

## EFFICIENT & RELIABLE COUNTING OF IMPROVED LATRINES

### Challenge Overview:

- Launched to Public on 8 June 2021
- Submissions Closed on 7 September 2021
- # of Registered Solvers: 205
- # of Submissions: 48

The lack of adequate sanitation facilities is a global problem with an estimated 2.3 billion people using unimproved toilets or no toilets at all when eliminating waste. One [United Nations Sustainable Development Goal \(SDG\)](#) is to globally achieve access to adequate and equitable sanitation for all and to end open defecation by the year 2030. [World Vision](#) is one of many organizations and governments working towards the achievement of this goal throughout rural low- and middle-income communities but there is a need for efficient and reliable methods to verify and track progress against this goal. [World Vision](#), supported by [SeaFreight Labs](#), is seeking to address this need and the objective of this Challenge is to design a monitoring approach that is optimally cost-efficient, time efficient, reliable and generalizable for rural communities in low- and middle-income countries.

*This is a Reduction-to-Practice Challenge that requires written documentation and experimental proof-of-concept data, if available. The Seeker may perform field testing of proposed solutions to determine if they meet the Solution Requirements of the Challenge.*

### Structure/Image/Logo: (Viewable by general public)

Banner Image



Card Image



### Overview: (Viewable by general public)

Openly defecating or using an unimproved toilet is a widespread problem globally leading to significant public health issues with up to 280,000 people dying annually of diarrhea-related causes attributable to poor sanitation. [World Vision](#) is working to achieve access to adequate and equitable sanitation for all and to end open defecation by the year 2030 throughout rural low- and middle-income communities. To help measure progress toward this goal, a low-cost, efficient, and reliable method to count the number of improved sanitation facilities in a geographic area is required. Proposed solutions should be able to correctly identify at least 90% of improved toilets in a region while having a very low false positive rate of counting unimproved facilities as improved. Proposals may include and/or combine (1) What data is collected (images, videos, alternative survey questions, etc.), (2) How the data is collected (technological solutions or logistical or process efficiency improvements), (3) When the data is collected (increasing the efficiency of information generated using alternative sample selection or timing coupled with advances in

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analytical techniques), or (4) Who collects the data (utilizing alternative sources or methods of data generation (e.g., crowdsourcing)) and any other innovative methods to meet the Challenge requirements. Proposals also may require initial setup activities and/or physical placement or inclusion of tags, stickers, or other features to help identify improved latrines.

The submission to the Challenge should include the following:

1. The detailed description of the proposed solution addressing specific **Solution Requirements** presented in the Detailed Description of the Challenge. This description should be accompanied by a well-articulated rationale supported by literature/patent precedents.
2. **(Optional)** Test results, demonstrations of proposed methods, and/or experimental proof-of-concept data, if available.

The Challenge award is contingent upon theoretical evaluation and experimental validation of the submitted solutions by the Seeker.

To receive an award, the Solvers will not have to transfer their exclusive IP rights to the Seeker. Instead, Solvers will grant to the Seeker a *non-exclusive license* to practice their solutions.

Submissions to this Challenge must be received by 11:59 PM (US Eastern Time) on Month Day, Year.  
**Late submissions will not be considered.**

### ELIGIBILITY

Employees of World Vision and their immediate families, as well as any individuals involved in the judging of this Challenge and their immediate families, are ineligible to receive an award for this Challenge.



### ABOUT THE SEEKER

[World Vision](#) is a Christian humanitarian organization conducting relief, development, and advocacy activities in its work with children, families, and their communities in nearly 100 countries to help them reach their full potential by tackling the causes of poverty and injustice. World Vision serves all people regardless of religion, race, ethnicity, or gender. For more than 35 years, World Vision has been bringing [water, sanitation, and hygiene services](#) (WASH) to the most vulnerable children around the world. Our 2021-25 Business Plan aims to leverage \$1 billion of investments into 41 priority countries, bringing sanitation to more than 13 million people. Our strategy includes market-based approaches, developing viable business models with tiered product offerings to leave no one behind, as well as increasing consumer demand.

Committed to making a positive and lasting difference in the world, and driven by our desire to serve God, World Vision has become a global leader in improving and transforming the lives of children, their families, and their communities.

