic or limited service) increased from 34 to 62 percent. In comparison, families practicing open defecation decreased from 37 to 20 percent during the same period. In rural areas, the percentage of households with access to improved sanitation services increased from 18 to 40 percent, and the percentage of households practicing open defecation decreased from 52 to 34 percent (Figure 2). While open defecation rates decreased across all income groups between 2000 and 2017, this trend was unevenly distributed across income groups and geographic

[1] The Human Development Index (HDI) is a summary measure of human development. It measures the average achievements in a country in three dimensions of human development: life expectancy, access to education and a standard of living. The Human Capital Index (HCI) measures the amount of human capital that a child born today can expect to attain by age 18.

[2] At the time of this report, the most recent poverty statistics for Haiti were from 2012.

locations. As Figure 3 shows, while overall open defecation rates for households in the poorest income quintile decreased by about 10 percent, it only reduced marginally for households in the poorest income quintile located in rural areas. Progress in reducing open defecation among the other income quintiles in rural areas decreased much more rapidly.

Figure 3*:* Open defecation rates by income quintile 2007-2017



Source: JMP WASH data. www.washdata.org

It is important to note that the proportion of households practicing open defecation is estimated based on surveys that inquire into their own use of sanitation services. Thus, these figures do not reflect the percentage of homes *exposed* to open defecation in their communities. JMP estimates suggest that 76 percent of Haitian households live in a community where at least one of the members practiced open defecation (UNICEF and WHO, 2019). This percentage is likely higher in rural areas, as overall rates for this practice are higher.

These precarious water and sanitation service conditions in the country contributed to the spread of the cholera epidemic (*Vibrio Cholerae, Serogroup O1, Biotype El Tor, Serotype Ogawa*) just about eight months after the earthquake that devastated Haiti in January 2010. The first cases were found in Artibonite and Centre departments in October that year. The outbreak infected about 820,000 people and killed 9,792 before being contained in early 2019 – with the last confirmed case of cholera being a 5-year-old boy from l'Estère in Artibonite (PAHO and WHO, 2020).

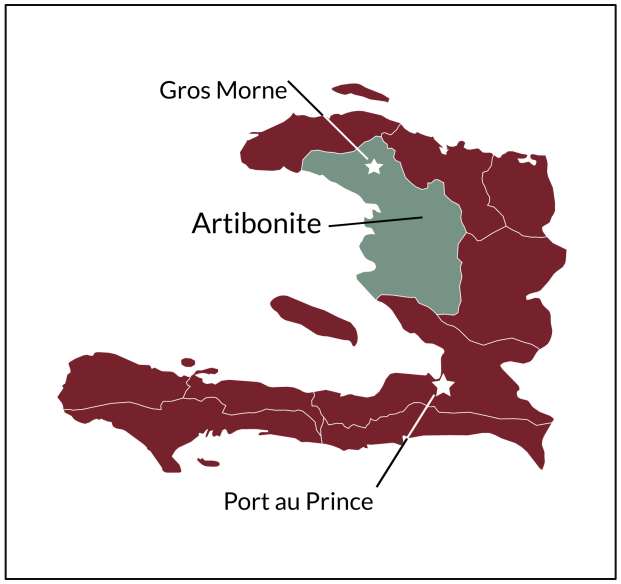
2.2 Water and Sanitation Institutional Framework

In 2009, the Haitian Parliament voted to reform its water and sanitation sector to decentralize Water Supply and Sanitation Services (WSS). The new institutional framework established the "*Direction Nationale de l'Eau Potable et de l'Assainissement*" (National Directorate of Water and Sanitation, or DINEPA) as a governing body, a regulatory institution, and the agency in charge of providing water and sanitation services at the national level. It also established four offices at the regional level (*Office Régional d'Eau Potable et Assainissement,* OREPA) responsible for both urban and rural WSS. Additionally, eleven units (*Unité Rurale Départementale,* URD) and about four hundred community-based organizations (*Comité d'Approvisionnement en Eau Potable et d'Assainissement*, CAEPA) were created to support the OREPAs in rural areas. Further, in 2014, a revised National Sanitation Strategy was endorsed, reflecting strategic orientations to improve access to sanitation and a framework to monitor implementation. The Strategy provided DINEPA with updated guidelines to increase investments in all areas of the sanitation cycle and increasing sanitation education. It also introduced incentives to encourage households to build or improve their own latrines or toilets (DINEPA, 2014).

Over a decade after the creation of DINEPA, the decentralization process is still not completed and Haiti's sanitation sector still faces severe challenges, especially in rural areas (World Bank, 2018). In addition, overall investment in WSS has been relatively low compared to financing needs, and largely dependent on donor grants. This dependence often produces uncertainty for long-term investments as the availability of these funds may vary widely over time. Between 2009 and 2015, DINEPA reported that about 99 percent of its budget came from donor grants and only one percent came from government transfers (World Bank, 2018).

