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Implementation of Smart Toilets as An Innovative Business Model in Public and Private Institutions

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Abstract

The main objective of the research article was to determine the implementation of smart toilets as an innovative business model. The deductive method and basic type were used because the research generates new knowledge, for the synthesis the PRISMA method was considered, as a technique was observation and as an instrument 52 articles of which 10 articles were left for review among them are Scopus, Web Of Science, Google Scholar, Scielo, Redalyc, Dialnet, Journals among others, the Boolean operators, AND, OR AND NOT were used for the inclusion and exclusion criteria, which were analyzed qualitatively. Smart toilets offer a number of benefits ranging from water savings and improved hygiene to remote control and problem detection, their adoption can improve the bathroom experience and provide an additional level of comfort and convenience for users. Finally, it is concluded that its implementation is an innovative business model due to its efficiency in the use of water and a significant advance in modern life, because they represent a remarkable hygienic aspect and comfort of the home and a personalized experience, its long-term success will depend on factors such as accessibility, acceptance, continuous and technological innovation.

Keywords: *Toilet, Smart, Model, Business, Innovative*

INTRODUCTION

This innovative business model, which is the dry toilet, is based on a deductive methodology, because it is based on a feasible proposal for the Peruvian market based on the review of different studies and documented experiences in African countries and India. We are not starting from a database, but from a series of encouraging data that show that changes need to be made to the current health system, which is not accessible to more than 2500 million people **Wang-Erlandsson et. al (2022).** In a world where the conservation of natural resources is a growing priority, the need for sustainable solutions in all aspects of daily life becomes imperative. In this context, the design and implementation of innovative business models stand as a crucial component to promote environmentally responsible practices. One of the sectors that deserves special attention in this regard is sanitation, where the use of water is significant and its conservation is essential. **Aburto et. al (2020).** This work focuses on the development of a business model focused on the dry toilet, an eco-friendly alternative to the traditional toilet that does not require water for its operation. For **Aquae (2024),** the dry toilet, also known as a toilet or composting toilet, offers a viable solution to reduce drinking water consumption and minimize environmental pollution associated with wastewater treatment. Sustainable nutrient management is a crucial area of focus for both research and policy. Many current nutrient practices have a harmful environmental effect and the need to ensure future access to fertilizers is increasingly imposed. Systems analyses have repeatedly identified a significant, but often overlooked, nutrient cycling resource: healthcare waste **(Krause et al., 2021).** Specifically, separately the human excreta collected in the dry toilets is considered a valuable resource for integrated recovery. of phosphorus, nitrogen and other nutrients in a regional circular economy from farm to

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fork to farm. By improving nutrient management and cycling, nutrient and water consumption can be reduced, greenhouse gas emissions can be reduced, and crop production can be improved **(Kraus et al., 2021).** Minimization of pathogens. Safe handling should not be ruled out, but it has already been successfully demonstrated in other studies **(Häfner et al., 2023)** that the United Nations 2030 Agenda and its Sustainable Development Goals **(United Nations 2015)** express a global consensus for a global, multidimensional and multi-stakeholder approach to sustainable development. In its adoption in 2015, the same year as the Paris Agreement on Climate Change (UNFCCC 2015), the 2030 Agenda. **For Amazon (2024)** In this research, a comprehensive methodology is proposed that combines analysis of current studies, as well as environmental and social sustainability considerations. For **Munshi (2016),** through an interdisciplinary approach, it seeks to identify business opportunities, evaluate challenges, and establish effective strategies for the successful implementation of this model. A CANVA model will be presented, which will synthesize the key aspects of the dry toilet business model, as well as understand the advantages and disadvantages of the product, as well as the marketing strategy.

METHODOLOGY

Methods

The deductive method was applied because it is a logical process that is used to reach a specific conclusion from premises or general statements. In essence, it involves reasoning from the general to the particular. It was of a basic type because new knowledge will be denied by employing documentary analysis.

The systematic review for this article was carried out following the model of the Prism Statement The systematic literature review (RSL) is an arduous process that identifies, evaluates, and interprets all relevant information about a research question, thematic area, or phenomenon of interest (Kitchenham, 2004); it offers a starting point for the academic community and needs planning, search, selection and systematization.

