The PREval (Pilot Research Evaluation) Framework

Evaluating Pilot Projects in Information Communication Technology for Development (ICTD)

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Overview

Information and communication technology for development (ICTD or ICT4D) is a burgeoning field that has attracted increasing interest from researchers, sponsors and policymakers in the last decade. Much of the work being carried out in this area is at the pilot stage, where researchers explore potential technology solutions to challenges in developing communities across the globe. Although ICTD projects are now widespread, there is still little in the way of theory or standards upon which this body of work is based. In terms of project outcomes, Heeks posits that “Most of the ICT4D research being produced is...descriptive not analytical.”\(^1\) While there is a need for standards in many aspects of this field, there is a particularly evident lack of structure concerning how such projects are appraised. Therefore, this document was created to offer a systemic approach to evaluating pilot-stage field projects in ICTD.

Most currently employed evaluation methods in ICTD are borrowed from economic development and information systems projects and programs. Although these approaches are theoretically sound they do not cater to the unique aspects of ICTD, which combines development endeavors with efforts in technology innovation and adaptation. Furthermore, these methods typically focus on summative evaluations that examine end results, and do not conduct formative evaluations, which scrutinize processes that greatly influence results of a project. Thus, we developed an ICTD-centric, practical method for conducting more comprehensive pilot project evaluations.

Our belief is that laying the foundation for evaluation of pilot-stage ICTD projects can benefit this emergent field of research in many ways. First, it would offer an opportunity to improve pilot studies, learn more from them and also make better decisions on how to scale them. Second, it can generate a standardized and more refined approach to reporting results of ICTD endeavors. Finally, it could improve the overall quality of work produced in the field of ICTD and thereby better serve the relevant developing communities.

Acknowledgements

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About The PREval Framework

This evaluation framework is intended to serve as a step-by-step guide for field researchers to complete a comprehensive evaluation of an ICTD pilot project. To this end the content of this document is designed to assist researchers in planning and executing evaluations, as well as organizing findings so as to aid decision making.

Purpose
The purpose of the PREval framework is to assist in the planning and execution of ICTD pilot project evaluations. Additionally, it is designed to improve reporting of project evaluation results by organizing findings in a way that would better enable decision makers to determine the best course(s) of action to take post-pilot study.

Intended User
This framework is intended to be used primarily by ICTD field researchers who are directly responsible for project execution and who typically will not be trained on how to conduct evaluations. From an administrative perspective, the PREval framework is designed to be utilized by program or project managers to obtain the information they require to make sound decisions on whether or how to continue the work.

Contents
There are two major sections of this framework, and both elements are essential in project evaluation:

1. Guidance on planning and executing evaluation, which is what the bulk of this document is dedicated to. This section is divided into three parts, according to major elements of an ICTD project:
   a. Process Evaluation
   b. Technology (Output) Assessment
   c. Outcome Evaluation

Within each subsection steps necessary in planning and executing the respective evaluation will be outlined and explained using theory and examples. Additionally, a template or worksheet will be included to facilitate data entry and analysis.
2. Instructions on how to report evaluation findings to decision makers. The idea is to answer critical questions involved in the decision making process.

**Scope and Application**

Since the ICTD field is still relatively new, much of the work in the area is at a trial stage. Thus, we limit the scope of the PREval framework to pilot level projects. In terms of its content, the framework is designed to serve as a guide to researchers on how to conduct evaluations. More specifically, the PREval framework covers a range of steps entailed in a structured project evaluation, with examples to elucidate the concepts.

The PREval framework is intended to be uses from the planning stages of a project onward, so that each phase of a project is evaluated, and such that lessons learned from earlier stages can better inform the latter phases of the project. Users should first familiarize themselves with the contents of the PREval framework and then decide on how to incorporate it into their specific undertaking, and accordingly budget for required time and resources. Users can follow the guidelines detailed in the framework to determine what data are needed for project evaluation as well as how that information can be collected. Once this aspect of the evaluation is mapped out, users can utilize the worksheets included in the PREval framework to collect and organizer data. Additionally, the framework offers guidelines on how to conduct data analysis. Finally, after data is collected and analyzed, the template included in the final section of the PREval framework can be used to systematically summarize key findings from the pilot project.
Section 1: Planning and Executing Evaluation

Evaluations can be divided into two broad categories:

* Formative Evaluation – “An evaluation intended to furnish information for guiding program improvement...because its purpose is to help form or shape the program to perform better.”\(^2\) Thus, this type of assessment examines whether, and how well, critical project activities and procedures are executed. This is essentially the ‘monitoring’ piece of an evaluation.

* Summative Evaluation – “An evaluation conducted to determine whether...expectations are met...because its purpose is to render a summary judgment on the program’s performance.”\(^2\) So, this type of evaluation focuses on assessing the output and outcome of a project relative to expected results.