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World Vision is supported in this project by SeaFreight Labs ([www.seafreightlabs.com](http://www.seafreightlabs.com)), an open-innovation consultancy using global challenges to cost-effectively deliver breakthrough innovation. Participation in this project is a direct result of the recent SeaFreight Labs decision to join the [Pledge 1%](#) movement.

**Detailed Description and Requirements:** *(Viewable by Solvers who signed user agreement for your Challenge. This and the Project Deliverables section appear on a different webpage from the Abstract and Overview, which is the reason for some duplication of content, for instance, background and award/IP details.)*



### BACKGROUND

Openly defecating or using an unimproved toilet is a widespread problem globally, with 2.3 billion people doing one of these two activities on a regular basis. This leads to significant public health issues with up to 280,000 people dying annually of diarrhea-related causes attributable to poor sanitation. In addition, poor sanitation is a major factor in several neglected tropical diseases, including intestinal worms, schistosomiasis, and trachoma as well as contributing to malnutrition. One [United Nations Sustainable Development Goal](#) (SDG) is to globally achieve access to adequate and equitable sanitation for all and to end open defecation by the year 2030. [World Vision](#) is one of many organizations and governments working towards the achievement of this goal throughout rural low- and middle-income communities. In this setting, progress is most often made through use of market-based solutions and behavior change programming that targets individuals to construct or pay for household toilets. In rural areas, these sanitation facilities often take the form of detached latrines, located within a home compound area, but not usually connected to the sleeping, living or cooking structures.

Toilets are often described based on “containment” (the mechanism by which waste is stored for treatment or removal), “interface” (the point of contact between the user and containment), and “superstructure” (the structure above the ground that serves to separate the user from the environment, providing privacy and safety). An ideal toilet should be able to effectively separate human excreta from human contact (the lack of this is the definition of an “unimproved toilet”) and facilitate treatment on-site or removal of waste from the containment system for treatment off-site. The interface and superstructure are often constructed with locally available materials, but efforts are being made to increase the quality of materials and construction practices, usually by connecting household consumers with local private vendors.

Improved toilets come in a variety of shapes and sizes and can be constructed of many different materials. The photographs above and in the attached file *Improved Toilet Examples.zip* illustrate just a few of the many variations found. As stated above, the key defining feature of an improved toilet is that it effectively separates human excreta from human contact. There is no single external defining element that identifies an improved toilet but certain elements, such as the presence of a slab, can provide a very good indication. The WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene published a useful guide to identifying improved sanitation facilities that contains a thorough definition of improved toilets. Please see pages 11-13 of <https://washdata.org/report/jmp-2018-core-questions-household-surveys>.

There are several potentially useful proxy indicators of an improved toilet. An examination of an extensive data set containing data from 14 countries found the following information. For all latrines in the data set, of those that were “intact with a door and roof and offers full privacy”, 87.2% (4,113 out of 4,719) were considered improved. For those that were improved, 28.2% had an intact door and a roof and offered full privacy (4,113 out of 14,608) so

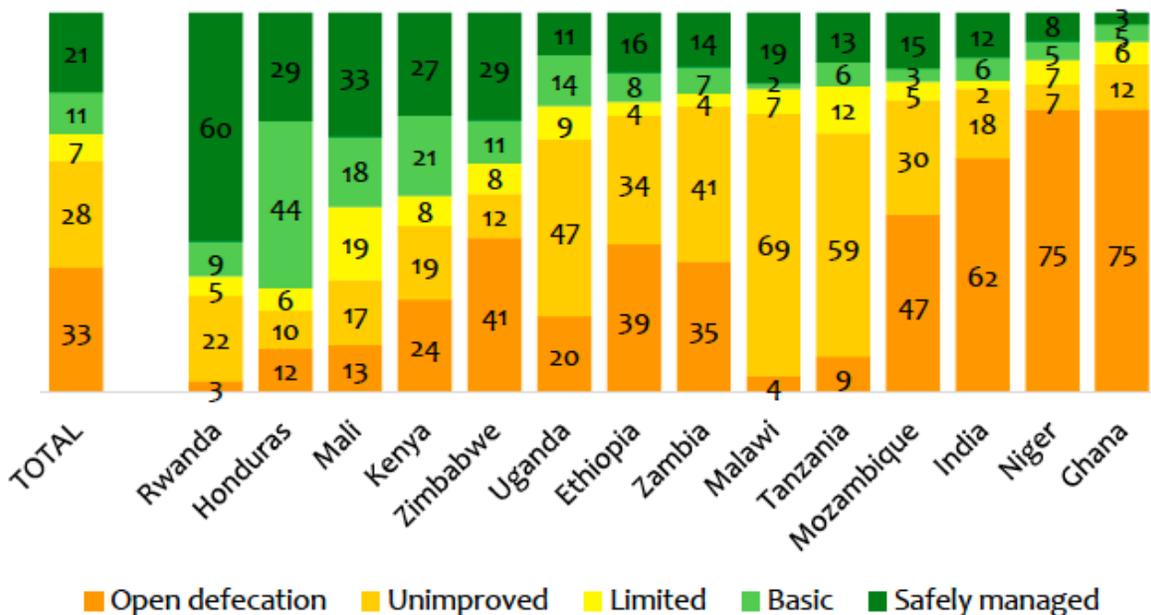
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superstructure quality is a high specificity, low sensitivity indicator – a quality superstructure means it’s likely improved but lack of one does not mean it is unimproved. If one looks at latrines with “some privacy”, 70.4% were considered improved, and of all latrines considered improved, 86.5% had at least some privacy. In general, latrines (whether improved or unimproved) are rarely larger than 4 feet by 4 feet square and are typically the smallest structure on a family compound.