Information Collection Process

The search for information was carried out in the databases: the study was carried out through a systematic review of the literature using several resources such as: techniques and instruments related articles, as well as: Scopus, Web Of Science, Google Scholar, among others. Initially, a large number of documents were collected to which several selection and quality criteria were applied, obtaining a small number of studies that were analyzed qualitatively. The search equation (AND OR and NOT) was also used as the main strategy of systematic search, the Tree of Science (ToS) tool was used, which uses the Web of Science (WoS) database. one of the richest collections of scientific research in the world. ToS was developed by **Robledo et al. (2013).**

Inclusion and Exclusion Criteria

For these equations, filters were used: by type of document (articles only), by publication period and by thematic area as allowed in the web portals of each one. From these searches, a total of (52) potentially usable scientific articles related to topics in this study were obtained.

Subsequently, in the first verification, between the compatibility of the title of each article with the objective and the guiding questions asked, 20 articles were filtered. Then, 20 were excluded because they were not directly linked to the central theme of this systematic review in the abstract. Later, 2 were excluded, since the content was not related to the present research. Finally, 10 sources of information remained, as shown the prism method was used.

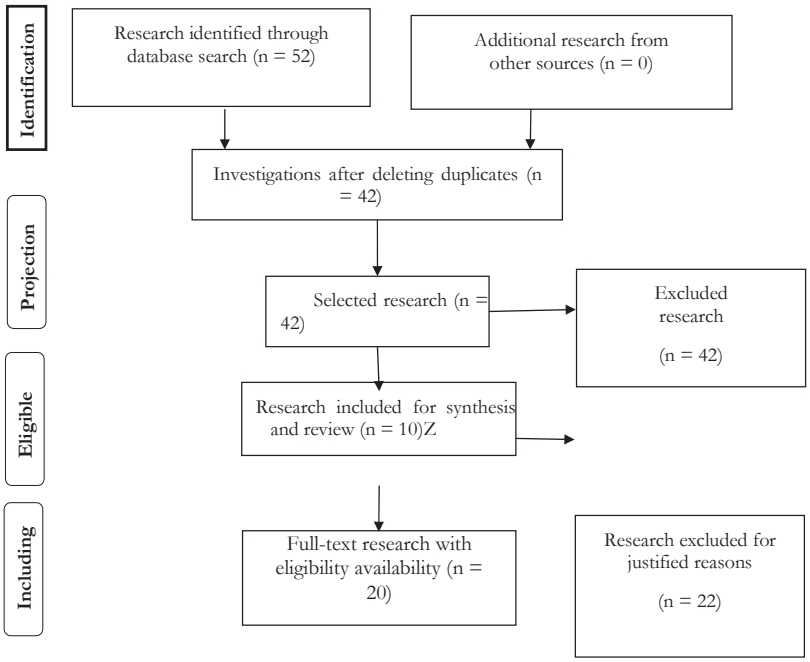

Figure 1 PRISMA Flowchart
*Note***.** Own elaboration (2024)

Procedures for Analysis

To this end, we have resorted to reviewing different studies, most of them indexed in English and of recent date, which gives us support to be able to make an adequate review in section II Results. In addition to this, we consider that in order to model a business model in the best way, it is necessary to make a business plan, which escapes the limits of this research work, the suggested methodology should complete the following steps:

Analysis of the Environment

A PESTEL (Political, Economic, Social, Technological, Ecological, and Legal) analysis is performed to understand the macro environment in which the company will operate. This analysis helps identify external factors that can influence the business, from government regulations to social and technological trends.

Industry Analysis

Porter's Five Forces model is used to assess competition in the industry and the bargaining power of both suppliers and customers. This analysis allows the identification of potential threats and the competitive intensity in the market.

Market Research

A combination of qualitative and quantitative research, including interviews with experts, focus groups, and surveys, is conducted to gather information on the needs, preferences, and behaviors of potential customers. This helps the target market and tailor the product's value proposition to the customer's expectations.

Product Development

A user-centered design approach is applied to the development of the product, ensuring that the features and functionalities of the smart toilet meet the requirements of sustainability and water efficiency desired by the target market.

Marketing Strategy and Positioning

A detailed marketing plan is developed that encompasses market segmentation, value proposition, product positioning, and marketing mix (product, price, place, and promotion) to effectively communicate the product's unique benefits and features.

Financial Evaluation

An in-depth financial analysis is performed, including revenue and cost projections, projected financial statements (income statement, balance sheet, and cash flow), and calculations of key financial indicators (NPV, IRR, break-even, among others) to evaluate the viability and profitability of the project.

Operational and Organizational Plan

The organizational structure, operational processes, human talent needs, and infrastructure required for the effective production and marketing of smart toilets are defined.