For the PREval framework, we focus on a process evaluation as the formative component of project assessment; where, “Process evaluation refers to a set of evaluation activities that document the development, implementation, and ongoing activities of a program and their level of quality.”\(^3\)

An important feature of ICTD projects is that their output includes technology applications or devices. Such output needs to be assessed based on standards within the specific technology field. Thus, the summative evaluation components of the PREval framework will specifically address evaluation of the technology (output) itself, as well as other outcomes of the project.


I. Process Evaluation
Well thought out and executed processes lead to more fruitful outcomes in a project. Additionally, in evaluating a project, solely focusing on outcomes does not provide a holistic view of the project. In particular, through an examination of processes, evaluators can ascertain why project outcomes turned out as they did and determine how the project can be improved. This chapter of the PREval framework is designed to assist ICTD field researchers in planning and implementing a project processes evaluation. To this end, the main goal is to assess whether and/or how well key processes are being or have been executed.

Process Evaluation Cycle
The different stages of a process evaluation can be depicted in the model give in Figure 1. A process evaluation is formative, in that it is conducted during the course of a project, rather than at the end of a project as is the case of summative evaluations. This nomenclature aside, what is important to keep in mind is that a process evaluation can serve as a tool to improve the project even while it is ongoing because it tracks activities that take place throughout a project, rather than focusing on outcomes that manifest at the completion of a project. Thus, process evaluation should be implemented iteratively; that is, by monitoring progress and making necessary modifications to processes as they are required. It is a tool to help keep the project on track and prevent missed opportunities for needed mid-course corrections.
Identify Key Processes/Activities
This is a crucial first step in a process evaluation. While specific processes may vary from project-to-project, there are four fundamental areas of activities that researchers ought to focus on; they are: preparatory work, on-site research, technology development and project sustainability management. We dedicate the next section to detailing these processes.

Assign Process Indicators & Targets
Once key processes have been identified mechanisms need to be put in place to ascertain whether (1) these processes are being or have been carried out, and/or (2) these activities are being or have been executed as planned. Process indicators are measures employed to answer these two main questions regarding project activities. We incorporate the two categories of process indicators introduced by the RAND Corporation:

(a) “Longitudinal measures that can be evaluated on a periodic basis to track program trends over time” (e.g. number of site visits per week), and
(b) “Single-event measures that document the achievement of key program achievements” (e.g. completing necessary bureaucratic paperwork). These will take the form of checking off an item on a checklist.

Along with these indicators, there need to be corresponding targets to achieve during the course of a project. For example, if conducting on-site observations is an identified activity, then the number of site visits could serve as a process indicator for that activity, with weekly site-visits being the target. Therefore, in this case, the target number of site visits should equal the duration of the field work, measured in weeks.

**Collect & Analyze Process Data**

The status of process indicators feeds into the process evaluation as data. As the project is set in motion, the indicators designated to evaluate progress of various activities need to be monitored. When to collect data on the different indicators should be determined by the type of activity. If a process needs to be completed prior to commencing field work then data on indicators for those activities need to be collected before researchers are on-site, while other activities can be monitored when on site. Additionally, data on longitudinal process indicators will be collected periodically, while single-event measures will only be taken once. How data will be collected is also an important consideration. In general, if people responsible for conducting a specific activity are also given the task of documenting their progress, this would facilitate data collection. For example, those conducting needs assessment could document how many people they interview each day to ultimately calculate the proportion of participants interviewed. Therefore, once researchers have laid out the different activities and associated process indicators and targets, they should also consider at what point(s) and how they will be collecting data.

Since process evaluations can help improve a project as it is ongoing, analyzing process data at different stages of a project will be necessary if modifications or improvements are to be made during the course of that project. Checking the status of various processes on at least a weekly basis will be prudent, especially during the beginning stages of a project. For those projects that are on an even more restricted time scale, it may even be necessary to conduct an analysis of process indicators at short intervals. An analysis of process evaluation data can be as simple as examining how actual data compares to what was expected. For example, researchers can examine whether targets for process indicators were met and if not investigate reasons as to why. This will facilitate efficient decision making on how to improve a project as it develops.

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Modify Processes
When it is clear from examining the data that a particular activity is not meeting expectations, there first needs to be an inquiry into why this is the case. If the problem is out of the control of researchers then their expectations may need to be modified, rather than the process or its style of execution. On the other hand, if the process or method of conducting the activity can be adjusted to meet expectations then those changes need to be implemented. Thus, it is important to follow process data analysis with an examination of how processes can be modified to better meet expectations, or to modify expectations to be more realistic.