2.3 Local Characteristics

Figure 4: Location of the Gros-Morne region, in Artibonite

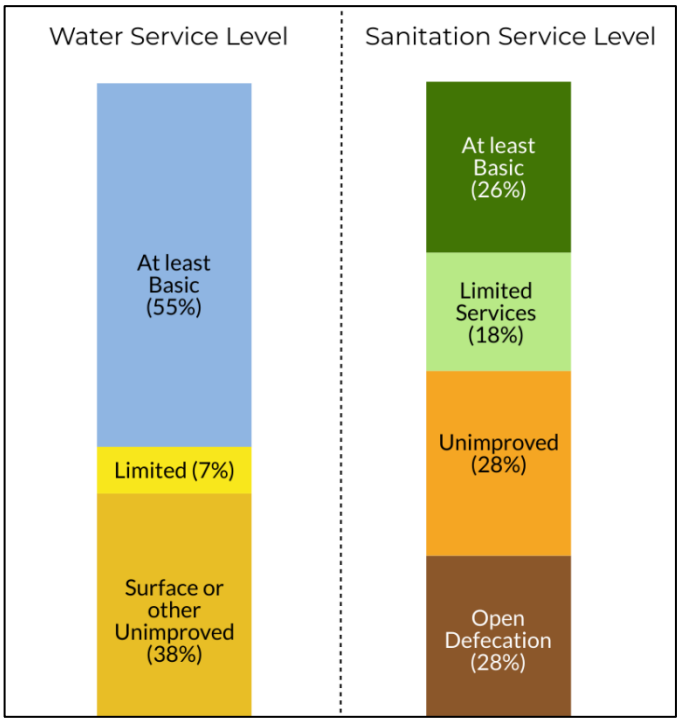


The CBS project discussed in this report took place in the Artibonite Department (Figure 4). In 2015, the population of Artibonite was 1.7 million (about 15 percent of Haiti's total population), of which approximately 57 percent lived in urban centers (Lozano-Gracia & Garcia Lozano, 2017). About 60 percent of the inhabitants in Artibonite are poor, and 23 percent are extremely poor (World Bank, 2018). With an area of 4,887 km^2, Artibonite has the largest area among Haiti's ten departments. The northern and eastern regions of Artibonite are mountainous terrain, home of the *Montaignes Noires,* and part of Haiti's Central Plateau. The southern part of the department hosts the *Chaîne des Matheux* and the lowlands along the Artibonite Valley. In the west, Artibonite's coastline at the mouths of the L'Estère and Artibonite Rivers is flat and swampy but rocky elsewhere. The department has much agricultural potential and produces a large share of Haiti's agricultural output. Still, the lack of geographical connectivity is a significant constraint to the region's economic and human development. Despite some efforts to build roads and other transport infrastructure, many areas with agricultural potential in Artibonite remain largely inaccessible (World Bank, 2020).

In 2017, only 22 percent of the households in the Artibonite department[3] had access to piped water, mostly standpipes. Another 40 percent depended on other improved delivery methods, and 38 percent relied on surface water or other unimproved sources (i.e., unprotected dug wells, unprotected springs, tanker trucks). As for sanitation services: 28 percent of households practiced open defecation, 28 percent relied on other unimproved services, 26 percent used shared improved services, and only 18 percent had access to non-shared improved services (Figure 5).

[3] Latest JMP data disaggregated at department level (2017) do not include disaggregation by urban/rural and poverty quintile, which are currently available only at national level.

Figure 5: Access to water and sanitation service in Artibonite (2017)



Source: WASH data. www.washdata.org

2.4 Attitudes Towards Sanitation Services

A 2012 study conducted focus group interviews in rural Artibonite to evaluate the impact of health education campaigns implemented to contain the cholera epidemic. It suggests that focus group participants broadly understood the mechanisms of cholera transmission and its connection to water purification, hygiene, and sanitation (Williams et al., 2015). However, it found that awareness of the importance of improved sanitation methods did not necessarily translate into action towards building latrines (Williams et al., 2015). About 40 percent of respondents in the study reported owning a latrine, and about 13 percent reported having a precarious type of latrine (defined as “an uncovered hole in the ground”); the remaining 37 percent reported open defecation as their sanitation alternative. When asked what families and communities needed to build more latrines, most respondents replied external aid from NGOs through directly providing latrines or a cash-for-work program (Williams et al., 2015). Reliance on external assistance for sanitation services also contributed to insufficient levels of community investments on maintenance, leading to shorter latrine lifespans (Photo 1). This phenomenon is not exclusive to Artibonite. Thus, to encourage families and communities to build and maintain latrines on their own, DINEPA discontinued subsidies for the construction of private latrines as

part of the National Sanitation Strategy (World Bank, 2016). Although there are no formal evaluations of the impact of this provision on WSS investments, it may have had the unintended effect of decreasing overall investment in sanitation services, largely depending on uneven donor investment strategies, especially in the country's poorest regions.