RESULTS

Dry sanitation has received acceptance in rural regions in Europe and the United States, its advantages being the non-use of water, low energy requirements and the creation of fertilizer as added value, as well as an opportunity to provide sanitation to 2500 million people in the world, although its use is still limited **(Aburto, 2000).** to this is added advantages in countries where sewage systems are lacking and suffer recurrently from water scarcity, which is not only in underdeveloped countries and even each country has developed its own technologies and adaptations **(Kaczala, 2006).**

In terms of characteristics, composting tanks usually have two or three chambers and comply with the composting, evaporation and finishing stages. On the other hand, there are electric and non-electric toilets, as well as urine separators and combined collectors **(Aburto, 2020).**

In the case of human excreta, it is important to have a specific treatment of concentrated waste streams, which eliminates most pathogens and pollutants, while avoiding dispersion in soil and groundwater **(Jung, 2023).** On the other hand, **(Kaczala, 2006)** highlights that urine is an opportunity as a fertilizer because of the useful nutrients it contains, such as nitrogen, phosphorus, and potassium.

The challenge for African countries is to use water efficiently and at the same time guarantee decent sanitation for the population, which is aligned with the recommendations and objectives of the WHO, which seeks proper handling of water and food and restricting the appearance of causes of diseases. While dry toilets do not require water, hand washing should be included before handling food **(Lundin, 2013).** In the case of the World Bank, it estimates that poor sanitation has an impact of 7% of GDP in Asian countries and 2% in African countries (**Rijsberman & Zwane, 2013).**

But it is not only in Africa, in India, the most populous country in the world today, has the problem that there is the widespread practice of open defecation, in addition to the fact that more than 1000 children under 5 years of age die from diarrhea. In this sense, the dry toilet offers the opportunity to eliminate the spread of diseases, use excrement and urine as fertilizer, avoid the contamination of rivers, lagoons or scarce sources of fresh water and save water for other purposes such as drinking, washing, cleaning **(Munshi, 2016).** Precisely the studies of **(Panesar, 2022)** in India went further to understand what he calls "the flow of shit", to close the complete circle so that this project is not something isolated but a new way of processing waste collection, its processing, as can be verified in the following figures.

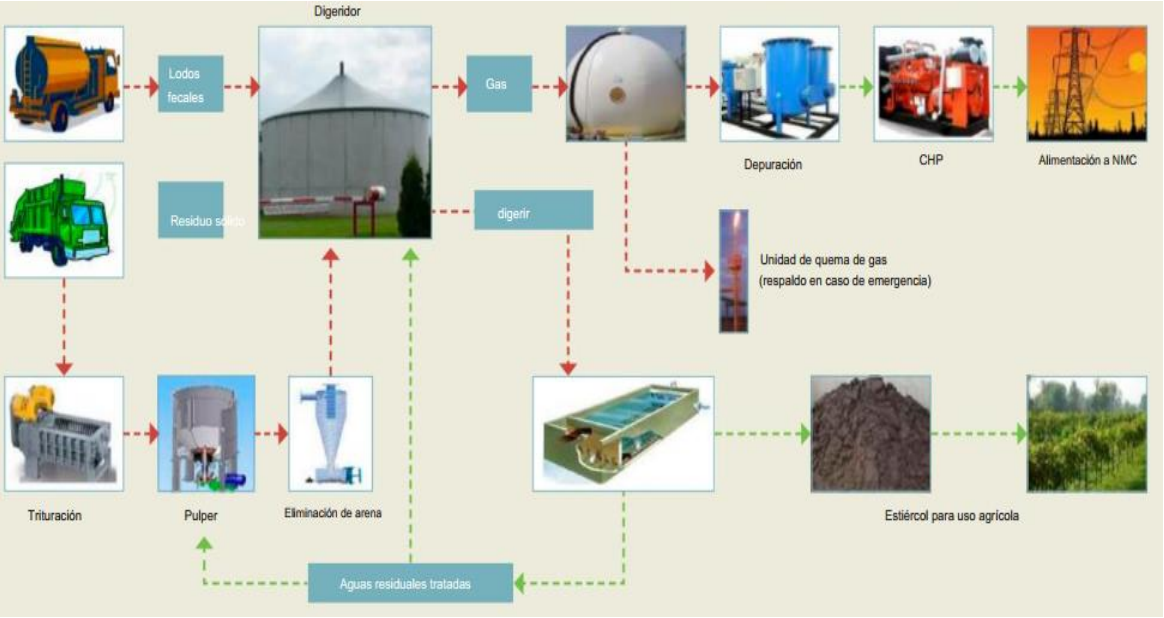

Figure 1 Process flow of Waste to Energy project in India

Note. Excerpted from Panesar (2022)