Key Processes
We focus on four major areas of project processes. Monitoring and evaluating activities in these categories will help shape outcomes and also improve operations during the course of a project in the field. Key activities\(^5\) presented here are determined based on our experiences in the field as well as on fundamental processes established in other project evaluation literature.

a) Preparatory Work
This entails activities that ought to be carried out prior to commencing field research. Such processes will better prepare researchers for on-site work and also improve chances of achieving project goals. Tasks in this category of activities include:

- **Define project goals**
  Setting goals or expectations for the project are a critical element in evaluating that endeavor since those objectives will define what project ‘success’ is. In essence, the project will be assessed based on whether or not it accomplishes those goals. Below are guidelines on how to set SMART objectives.\(^6,7\)

  **Specific**: Objectives should be specific enough that they leave very little room for misinterpretation. For example: “Improve well being” is a very broad objective since it could refer to numerous aspects of ‘well being’; whereas, “Improve English subject test scores” is much more specific and immediately clear.

  **Measurable**: In pilot research (including in ICTD) some important outcomes may not be captured by a number (e.g. increased motivation). However, there needs to be a

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5 Note that we use the words ‘process’ and ‘activity’ interchangeably.


mechanism through which one can ascertain whether or not an objective was accomplished. This measure can be quantitative or qualitative.

**Achievable:** When setting objectives it is important to keep in mind the scope of a project and what can be accomplished within that context. For example, it is usually infeasible to think that a pilot project will lift a community out of poverty.

**Relevant/Realistic:** It is important to keep objectives within the realm of the type of project. Objectives should also be realistic and only include outcomes that can be attainable using the resources and expertise available to a given project. This is particularly important to keep in mind for pilot studies that are typically limited in time and resources. In many ways, ‘achievable’ and ‘relevant/realistic’ overlap, since in order to be achievable an objective needs to be realistic, and vice versa.

**Time-based:** Aiming for “an increase in exam scores” is not the same as “improving exam scores after three months of using the technology”. In ICTD pilot studies it may not be clear how soon some objectives will be realized, if at all. However, project objectives should be realized within a reasonable amount of time if stakeholders are to believe that the project played a role in bringing about that change. Thus, it is important to demarcate which objectives relate to more immediate outcomes and which pertain to results that will manifest over a longer period of time.

- **Identify stakeholders**
  An ICTD project’s success is to a great extent, determined by the perceptions and participation of stakeholders. Therefore, it is important to identify the different groups that need to invest time, resources and personnel into the project and understand each of their roles in the endeavor. Additionally, each stakeholder’s expectations for the project should be determined to ensure that they are not contradictory, and that they satisfy the SMART criteria.

- **Establish a partnership with a local group or organization**
  Having a local partner who is recognized by the project’s target community can be very beneficial in establishing trust and communicating with the local community, enabling researchers to successfully adapt to the field setting, and sustaining a project beyond the pilot stage. Therefore, it is important to take steps to identify and secure a local partner or partners who can collaborate with researchers on the field research. For example, project managers or researchers could take the following steps:
  
  i. Research potential partners in the area – utilize media resources as well as colleague recommendations and previous contacts in the area; a partner invested in community development or ICT work is most suitable
  ii. Communicate project details with chosen partner and solicit their feedback
iii. Form an agreement with the local partner, clearly outlining each party’s role in the project

iv. Identify a key person within the local partner organization to be the main point of contact between researchers and the local partner

v. Obtain information about the local community based on the experiences and expertise of the local partner

- **Conduct background research**
  It is important to gain a better understanding of the target community and culture prior to commencing field work. Being educated about the local community and culture will limit the number of cultural faux pas researchers make and thus, reduce the chances of offending the participants of the study. Furthermore, learning more about the site-location will help researchers better prepare for their visit there. To this end, researchers should take the following measures:
  
i. Reviewing literature and information on the target location and community.

ii. Gain an understanding of any prior ICTD efforts in that region. This will provide clues as to what steps are needed to successfully execute a pilot ICTD project in that location.

iii. Look into any other technology that is currently used within that locality, to gain insight into what type of technologies thrive in that community and also how local people respond to technology in general.

iv. Determine the target community’s capacity to adopt technology. Conducting such an exploratory investigation into the target location prior to and during the field study will better inform decisions regarding the design of the technology and render it more context-specific and appropriate for the given audience. This involves gaining a better understanding of key aspects of the target community and environment, including the following:
  
  o Community access to computers, cell phones and other IT hardware
  o ICT infrastructure (e.g. cell phone coverage, Internet access, etc.).
  o Energy Infrastructure – determine what type of access is available to affordable power sources. For example, if power outages are frequent, generator or battery power may be more feasible.
  o Locally available services for technical assistance and maintenance.
  o Environmental factors (e.g. temperature, humidity, dust, etc.), which may affect the function of technology.