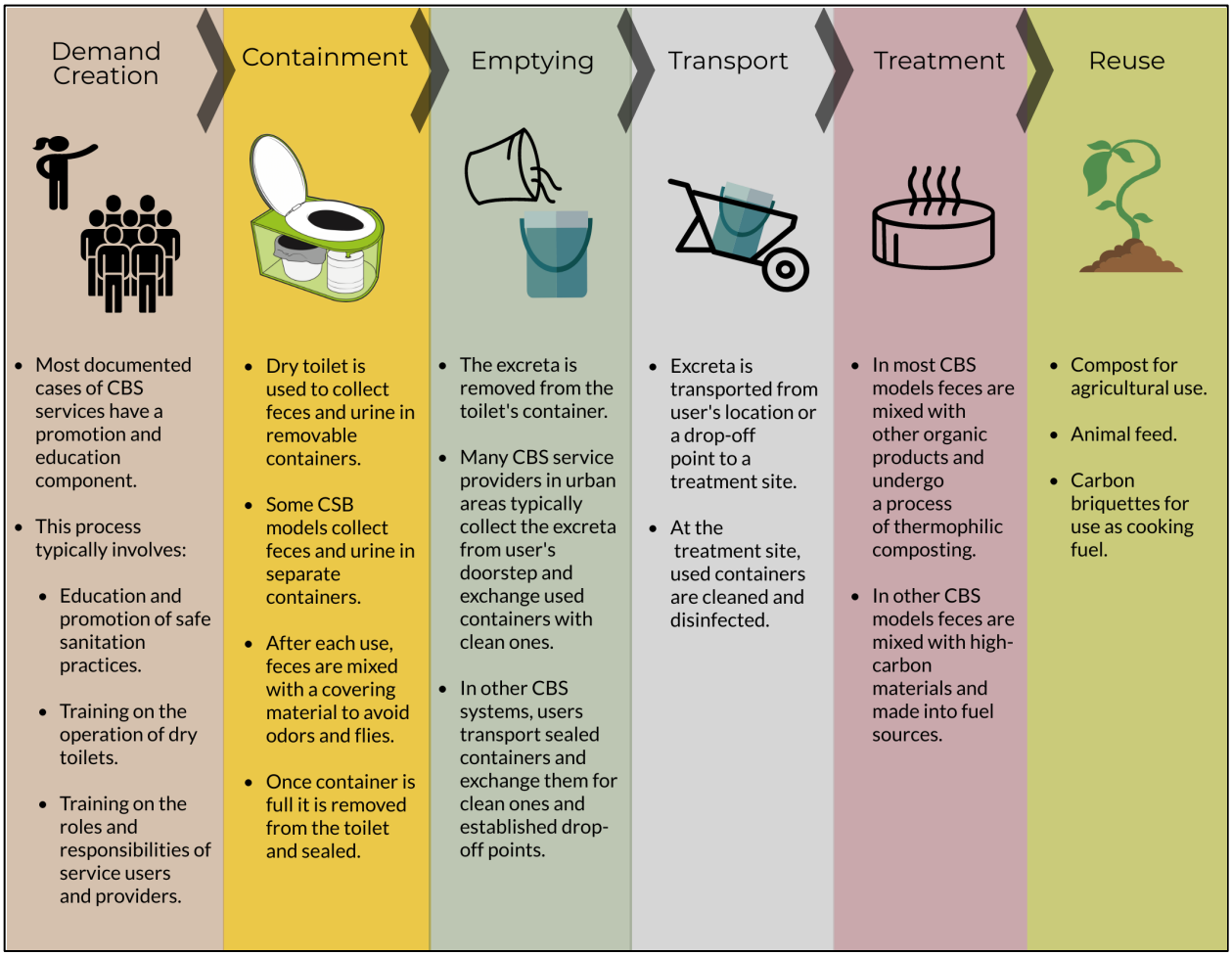
Photo 1*:* Latrine in Gros Morne, 2020

Credit: Gaston Jean

3. Container-Based Sanitation Initiatives

CBS approaches have gained popularity and emerged as a feasible option for providing services during the last decade. In 2018, JMP classified CBS approaches as improved sanitation services (UNICEF & WHO, 2018 and definition in Figure 1). In 2019, the World Bank published the results of a seminal study evaluating the potential for CBS and analyzing evidence from several large-scale CBS initiatives implemented in urban areas around the world. Lima (Peru), El Alto (Bolivia), Nairobi and Naivasha (Kenya), Kumasi (Ghana), Antananarivo (Madagascar) and Cap-Haitien and Port Au Prince (Haiti) are just a few of the cases documented in the literature regarding CBS programs. Their findings revealed the tremendous potential for CBS as a sanitation option when conditions for implementation are favorable (World Bank, 2019a). This section of the report relies heavily on the findings of the aforementioned study. Yet, to date, there are no documented experience of CBS implementation in rural areas.

Figure 6: Container Based Sanitation Service Chain.



Source: Based on World Bank's (2019a) description of CBS service models across the sanitation service chain

3.1 The CBS Service Chain

As described in Figure 6, the typical CBS service chain consists of six stages, from demand creation to the reuse of processed excreta (World Bank, 2019a). The first stage, demand creation, consists of a promotion effort designed to raise awareness on safe sanitation practices, the benefits of CBS systems, and the roles and responsibilities of service users and providers. In many cases, this process also involves trainings for onboarding new customers on the guidelines for safe operation of dry toilets and hygiene practices.

The second stage, containment, typically involves a portable toilet structure made of wood or fibrocement located inside the user's house. Most CBS toilets have a diverting mechanism to separate urine from feces into different containers located below a toilet seat. In addition to the dry toilet, the containment stage requires a cover material is placed over the waste after each use to avoid odor and flies (World Bank, 2019a). The type of covering material used – sawdust, ash, and agricultural waste (e.g. sugar cane bagasse) –usually depends on its availability at the CBS system site (Russel, et al., 2019). Some CBS providers supply the covering materials as part of their service, while others rely on the user to gather their own.

When full, containers are removed from the dry toilet and exchanged for a clean one. The excreta-filled containers are transported to a treatment site to be emptied, cleaned, and disinfected for future reuse. The role played by the user vis-à-vis the service provider in these stages varies widely across programs. In some CBS programs, service providers empty, transport, and clean the containers, periodically collecting and exchanging them for clean ones at the user's residence. In others, users transport the full containers to drop-off collection points where they exchange them for clean containers. (World Bank, 2019a; Russel, et al., 2019).

Finally, the excreta collected from users in the CBS system is transported to treatment sites to be processed into a product, such as animal feed or fuel briquettes. The most common treatment used by CBS providers is thermophilic composting through aerobic and anaerobic methods to obtain agricultural fertilizer (World Bank, 2019a; Russel, et al., 2019).

3.2 The Appeal of CBS Approaches

One major draw of CBS approaches is that they do not require high upfront investments for the user in infrastructure or sanitation facilities. CBS systems are convenient in places where sewer-based sanitation or septic tanks are not feasible due to geographic constraints (e.g.

floodplains, steep slopes, rocky soil). Similar to improved pit latrines, they are also convenient where installation costs for other sanitation services are too high, such as dense urban areas or inaccessible rural zones with precarious or non-existent water systems. CBS also offers users safety and comfort as it provides a dry toilet inside the home in contrast to outdoor pit latrines, which, in many cases, are shared by many families (Russel, et al., 2015; Koski-Karell, et al., 2016). Additionally, the transformation of excreta into fertilizer, fuel, or animal feed is one of the main appeals of CBS, because these end products are convenient for communities. Further, service providers may sell these to recover (part of) operation and maintenance costs.

Finally, CBS approaches are gaining popularity as an ecologically-friendly alternative that produces soil nutrients and requires less water and energy than other forms of sanitation. Recent studies document the potential of CBS approaches to reduce greenhouse emissions at higher levels than other waste management methods such as pit latrines. (McNicol, et al., 2020; Ryals, et al., 2019).

3.3 The Challenges of CBS Approaches

Despite JMP's recognition of CBS strategies as an improved sanitation service, governments in developing countries have been timid to embrace CBS as part of their sanitation services' portfolios (Russel, et al., 2019). This has contributed to a slow development of local regulatory frameworks governing CBS systems and little interaction with local authorities in places where CBS has been implemented. In addition, the documented case studies of CBS programs show that most of these systems are funded exclusively by NGO grants (World Bank, 2019a). This is an important threat to CBS systems' sustainability because not only do CBS systems require investments to get started (mainly for the transportation service and the treatment site), but they also require funds to ensure future operation and maintenance of the CBS services. These costs are partly covered by user fees, which in some cases may influence poor households' decisions to leave the service or not join in the first place (World Bank, 2019a; 2019b).

Furthermore, none of the providers have been able to generate profits by commercializing the products they produce from excreta (World Bank, 2019a). As the number of households using CBS systems grows, they may achieve economies of scale that can help to reduce the operating costs per individual customer. Sustainability is challenging even when local stakeholders are included in the planning and trained to maintain a CBS system. After the 2010 earthquake, the NGO GiveLove funded a CBS system in Haiti's Santo Village, in Leogane (18 miles west of Port-Au-Prince). Their planning included broad community participation and training. By 2013, 300 households used CBS, and the system successfully produced high-quality compost for reuse (Jenkins, 2014). However, communities could not afford CBS costs when funding for the project

was withdrawn. By 2018, the village abandoned the project, and households switched to pit latrines (although it was not recommended for the region given its high flooding risks) (Jean, 2018).