In the case of Hamburg, Germany, there is a project aimed at making sewage to produce biogas and fertilizers, gray water is treated separately and used for the irrigation of green areas. To achieve this, efforts must be joined between different agents, both government and private (**Panesar, 2022).**

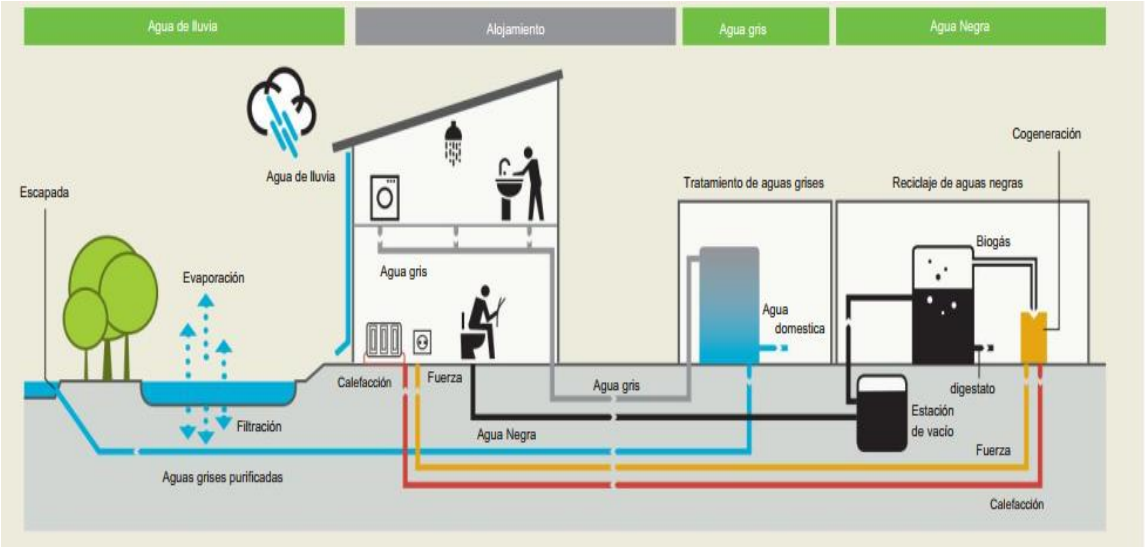

Figure 2 The water cycle in Hamburg

Note. Excerpted from Panesar (2022)

Now these initiatives must go hand in hand with the awareness that must be taken care of water, which does not occur, for example, in the United States and several European countries (Rizzadini, M. 2016). In the case of Europe, the use of the toilet represents 30% of a person's water consumption, while the shower represents 35%. If we consider (Gaceta Udeg, 2022) where it indicates that a person needs an average of 100 liters of water a day and according to (Aquae Foundation, 2024) the ideal would be 50 liters so that more people in the world have access to water, the dry toilet would be a great solution to get closer to that ideal of consumption.

It is recommended that you think about architectural solutions where waste can be treated without having to personally take it to the containers, considering that, for example, in Barcelona most people do not live in houses but in apartments **(Rizzadini, M. 2016)** this type of solutions go hand in hand with the 2030 Agenda (Taka & et al., 2021), which focuses on the integration of people and planet, in an environment where social, economic, and environmental tensions predominate, which is why it is necessary to think about new sustainable and sustainable ways (Sjåfjell, Cornell & Häyhä, 2023).