Coverage of improved sanitation facilities varies widely across countries in which World Vision operates. The graphic below illustrates this wide range.

### 4.1.3. Household sanitation

Across all countries, an average of 32% of households had at least a basic sanitation facility. Across all 14 countries, 21% of households had a safely managed sanitation service as defined by the JMP. This was highest in Rwanda (60%) and lowest in Ghana (3%).



Source: The Water Institute at UNC. The World Vision 14-Country Evaluation Final Report. The Water Institute at UNC, Chapel Hill, NC, USA.

### CURRENT TECHNOLOGY

Methods currently employed for assessing the prevalence of improved sanitation facilities in an area are time-consuming and labor intensive. Typically, an organization will perform an annual survey where 20-30 villages or other geographic areas are selected, data collectors drive to these potentially remote areas, and a couple dozen door-to-door surveys are conducted. Results from this sample are extrapolated using statistical techniques to the broader region based on ensuring that the selected villages are selected in an unbiased manner and/or based on adjusting for characteristics of the selected villages compared to the rest of the geographic area. For example, a typical community where World Vision works might have 30,000 residents. This might be 5,000 households. World Vision would randomly select about 200 of the households to assess with an in-person survey. It typically takes about 6 staff members 1.5 weeks to complete the survey of households and to organize the collected data. The cost for a latrine survey, per household, is typically US\$12 and the survey might encompass 10 such areas, so the cost to complete this survey annually across a country where World Vision works would be US\$24,000. At this cost, World Vision can only afford to do the desired survey every 3-5 years or has to focus on specific geographies. This also

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makes assessing district-wide coverage (outside of World Vision areas, but useful for planning and policymakers) infeasible.

### REFERENCES

The attached file *GIS UC Paper.pdf* provides a comprehensive study of overall WASH coverage in a rural village in Kenya. GIS data of latrine location and type from the study is also provided in the attachment *Bartabwa Data Survey123.xlsx* and may be useful in the development of proposed solutions.

Solvers may also find the WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene 2018 update [Core questions on water, sanitation and hygiene for household surveys](#) useful in the development of solutions.

### THE CHALLENGE

[World Vision](#), supported by [SeaFreight Labs](#), is seeking to address the need for more efficient and reliable methods to assess the number of improved sanitation facilities in a region and the objective of this Challenge is to design a monitoring approach that is optimally cost-efficient, time efficient, reliable and generalizable for rural communities in low- and middle-income countries. The following parameters may serve as guidelines for this Challenge:

- The solution must take use of already available and demonstrated reliable processes, technologies and products. The Seeker is not looking for a newly designed/created technical product that would require manufacturing. However, use of an existing technology in a new way is acceptable.
- The solution should be obtainable to World Vision and other stakeholders, either through open source, licensing or ownership.
- To the maximum extent possible, use of any materials that are commonly available in markets in Sub-Saharan Africa should be prioritized.
- Generalizable - the solution should be applicable over many contexts. Contextualized solutions for one geography, country or type of toilet will not be highly considered.
- Time efficiency is highly prioritized. Solutions that allow for fast verification at any moment in time will be looked at more favorably than solutions that are time consuming or require a high level of human resource.
- Reliability – both in the ability to conduct the solution and in the results recorded in implementing the solution.
- Cost efficient – solutions that look at keeping costs minimal, as this solution will be applied across thousands of communities, over 40-50 different countries in Sub-Saharan Africa, Asia, and Latin America.
- Ability to run in a new community and to run in a community where it has been run before.