In summary, the documented cases of CBS in urban areas point to several opportunities of CBS as a sanitation alternative, including resilience, sustainability, inclusiveness, customer buy-in, efficiency, affordability, and hygiene safety (World Bank 2019a). On the other hand, some of the challenges for CBS implementation point to dependence on external funding and expertise, a relatively slow growth rate, lack of explicit regulations from governing structures and limited interactions with local sanitation authorities in areas where they have been implemented. Finally, in general, CBS systems are focused on the treatment of feces and not with the treatment of gray water or urine, making them a partial sanitation strategy (Table 1).

Table 1: *Potential advantages and challenges of CBS approaches in urban areas*

Advantages	Challenges
• Inclusiveness • Resiliency • Sustainability • Acceptable to Customers • Hygienically safe • Affordability • Efficiency	• Dependence on external funding • Dependence on external expertise • Relatively slow growth rate • Lack of explicit regulation and service standards • Partial solution • Limited interaction with local authorities

Source: World Bank (2019a)

The appeal and challenges CBS initiatives discussed in this section suggest that densely-populated urban areas are more likely to provide favorable conditions for the implementation of large-scale CBS systems because they can sustain economies of scale that allow a CBS system to become economically viable. This may explain, in large part, why most documented CBS experiences are from urban settings. Yet, the ZANA model described in the next section provides an example of rural communities in the Haitian Gros-Morne region of Artibonite who have piloted small self-sustainable CBS systems.

4. The ZANA CBS Model

ZANA, in Creole, stands for "*Zanmi Lanati*" (friends of nature), a name adopted by a group of households that pioneered the implementation of CBS in the Grande Plaine area of Gros-Morne in 2015. ZANA was designed by Gaston Jean, a local leader and environmental activist, who implemented the pilot program as part of a doctoral thesis on dry toilets and composting in 2015.[4] The pilot received funding from the *Agence des Micro Projets* (AMP)[5] and the SUEZ Foundation. It also received technical support from the *Centre Francophone de Recherche Partenariale sur l'Assainissement, les Déchets et l'Environnement* (CEFREPADE)[6] and administrative support from the *Asosyasyon Orijinè Granplenn* (AOG) (Indigenous Association of Grande Plaine), a local community-based organization that implements projects in the areas of health, education, sustainable farming, reforestation, and environmental stewardship.

The ZANA approach involves a community-driven effort that engages and trains households to implement their own collective CBS systems. The dual goal of the model is to reduce the practice of open defecation in rural areas and increase environmental awareness by empowering communities to implement their own self-sustaining CBS systems. ZANA adopters choose this method over pit latrines and open defecation, the only other sanitation options available in the areas where ZANA has been active.

The World Bank's involvement with ZANA started in 2020 and was concentrated mainly in supporting ZANA's education efforts by financing printed materials used in community trainings and support to community organizing (see for example Figures 8 and 9). The main features of the ZANA approach are described below.

4.1 Community Organizing

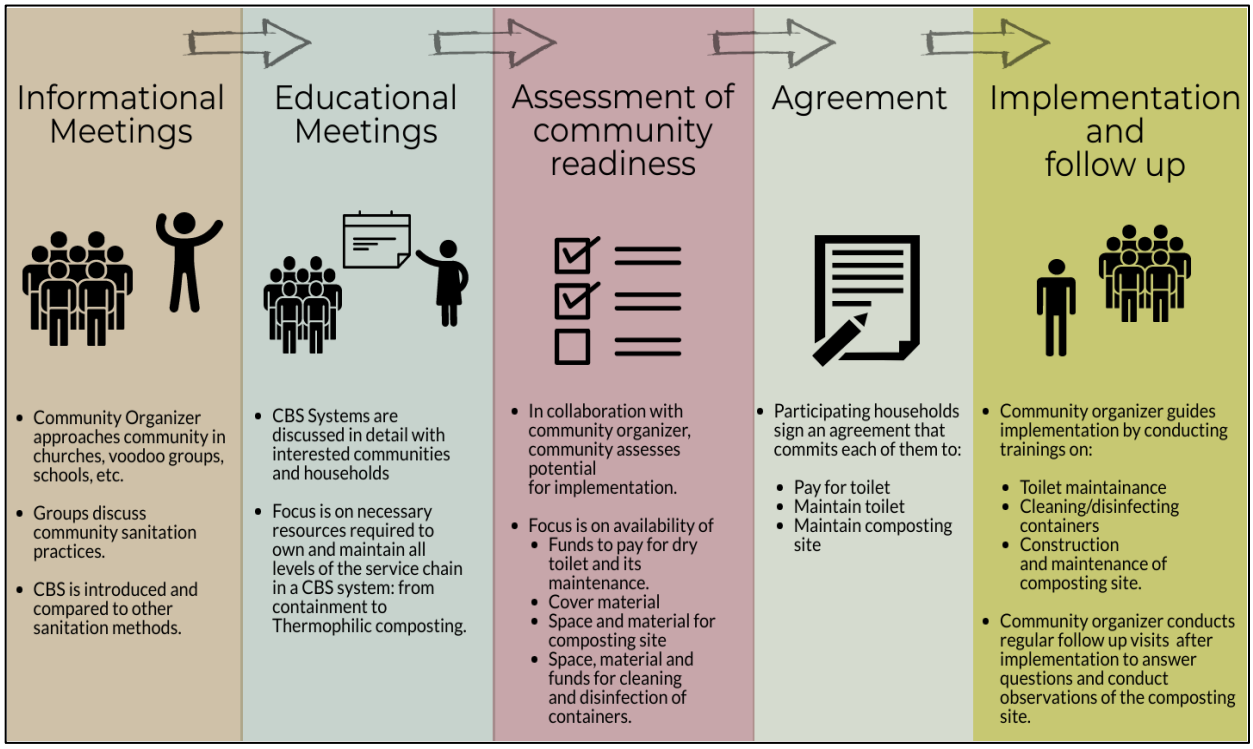
The process of community organizing in the ZANA model consists of five phases designed to engage, educate and train communities to implement and manage CBS systems (Figure 7).