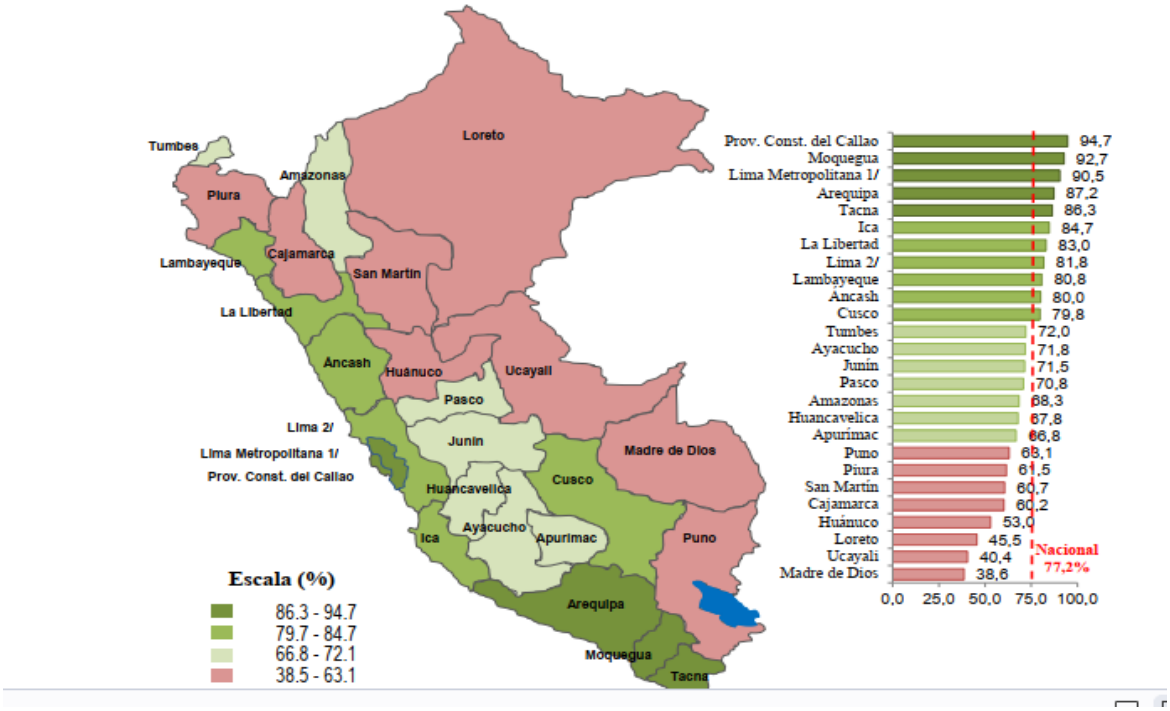

Figure 3 Percentage of population with access to the public sewerage network as of 2022

Note. Excerpted from INEI (2023)

According to the bulletin (INEI, 2023), as of 2022 in Peru, 77.2% has drainage connected to the public network (86.8% being urban and 39.1% rural). It is worrying that 22.8% of the country's population does not have access to sanitation service through the public network. The departments with the most complicated situation are Puno, Piura, San Martín, Cajamarca, Huánuco, Loreto, Ucayali and Madre de Dios (see Figure 3).

Based on the review of the vast bibliographic material, we rely on the revised CANVA Model. Although the greatest opportunity is for rural areas, we see that as an initial launch would be the massification of its use in urban areas without access to water and sewage. As a trade name, we consider as a group that a suggested name is "Smart Toilet" and as a slogan "Less water, more life". The CANVA model for the widespread use of dry toilets in urban areas without access to water and sewage could be organized as follows:

Market Segmentation

Identification of urban areas with water scarcity and lack of drainage infrastructure.

Demographic analysis to understand the needs and preferences of the target population.

Value Proposition

Highlight the benefits of dry toileting, such as water conservation, reduced operating costs, and positive impact on the environment.

Highlight the convenience and hygiene of the composting system used in dry toilets.

Distribution Channel

Explore different distribution channels, such as partnerships with local NGOs, housing cooperatives, municipalities, and commercial establishments.

Consider direct sales, installation in public spaces and rental of mobile units.

Customer Relations

Establish clear and educational communication about the operation and maintenance of dry toilets.

Offer technical support and warranty services to ensure customer satisfaction.

Sources of Income

Income from the sale or rental of dry toilet units.

Maintenance and waste collection services.

Possibility of offering financing programs or subsidies to facilitate the acquisition of dry toilets.

Key Resources

Strategic alliances with manufacturers of dry toilet systems and suppliers of compostable materials, as well as with the Peruvian government.

Technical team trained for the installation and maintenance of dry toilets.

Marketing and education campaigns to generate public awareness and acceptance.

Something important is that the impact that the product is having must be measured through some indicators such as:

Evaluation of drinking water savings and reduction of environmental pollution.

Monitoring of the increase in sanitation coverage in urban areas without access to water and sewerage.

Collection of data on the improvement in the quality of life and public health of the population served.

Reduction of pollution of rivers, lakes, seas, which affects biodiversity.

Improve water treatment by reducing the presence of fecal waste that is more difficult to treat.

In the case of the advantages that we find in the proposed dry bath product are:

Saving drinking water.

Reduction of water pollution.

Elimination of the need for drainage.

Production of organic compost.

Lower environmental impact in sensitive areas.

Although it is an eco-friendly product and aligned with the sustainability objectives of the 2030 Agenda, it does have disadvantages, the main ones being:

Requires additional space for composting.

Increased maintenance requirements.

Possible odor generation if not handled correctly.

It requires education and changing user habits.

Initial installation cost may be higher.