Any proposed solution should address the following **Solution Requirements**:

1. Provide a method, following the guidelines listed above, to count the number of household-level improved sanitation facilities in a specified rural geographic area.
2. Correctly identifies 90% of improved sanitation facilities and erroneously identifies as improved sanitation facilities less than 10% of non-improved sanitation facilities. However, accurate assessment of improved facilities is more informative than accurate classification of unimproved facilities, given one of the goals is to verify high levels of coverage of improved sanitation. Therefore, reasonable tradeoffs of improving the former while the latter worsens would be considered preferable (so, correctly identifying 95% of improved facilities while erroneously identifying as improved 15% of non-improved facilities would be an improvement over 90%/10%).
3. Capable of assessing an area encompassing 30,000 people, approximately 5,000 households, with a population-level margin of error not more than +/- 5%, and covering 1000 square kilometers for as close to \$1,000 as possible (or less certainly desirable), not including any cost or time associated with initial setup. [Note that device/materials cost may be disaggregated from staff time for purposes of presenting

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the resources required for a solution—ideally, staff time would be minimized as a part of the total resource requirement]

4. Capable of being conducted by individuals and through resources accessible in low and middle income countries.
5. Sufficiently transparent such that an audit of the data/assessment could be performed if desired.

The solutions would preferably satisfy the additional following criteria (but not essential):

1. Include a way to distinguish between private vs. shared latrines. (latrines used by more than one household)
2. Able to identify latrines that were in place during the prior count and those that are new since that count was done.
3. Can create or utilize an existing “denominator” such that the number of households with an improved facility could be converted into a proportion of households with an improved facility in a given area.

Proposals may include and/or combine (1) What data is collected (images, videos, alternative survey questions, etc.), (2) How the data is collected (technological solutions or logistical or process efficiency improvements), (3) When the data is collected (increasing the efficiency of information generated using alternative sample selection or timing coupled with advances in analytical techniques), or (4) Who collects the data (utilizing alternative sources or methods of data generation (e.g., crowdsourcing)) and any other innovative methods to meet the Challenge requirements. Proposals also may require initial setup activities and/or physical placement or inclusion of tags, stickers, or other features to help identify improved latrines.

### Evaluation Criteria

Proposed solutions that are judged to be capable of meeting the **Solution Requirements** above will be evaluated on the following criteria:

- Practicality/feasibility of implementation
- Cost effectiveness
- Innovativeness

### Project Deliverables: *(Viewable by Solvers who signed user agreement for your Challenge)*

The submitted proposal should include the following:

1. Detailed description of a device/technology/approach that can meet the above **Solution Requirements**, including assumptions about available products and services needed to enable the solution and any data on estimated fixed or variable costs related to devices needed, staff time, or other costs.
2. Rationale as to why the Solver believes that the proposed system will work. This rationale should address each of the **Solution Requirements** described in the Detailed Description and should be supported with any relevant examples and literature references.
3. **(Optional)** Test results, demonstrations of proposed methods, and/or experimental proof-of-concept data for any technology utilized in the proposed solution.

The Seeker may wish to partner with the Solver at the conclusion of the Challenge. Solver should describe their expertise and include a statement indicating their interest in this opportunity.

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The proposal should not include any personal identifying information (name, username, company, address, phone, email, personal website, resume, etc.) or any information the Solvers may consider as their Intellectual Property they do not want to share.

The Challenge award is contingent upon theoretical evaluation and experimental validation of the submitted Solutions by the Seeker. If multiple proposals meet all the **Solution Requirements**, the Seeker reserves the right to award only the solution which they believe is the most cost and time efficient.

To receive an award, the Solvers will not have to transfer their exclusive IP rights to the Seeker. Instead, Solvers will grant to the Seeker a *non-exclusive license* to practice their solutions.

Submissions to this Challenge must be received by 11:59 PM (US Eastern Time) on 21 September 2021.

**Late submissions will not be considered.**

### ELIGIBILITY

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### ABOUT THE SEEKER

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