[4] The doctoral theses (Université Quisqueya / INSA de Lyon) describing the pilot program implementation , titled " *Conditions pour la mise en place durable d'une filière d'assainissement par toilettes sèches à litière bio-maîtrisée dans les zones rurales des pays en développement. Application au contexte haïtien,*" is available at http://theses.insa-lyon.fr/publication/2018LYSEI126/these.pdf.

[5] AMP is an NGO funded by the Frech Development Agency (AFD) to support small and medium-sized French international solidarity associations (https://www.agencemicroprojets.org/qui-sommes-nous/).

[6] CEFREPADE is a French NGO funded by various public and private sources to implement projects that restore and protect ecosystems in developing countries (https://www.cefrepade.org/).

Figure 7: ZANA CBS Community Organizing Model



Source: Author

Phase 1. The process begins with a community organizer visiting a rural community and creating awareness and interest for CBS. This first phase includes information sessions with different community groups such as, but not limited to, churches, schools, trade associations, voodoo groups, school officials, and other elected leaders (Photo 2). Informational meetings follow a curriculum that encourages discussion of the communities' sanitation practices, the economic and health impacts of defecation in the open or of poorly constructed latrines, and the functioning and benefits of CBS.

Phase 2. Communities that express interest in implementing CBS after attending informational meetings, are invited to participate in educational meetings. These meetings are focused on the expectations of potential CBS adopters with regards to the upfront payments and the labor commitment required for owning and sustaining a system across the service chain, from containment of excreta to composting in a treatment site maintained by the community.

Photo 2: Educational meetings in Gros-Morne region

Credit: ZANA

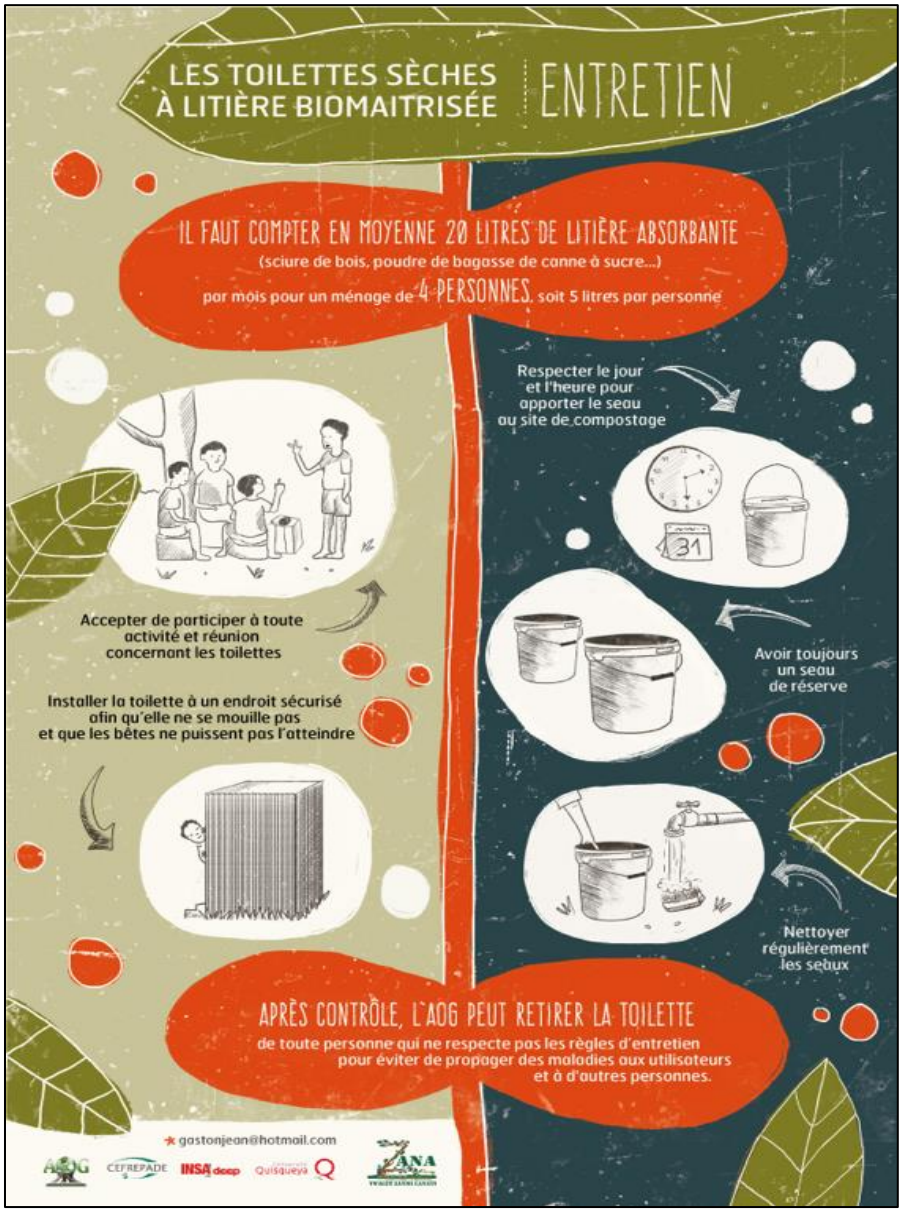
Photo 3: Agreement signed by participating households to use ZANA toilets

Credit: ZANA

Phase 3. Once communities have confirmed their interest in CBS after learning about the costs and labor commitments required to implement such systems, the community organizer does an assessment of their readiness to implement a ZANA system. The assessment consists of determining households' capacity to pay for a dry toilet and its maintenance, including the covering materials required to operate their toilet after each use and cleaning materials to periodically disinfect the toilet and its containers. During this phase, the community organizer also considers whether the community has sufficient resources (space, materials, and labor) to build and maintain a composting site. Not all communities are ready to implement a sustainable CBS system, even if they are interested. Since the ZANA model relies on

community ownership and sustainability principles, communities lacking the necessary resources to sustain a CBS system on their own are not encouraged to implement one.