As for the marketing strategies for "Smart Toilet", the following actions will be focused, which will be accompanied by the slogan "Less water, more life".

Education and awareness: Develop educational campaigns to inform the public about the benefits of dry toilets and how it works.

Live demonstrations: Organize events where potential customers can see and experience directly the operation of a dry toilet.

Participation in events and fairs: Be present at events related to the environment, sustainable construction and public health to promote dry toilet and establish contacts with potential customers.

Financing Programs: Facilitate affordable financing options for those who wish to install a dry toilet, which can help overcome initial economic barriers.

Influencer collaborations: Working with influencers and thought leaders in the sustainability and environmental space to increase the visibility and impact of dry toilet marketing campaigns. Relying on **(Velandia, 2024),**

We verify that the most suitable pattern for "Smart Toilet" is the *service transformation pattern.*

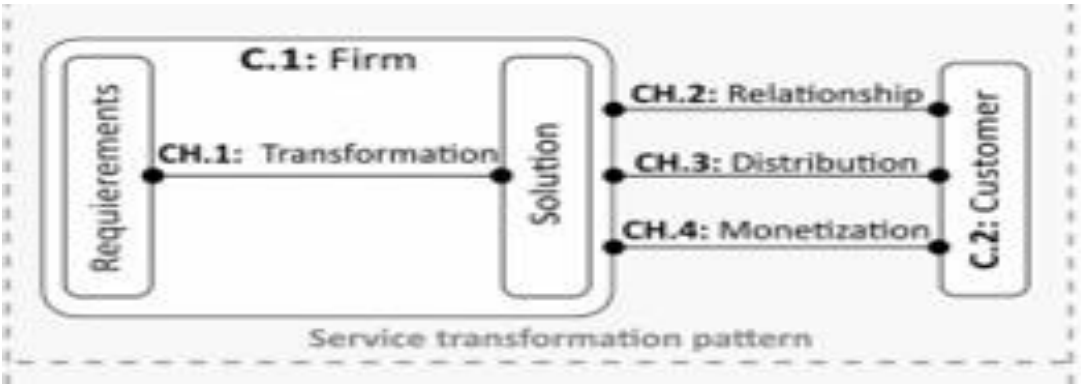

Figure 4 Service transformation pattern

Note. Excerpted from Velandia (2024)

Considering precisely this pattern and based on the literature review, the following activities are carried out for each stage:

CH1: Transformation

Feasibility study.

Adapted product development.

Establishing a sustainable supply chain.

Comply with regulations and permits.

Monitoring through business indicators.

Education and awareness of society.

CH2: Relationship

Community participation.

Beneficiary registry.

Establish a customer service area.

Communication support through multimedia material.

Continuing education on sustainable practices.

Personalization of the service.

CH3: Distribution

Efficient delivery logistics.

Installation of a dry toilet.

Assistance and follow-up.

Returns and replacements management.

Support service in use and delivery of supplies.

CH4: Monetization

Sale of the product.

Sale of additional additives (coconut fiber, special sawdust).

Proposals for financing and subsidies with the company and/or government.

Waste collection fees (reverse logistics).

Advertising and sponsorship.

As for the product considered for the Peruvian market, we consider that the right one is a product that is not so expensive but that offers advantages in its installation and maintenance, it is important to mention that the prices of this type of bathrooms especially used for Camper or tourism is between 50 to 60 US dollars, which are published on pages such as Amazon and even in Youtube videos (Amazon, 2024, Brunner, 2024).

Product Design Photo Panel

	
The seat and lid can be opened and closed separately and toilet paper holder	**Modern and portable design**

Bucket with removable lid and robust PP durable construction	Removable internal accessory

Figure 5. Suggested Dry Bath Model

Note. Brunner Outdoor in Motion

Table 1First Year Flow

Month	Gross income (soles)	Costs (soles)	Labor (soles)	Net income stream (soles)
January	300,000	200,000	50,000	50,000
February	300,000	200,000	50,000	50,000
March	300,000	200,000	50,000	50,000
April	300,000	200,000	50,000	50,000
May	300,000	200,000	50,000	50,000
June	300,000	200,000	50,000	50,000
July	300,000	200,000	50,000	50,000
August	300,000	200,000	50,000	50,000
September	300,000	200,000	50,000	50,000
October	300,000	200,000	50,000	50,000
November	300,000	200,000	50,000	50,000
December	300,000	200,000	50,000	50,000

*Note***.** Prepared according to income (2024)

Interpretation

The net income stream for each month is 50,000 soles, as gross income of 300,000 soles is reduced by total costs of 200,000 soles and labor expenses of 50,000 soles. It is suggested that this be done hand in hand with the support of the government, private enterprise, NGOs, and mining canon.