Figure 8: Educational material illustrating households' commitment to adhere to CBS



Source: Concept prepared with support of the World Bank.
Design: Dotzauer & Esquirol Rios – El Taburete

Phase 4. After it is determined that households in a community are ready and able to implement a CBS system, each participating household signs an agreement with ZANA designed to encourage engagement in the sustainability of the system for the benefit of the entire community (Photo 3). Contrary to documented CBS initiatives in urban areas, in the ZANA model, there is no external service provider. Instead, through the agreement, households first commit to pay for the construction of the dry toilets and their maintenance (keep the toilet clean, regularly empty the containers on a schedule established by the community). They also commit to contribute to the safe functioning of the composting site and to participate in training and community events regarding the CBS system (Figure 8).

Phase 5. Production of the dry toilets and construction of the composting and container disinfection sites begin after all households have signed the agreements. The community organizer provides training activities for building and installing toilets and the compost platform (Photo 4). The organizer also conducts periodic follow-up visits to the community to answer questions and observe the treatment site. The entire community organization process can take between three and six months from the first meeting to the time families begin using their toilets.

Photo 4: Construction and implementation of toilets

Credit: ZANA

4.2 Containment

As with most CBS approaches, ZANA uses dry toilets with a diverting mechanism to separate urine from feces into different containers —a 3.8-liter jug for the former, a 20-liter bucket for the latter — under a toilet seat supported by a 51x40X51 cm wooden structure to hold these vessels. The jug has a 10-centimeter diameter funnel acting as the diverting mechanism (Figure 9). A spare container and bucket are required to ensure timely replacement when a container is full.

Figure 9: Educational material illustrating the ZANA dry toilet model (in Creole)

Design: Dotzauer & Esquirol Rios – El Taburete

Community members build the dry toilets and install them inside their homes under the supervision and assistance of a craftsman. Each dry toilet costs about 6,600 HTG (approximately US$73)[7] for labor, parts, and installation. ZANA offers microloans[8] to families to cover the cost of a toilet, which families pay in monthly payments ranging from 100-250 HTG (1.1-2.8 US$).

Households are responsible for obtaining the covering material required after each use. The two most common materials are sawdust and sugar cane bagasse, which are available at no cost from local carpenters or sugar cane mills. A pilot implementation estimate suggests that a minimum of five liters of covering material per person per month is required to optimally operate a household's dry toilet.

4.3 Transport and Disinfection

The ZANA model currently does not include a treatment process for urine. During the training sessions, households are advised to use it for garden irrigation (using a 1: 10 urine to water mixture) or dispose of it in the open at a safe distance from water sources. About a third of households in the pilot implementation group reported using urine for their gardens.

Once a week, a household member carries the feces container tightly sealed with a lid to the treatment site. In the communities currently implementing CBS, the distance from a household to the community treatment site ranges from 200 to 600 meters. Further, the pilot tests showed that the average weight of a bucket after a week's use by a household of five members is approximately eight kilograms (kg). Once at the treatment site, the container's contents are emptied into the composting bin (Photo 5). The treatment site has a water source to clean and disinfect the vessels using a two-step process. First, the container is carefully rinsed with water; the wastewater flows towards a landscaped and vegetated infiltration zone (preferably with plants having purification and water retention properties, like the local "vetiver"). Once cleaned, the container is disinfected with a solution of water and chlorine (3 cups for 10 liters of water) and rinsed.

In the absence of a CBS service provider that performs the functions of collecting, transporting, and emptying excreta-filled containers to the treatment site as is the case with CSB services in urban areas, ZANA users perform these tasks themselves. This may pose a health risk from potential unsafe handling of excreta, especially in rural areas where protective equipment

[7] The exchange rate was 0.011 US$ for 1 HTG on May 10th, 2021

[8] The terms of the microloans vary. They range from 6-24 months at 0-20% interest rates. The loans are administered by AOG. It is important to note that while AOG assists with the administration of the loans it is not a financial institution. Funds for the microloans currently being used came from the initial funding received by AMP and the Suez foundation for the pilot program.

(e.g., gloves, masks, etc.) may not be easily accessible. To mitigate these risks, ZANA conducts extensive training on best practices to safely transport, empty, and disinfect containers during its community organizing stage of implementation and on follow up visits. In addition, to further mitigate these risks, some communities have organized themselves to schedule deliveries on the same day of the week to make the emptying and disinfection process a community effort where users can help each other and reinforce safety practices among themselves.

Photo 5: ZANA Composting bin in Grande Plaine, 2016

Credit: Gaston Jean

4.4 Treatment and Reuse

Communities are trained to build and manage their own composting sites. They also receive periodic follow up visits from ZANA to check the sites during the first months of operation. The composting occurs in wood or bamboo bins laid directly on the ground, their bases lined to avoid extra humidity and soil filtration. A mosquito net is placed on top to prevent insect infestations. The bins vary in size depending on the number of users, and their capacities range from 300 to 2000 liters.

A pilot study conducted in 2015 determined it takes about nine months for the compost to become hygienic and achieve its best consistency and water retention qualities (Jean, et al., 2017). Once a bin is full, it sits for three months, after which its contents are mixed before being emptied and composted for an extra six months, without adding any materials during this process. Thermophilic composting requires high temperatures — between 57° and 71° C, as demonstrated by research — to destroy insect eggs (e.g. fruit flies), pathogenic organisms,

and undesirable weed seeds in the compost. Measurements taken during the pilot study suggest that the compost piles achieved temperatures above 70°C and remained at temperatures above 50°C for at least eight days in all bins. The highest temperatures were reached in compost piles using only sugar cane bagasse as covering material. Additionally, tests on the compost bins showed that levels of E-coli bacteria were minimal in all the samples after one month and non-existent after nine months of composting. Levels of other pathogens (helminth eggs, intestinal enterococci, salmonella, aspergillus) were also below the minimum acceptable levels of pathogens mandated by DINEPA (Jean, et al., 2017).

The resulting compost belongs to the community implementing the CBS system. To date, none of the communities have commercialized it for agriculture, and mainly employ it for household and community gardens, to grow papaya trees locally, or for areas undergoing reforestation. Part of the compost was also donated to a local organization implementing environmental and agricultural projects in the region.

5. Model Implementation and Outcomes

5.1 Implementation

The pilot program started in 2016 with 25 households. One year later, these came together as the ZANA group and became volunteer ambassadors for CBS in their region. AOG, which provided initial support for the pilot program remains an integral part of CBS implementation, providing institutional and administrative support for awareness and education activities while providing microloans to implement the ZANA model in other communities in the Gros-Morne and Terre Neuve regions of the Artibonite department. In addition, the ZANA CBS program entered AOG's environmental conservation and sustainable agriculture program. Part of the compost produced by ZANA communities, for example, is donated to AOG's sustainable agriculture commission.

By 2018, ZANA had added 26 more homes from the *Moulin* community, bringing the total number of operating toilets to 51. In 2019, no new households entered the program, and three of them left the CBS systems when they moved away from the region. In 2020, 26 new families from the *Eau Janvier*, *Ti coin*, and *Bellevue* communities joined the program, partly as a result of intensified community organizing efforts thanks to support from the World Bank. That year, a total of 444 individuals from 74 households were engaged in the ZANA CBS model. In addition, the CBS system processed a cumulative estimate of 59,480 kg of feces and produced a cumulative estimate of 11,900 kg of compost (Table 2). The proportion of participating households within each community ranged from 11 percent of households in *Eau Janvier* to 45 percent in *Moulin*.

Table 2: Installed toilets, individuals served and compost production per year 2016-2020

	Year				
	2016	**2017**	**2018**	**2019**	**2020**
Toilets installed by year	25	24	2	-3	26
Toilets in operation (Cumulative)	25	49	51	48	74
Individuals served per year	150	144	12	-18	156
Individuals served (Cumulative)	150	294	306	288	444
Processed feces per year (Kg)	6,000	11,800	12,290	11,560	17,830
Compost produced per year (Kg)	1,200	2,360	2,460	2,310	3,570

Source: ZANA

A noteworthy outcome of ZANA's implementation is its high level of participant retention. To date, 95 percent of participating households are still operating their ZANA systems. While a survey to collect direct feedback from participant households on their motivations and satisfaction was beyond the scope of this study, anecdotal evidence suggests that ZANA

participants consider their toilets to be more affordable than latrines and value the comfort and safety of having their toilets in their homes.

5.2 Costs

As explained in the previous section, part of the costs that communities need to pay to implement the ZANA system includes the HTG 6,600 construction and installation per dry toilet, plus the cost to purchase covering material and build the composting platform.[9] Further, ZANA assumes the costs for the intensive community organization and education activities, including transportation and salaries for community educators. Overall, each community may need up to 24 meetings spanning a period of three to six months to be fully organized for implementation. Thus, a community of 25 adopters would need to invest approximately HTG 118,000 (about US$1,300), or a significant amount of HTG 4,720 (US$52) per household. This amount includes the average price for transportation and daily pay per educator. Table 3 details these costs below.

Table *3*: Costs of Implementation per community - Transport and daily pay for community educators (2016-2020)

Activity	Meetings #	Transport costs (HTG)*	Meeting Facilitator (HTG)**	Total costs of community organization (HTG)
Meetings with community leaders	3	6,000	7,500	13,500
General information meetings (with interested communities)	3	6,000	7,500	13,500
Awareness meetings for selected households	6	12,000	15,000	27,000
Toilet manufacturing workshop	4	8,000	20,000	28,000
Training in the composting process	4	8,000	10,000	18,000
Composting platform manufacturing workshops	2	4,000	5,000	9,000
Distribution of toilets microcredit explanation and signature of agreement	1	2,000	2,500	4,500
Follow-up meeting after implementation	1	2,000	2,500	4,500
Total cost per community (HGT)		48,000	70,000	118,000
Total cost per household (HGT)		1,920	2,800	4,720

Source: ZANA.
* Average transport costs are estimated at 2,000 HTG. Covering a round trip (15 km away) from the educator's residence.
**Average costs for are estimated at 2,500HTG per day for community educators and 5,000 HTG for master builders

[9] This estimate does not include the costs of the microloan many households use to finance the dry toilets.

The total expenses of community organizing, materials and toilet manufacturing gives a total of 11,320 HTG (US$125) per household to implement ZANA CBS. Assuming a 10-year life span and a five percent discount rate, this represents an annualized cost of about US$16. For comparison purposes, estimates based on UNICEF data suggest the annualized cost per household of a typical latrine installed in the area where ZANA operates is about US$29 (Table 4).

Table 4: Costs per household of a ZANA CBS toilet compared to a Pit Latrine in rural Artibonite

	ZANA CBS Cost per household	Pit Latrine Cost per household
Materials and manufacturing (HTG)*	6,600	7,800
Community organizing (salaries and transport costs for educators, meetings etc.) (HTG)**	4,720	12,890
Total cost (HTG)	11,320	20,690
Total cost (US$)	125	227
Annualized cost (US$)	16	29

Source*:* ZANA and UNICEF

* These costs do not include financing costs (microloans)

** A potential reason to explain the difference in cost for community organization might be the related to the involvement of international experts, while the ZANA model only involves locals.

It is important to note that Table 4 only presents the financial costs of the initiative, and do not include economic costs and benefits associated with latrines or ZANA toilets, including on the one hand, potential, though limited in the ZANA model, health and contamination risks related to the container transportation and emptying, and on the other hand, positive externalities such as the perspective of ending open defecation in the CBS communities. While the estimation of all economic costs involved was beyond the scope of this study, it represents an important area for future research on the feasibility of CBS approaches in both urban and rural areas.

5.3 Sustainability and Scalability

As Table 1 shows, the number of dry toilets installed, while small compared to large CBS initiatives in urban areas, tripled (from 25 to 74) during the 2016-2020 period. Remarkably, virtually all families that signed up in 2016-2018 continued to use their CBS systems by 2020. This underlines that the ZANA systems experience low turnover and high self-reliance once implemented, which is not surprising because sustainability is one of the model's hallmarks. Only communities willing, ready, and with sufficient resources are encouraged to implement such systems. Community selection and training have been successful so far, demonstrating the importance and success of the community organizing aspect of the ZANA model.

Scalability is one of the main challenges for CBS systems, and the ZANA model is not an exception. The model has been replicated successfully beyond the pilot in neighboring communities of the commune of Gros Morne. Still, future expansion and replication in other regions will face three potential barriers: access to microcredits, institutional support that would accommodate scale up to other communities, and community readiness.

5.3.1 Access to Credit

As explained in the previous section, households must cover the cost of a dry toilet in cash or credit. Most families using CBS systems require microloans that have so far been administered by the NGO AOG, while the payments for existing loans finance additional ones in other communities. Access to credit is constrained by the availability of funds and does not allow to offer microcredits to all households of a community. Additionally, not all new households would require the same loan terms.