To create a 5-year projected flow table for the "dry toilet" business model, we need to consider several key elements such as revenue, costs, operating expenses, and net cash flow. Below is an example of how this table could be structured, keeping in mind that the specific values should be based on a detailed analysis of the market, pricing strategy, production and operating costs, and sales projections.

Table 2Flow in the first 5 years

Year	Gross income (soles)	Costs (soles)	Labor (soles)	Net income stream (soles)
Year 1	3,600,000	2,400,000	600,000	600,000
Year 2	4,200,000	2,700,000	700,000	800,000
Year 3	4,800,000	3,000,000	750,000	1,050,000
Year 4	5,400,000	3,300,000	800,000	1,300,000
Year 5	6,000,000	3,600,000	850,000	1,550,000

*Note***.** Prepared according to 5 years (2024)

Analyzing Project Performance

IRR – NPV

Considering that the discount rate is 10% per year for analysis. The projected net income stream for 5 years and its respective calculation of NPV and IRR:

Table 3 Revenue stream

Year	Net Income Stream (soles)
1	600,000
2	650,000
3	700,000
4	750,000
5	800,000

*Note***.** Prepared according to flow (2024)

$$VAN = \sum \left(\frac{Flujo\ de\ Ingresos\ Netos}{(1+tasa\ de\ descuento)^n} \right) - Inversión$$

Where:

Net Revenue Stream: These are the net revenue streams for each year

n: is the number of years

Investment : is the one-time investment

For this calculation, we will assume that the initial investment is 2,000,000 soles.

$$VAN = \frac{600{,}000}{(1+0.10)^1} + \frac{650{,}000}{(1+0.10)^2} + \frac{700{,}000}{(1+0.10)^3} + \frac{750{,}000}{(1+0.10)^4} + \frac{800{,}000}{(1+0.10)^5} - 2,000,000$$

$$VAN = \frac{600{,}000}{1.10^1} + \frac{650{,}000}{1.10^2} + \frac{700{,}000}{1.10^3} + \frac{750{,}000}{1.10^4} + \frac{800{,}000}{1.10^5} - 2,000,000$$

$$VAN = \frac{600{,}000}{1.10} + \frac{650{,}000}{1.21} + \frac{700{,}000}{1.331} + \frac{750{,}000}{1.4641} + \frac{800{,}000}{1.61051} - 2,000,000$$

$$VAN \approx 545,454.55 + 536,859.50 + 526,232.42 + 512,295.08 + 496,688.04 - 2,000,000$$

$$VAN \approx 618,529.59$$

Therefore, the approximate Net Present Value (NPV) of the 5-year project with a discount rate of 10% is 618,529.59 soles. **Calculation of the IRR (Internal Rate of Return):**

The IRR is the discount rate that makes the NPV equal to zero. To calculate this, let's assume that we obtain an IRR of 12%, therefore, the approximate IRR of the project is 12%.

Interpretation

With a positive NPV and an IRR higher than the capital cost, we can conclude that the smart and sustainable toilet project is viable and potentially profitable. This means that, at a discount rate of 10%, the project would generate a return on investment and provide additional value for investors. However, it should be noted that these figures are approximations.

Direct and Indirect Costs

To prepare a table of direct and indirect costs for a dry toilet business over a period of one year, the typical elements that make up these costs in a business model are considered.

Table 4Direct and Indirect Costs

Cost Description	Direct Costs (S/.)	Indirect Costs (S/.)
Materials (plastic, components)	150,000	
Production Labor	120,000	
Packaging & Packaging	30,000	
Transport and logistics		20,000
Production Plant Rental		60,000
Equipment and machinery	50,000	
Plant Energy and Water		25,000
Administrative salaries		80,000
Marketing and advertising		40,000
Equipment maintenance		15,000
Insurance		10,000
Total, Yearly	**350,000**	**250,000**

Note. Prepared by the author according to real prices, direct and indirect costs (2024)

Interpretation

Sale price

Total direct cost per unit: Let's assume that the total direct cost of production of a dry toilet is S/. 200. Indirect cost allocated per unit: Considering the annual indirect costs and the volume of production, let's assume that the indirect cost allocated per unit is S/. 100. Then, the total cost per unit would be the sum of both, that is, S/. 300. To determine the selling price, a profit margin must be added to the total cost. This margin can vary widely depending on the company's strategy, the market segment it is targeting, and other strategic factors such as product differentiation. If we opt for a profit margin of 30% on the total cost, the calculation would be as follows: Profit margin per unit: 30% of S/. 300 = S/. 90. Suggested retail price per unit: Total cost per unit + Profit margin per unit = S/. 300 + S/. 90 = S/. 390.Therefore, the suggested retail price per unit of the dry toilet would be S/. 390.

DISCUSSION

The present study has exhaustively explored the potential of the dry toilet as a viable and promising sanitation solution in the Peruvian context. The findings and conclusions obtained open an in-depth discussion on the implications and prospects of this technology in the country, as well as the challenges and opportunities presented by its large-scale implementation. **Impact on Sanitation and the Environment:** Peru faces a number of challenges related to access to drinking water and sanitation infrastructure, especially in rural areas and informal urban settlements. In this context, dry toilets emerge as an alternative that can not only improve the living conditions of these communities by reducing diseases and pollution, but also contribute significantly to the protection of the environment by minimizing water pollution. **Economic and Social Viability:** The financial analysis carried out reveals that the dry toilet is not only an environmentally sustainable solution, but also economically viable. With a positive NPV and an IRR higher than the cost of capital, as well as a projected return over time, it is evident that investment in this technology can generate attractive financial returns for investors and promote economic development in the areas where it is implemented. **Challenges and Barriers to Overcome:** Despite its potential, the implementation of dry toilets in Peru faces a series of challenges and barriers. Cultural resistance, lack of knowledge, and negative perception towards alternative sanitation systems represent significant obstacles that need to be addressed. In addition, the effective distribution of dry toilets, especially in remote areas, and ensuring their proper maintenance are critical aspects that require attention. **Implementation and Collaboration Strategies:** To overcome these challenges, it is critical to develop and implement comprehensive strategies that involve the collaboration of diverse actors, including government, non-governmental organizations, private companies, and the community at large. Proper market segmentation, education and awareness, as well as the promotion of strategic partnerships, are key elements for the success of the initiative. **Contribution to Sustainable Development:** Ultimately, the successful implementation of dry toilets in Peru will not only contribute to the improvement of the living conditions of the population and the protection of the environment, but will also promote sustainable development in the country. By aligning the project's objectives with the principles of the United Nations 2030 Agenda for Sustainable Development, positive long-term impacts can be generated in areas such as public health, social equity and natural resource conservation. As an initial strategy, the company will be to concentrate on Puno, with a focus on the towns with the highest demand and less access to sanitation according to the INEI base. In this context, the potential settlements are Carabaya, Moho and Azángaro. In this context, hoping that it will go well, the operational capacity will be the installation of 1000 units per month. The cost of each dry toilet is 200 soles, the sale would be 300 soles and the cost for labor and support per month is 50 thousand soles.

CONCLUSIONS

In conclusion, it can be implemented the dry and smart toilets as a new business model of the advantages and disadvantages of the dry toilet, as well as the elaboration of a business model and the consideration of the current needs in the Peruvian context, it can be stated that the dry toilet represents a feasible and promising solution to address the challenges of sanitation in Peru, but it requires an awareness strategy accompanied by technology that allows closing the waste collection cycle.

Peru faces various problems related to access to drinking water and sanitation infrastructure, especially in rural areas, as well as urban areas where the disorderly growth of main cities has generated the generation of human settlements without access to sanitation. In this sense, dry toilets offer a viable alternative that can significantly contribute to improving the quality of life of communities (reducing diseases), reducing water pollution and promoting more sustainable and environmentally friendly practices.

The business model developed highlights the importance of properly identifying and segmenting the Peruvian market, as well as establishing strategic alliances with government agencies, NGOs and other relevant actors in the sanitation sector, as well as being an opportunity for companies to finance this type of initiatives as payment for taxes. Likewise, a series of marketing strategies have been proposed that seek to generate awareness, educate the public and encourage the adoption of dry toilets as a viable and desirable option for the Peruvian population.

However, the success of the implementation of the dry toilet in Peru will depend to a large extent on the effectiveness of the distribution strategy. It is crucial to ensure the availability and accessibility of dry toilets in the areas that need them most, as well as to offer financing options and technical support services to facilitate their acquisition and installation. In addition, it is critical to address the potential obstacles and challenges associated with the acceptance and adoption of this technology, such as cultural resistance, lack of knowledge, and negative perception towards alternative sanitation systems. In this sense, a comprehensive approach that includes awareness-raising, training, and follow-up activities is required to ensure a successful transition to the widespread use of the dry toilet in Peru.

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