However, assuming a conservative scenario where 25 households would cover the costs of implementation through microloans, a rather limited credit of about HTG 165,000 (about US$1,825 at May 2021 exchange rate) would be needed to develop a system. It could take less than two years to recover this amount at current interest and default rates.[10] Further analysis would be needed to assess the interest of potential microlenders to invest into such systems.

5.3.2 Institutional Support

During the past four years, ZANA expanded the model to neighboring communities without needing to cover the total costs reflected in Table 2, thanks to ZANA members and AOG educators who volunteered their time and, in many cases, paid their travel costs.
The lack of donor funding and sole reliance on volunteers has proven to be a significant challenge, as they require training to become educators. Further, many of them move away from their communities to look for employment after being trained, typically moving away to the Dominican Republic, leaving the organization with few educators for the intensive community organizing efforts required by the ZANA approach.

Hence, ZANA's expansion will depend on the size of its volunteer group and the mobilization of funds to pay salaries and travel costs to recruit and retain new educators. This would also require the setup of an organization that would replicate ZANA founder's and have to ability to train and organize these volunteers. To date, AOG has provided a large share of this institutional support.

[10] This estimate assumes a scenario where the 25 households finance the full cost of a toilet and its installation (6,600 HTG) at 20 percent simple interest over the life of the loan at 24 months and a 10 percent default rate.

However, model replication in other parts of the country would need the institutional infrastructure of a community-based organization like that supplied by AOG.

5.3.3 Investing in Community Readiness

The lack of donor funding and sole reliance on volunteers has proven to be a significant challenge, as they require training to become educators. Further, many of them move away from their communities to look for employment after being trained, typically moving away to the Dominican Republic, leaving the organization with few educators for the intensive community organizing efforts required by the ZANA approach.

5.4 ZANA in the context of other documented CBS approaches

Ample contextual differences impede a direct comparison between urban and rural CBS sanitation models. However, the ZANA experience suggests that this rural CBS system shares many of the same opportunities and challenges experienced by other CBS systems implemented in urban areas (Table 1).

ZANA's community organizing model has ensured that households adopting the model build sustainable and resilient systems that are highly valued by them in terms of their affordability, comfort, and safety over other available methods of sanitation — as is the case with other documented urban CBS systems. However, while ZANA implements self-sustaining community-ran systems that once implemented could subsist in the absence of ZANA, the model's capacity to be replicated in other communities has been limited and required external financing and technical support. In addition, and similar to its urban counterparts, the model has been implemented with little direct involvement from local sanitation authorities and has not included steps for the treatment of urine or gray water. This suggests that promoting the development of local policies and regulatory frameworks that foster CBS systems in urban areas may be beneficial for advancing CBS implementation for rural areas as well.

5.5 Conclusions and Lessons Learned

Between 2000 and 2017, Haiti substantially decreased the practice of open defecation in rural and urban areas. Yet, one out of five Haitian households continue this practice, particularly in rural areas. The most impoverished rural families have the highest rates of open defecation, and there has been little progress in this regard during the past decade.

DINEPA's concentration of WASH investment in urban areas, still limited institutional capacity of the OREPAs, and the sector's heavy reliance on external funding result in a lack of progress in ending open defecation in these areas. In the Artibonite department, the epicenter of Haiti's cholera epidemic in 2010, the lack of accessibility has further hindered investments in improved sanitation. Those investments were focused almost exclusively on building uncovered pit latrines that received little follow-up or maintenance. Usually, communities abandoned the latrines once these filled up and waited for their local OREPA or an NGO donor to construct new ones.

The purpose of this study was to build on the World Bank's efforts to evaluate the potential of CBS sanitation alternatives by describing the implementation of a homegrown CBS initiative developed and implemented in rural Haiti. The ZANA model emerged as a locally-designed CBS alternative for rural households in the area of Gros-Morne region of the Artibonite department and has allowed them to be in charge of their own improved sanitation systems. ZANA engages communities and trains them to build self-sustaining CBS systems. During its first five years of operation (2016-2020), the ZANA approach was able to provide 444 people with an improved sanitation solution and replicated its approach in five different communities in the Gros-Morne region. ZANA was able to retain all its customers and ensure high levels of community engagement.

Two factors largely determined this success: extensive community training and detailed assessments for implementation readiness. Firstly, as is shown in the literature, community buy-in into sanitation and hygiene solutions requires raising awareness and education on sanitation alternatives and community ownership and self-reliance to ensure the sustainability of the CBS systems. Secondly, ZANA's success in developing sustainable systems relies on its thorough approach to make sure that only communities that are willing, able, and ready will implement a CBS system. This may adversely affect the ability of the ZANA approach to replicate the model on a larger scale. However, this challenge is expected in any sanitation program in Latin America and the Caribbean and other areas around the world where poor people lack access to sanitation solutions. Further, it does not take away ZANA's success in sustainably reducing open defecation by providing a safe and hygienic sanitation service in the participating communities. Finally, ZANA also educates and empowers communities to collectively take care of their environment using a culturally appropriate community organizing method. This empowerment process impacts communities, allowing them to build and operate their CBS system, but it is also likely to have positive spillover effects on improving community lives and environment.

It is early in the process, and beyond the scope of this report, to evaluate the feasibility of large-scale investments in CBS in rural areas using ZANA's example. Moving forward, we believe additional research is needed on three fronts: First, it will be important for future research to

evaluate both individual and community-level health benefits and risks of community-ran CBS systems when compared to latrines and open defecation. In addition, additional case studies that highlight household and community factors that determine the successful adoption of CBS systems in rural areas is needed to understand how CBS can be scaled up as regional strategy. Finally, the literature on cost benefit analyses evaluating CBS vis-a-vis other sanitation alternatives is still limited for urban areas and, to our knowledge, non-existent for CBS in rural areas. These are critical areas of research that could further inform NGO and public sanitation agencies' future investments in CBS strategies for reducing open defecation and making progress towards the 2030 Sustainable Developing Goals.

Within the large scheme of sanitation strategies CBS is still an emerging field. More studies that highlight the challenges and opportunities of CBS approaches, especially in rural areas are needed. Yet, as described in this report, the Haitian communities that have embraced the ZANA approach over other sanitation alternatives suggest that CBS systems can be attractive to rural communities and should be considered as part of the repertoire of potential strategies for improving sanitation for the rural poor.

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