- **Logistics and legalities**
  With any field research there is paperwork and logistics that need to be managed. The following measures should be taken in preparation for ICTD pilot work:
i. Make necessary travel arrangements, including obtaining any visas or other permits necessary to conduct research at the given location.

ii. Comply with institutional level requirements; e.g. universities require their researchers to obtain Institutional Review Board (IRB) approval prior to beginning a study involving human subjects.

iii. Vet site in order to approve it from a safety standpoint.

iv. Obtain immunizations, travel insurance and other health and safety necessities.

- **Identify and form agreements with data sources**
  
  Data is arguably the most important element of any evaluation and in many ICTD projects obtaining sufficient high-quality data is a difficult task. If project goals are well defined researchers can think about potential types of measures they would need to assess the effects of the technology solution. Thus, potential sources of data can also be identified and contacted in advance, in order to increase the likelihood of obtaining credible data in the field. While the field may still present obstacles to data collection, by taking this step prior to departing for the project site, researchers will be better equipped to maneuver through such drawbacks.

b) **On-Site Research**

Once researchers are on site there are a few key processes they need to execute in order to understand the target audience as well as realities in the field. This in turn will facilitate the creation of a technology solution that is location and user appropriate and therefore have a greater probability of successful adoption. This includes the following activities:

- **Obtaining participant consent**
  
  Participants are a critical component of any study that involves a product or service ultimately intended for human consumption. From an ethical standpoint, it is important to ensure that participants comprehend exactly what they are signing up for. Additionally, obtaining written consent to participate might be a legal requirement for most researchers. The process of obtaining participant consent, however, can be challenging when faced with cultural and language barriers. Therefore, it is prudent for researchers to plan ahead for this process.

  i. Set aside time to discuss the project with pool of potential participants.

  ii. Find out in advance whether a translator would be required and make arrangements accordingly. Someone within the participant group who can speak both English and the local language is best suited to translate.

  iii. Devise a method for obtaining written consent from participants who may not be able to write (e.g. illiterate, visually impaired or physically challenged participants), if applicable. Consult with a local partner or expert on methods currently used by such participants.
• **Needs assessment**

Given the time constraints associated with ICTD pilot projects, it may be tempting to immediately delve into technology development. However, conducting needs assessment is not a step that can be skipped in ICTD work, because it forms the backbone of the work by providing context for the technology and overall study. Without a good understanding of on-site conditions, it is almost impossible to design a solution that will be effective and sustainable in that location.

i. Prepare interviews, questionnaires and/or focus group discussion material to collect information during the needs assessment process prior to site visit. Avoid questions that would solicit a simple yes/no answer, or ask participants to explain why they said yes or no.

ii. Try to obtain information from at least one or two participants one-on-one, so as to identify any data that might be biased by group dynamics.

iii. Identify a key informant in the group of participants. This can be extremely valuable in gaining the group’s trust and also in obtaining more detailed information about the user group from the perspective of an insider.

iv. Listen carefully to participants and always show respect.

v. Do not intimidate participants by asking them questions in a formal setting. Try to make interviews/focus group discussions more conversational, share some background information about oneself with participants, and always ask clarifying questions. Keep in mind that the more comfortable participants are the more accurate and honest the information collected will be.

vi. If audio or video recordings are permitted, utilize these tools to help transcribe findings. However, first ensure that participants are comfortable with the use of such devices.

vii. When conducting interviews, if recording devices are not acceptable, it is useful to assign two people to each interview so that one person can focus on note-taking while the other can focus more on conducting the interview. This allows for a more accurate recording of findings and eases the task of interviewers.

viii. Once results from the needs assessment are compiled, meet with community members to reiterate findings and obtain community feedback as to whether researchers’ interpretation of results is in line with their viewpoints.

• **Observations**

It is vital to document what researchers observe in the field throughout the course of the time they are on-site. These records can serve two purposes: (1) They can help validate information received via the needs assessment, (2) They can provide more insight into how things function on the ground, and lead to follow up questions and/or
clarification of some questions, and (3) They can offer clues as to how the technology intervention may have altered user behavior.

i. Prior to introducing the technology intervention, observe participants to create a baseline profile of behavior and attitudes.

ii. Post-technology intervention, record any changes detected since baseline observations were made.

iii. Do not actively disrupt proceedings during observations.

iv. Always carry a notepad during site visits to record any important observations.

v. If permission is granted, video recordings might be useful in analyzing participant behavior and attitudes; although, keep in mind that video cameras can significantly alter behavior.

c) Technology Development

This phase of the project will revolve around the actual design, construction, or modification of the technology output. It is a critical step in the project since it is a major product that results from ICTD work and subsequently affects project outcomes in a significant way. At this stage, the main activities to monitor will include the following:

- **Technology design**
  There are essentially two approaches to technology development in ICTD work. One is when researchers arrive on-site with a working prototype or version of a technology; and the other is starting from a blank slate that is, building technology from scratch. In either case, the ultimate design decisions should be based on results of needs assessment and observations in the field, since this information represents actual needs and concerns of the given community of end users. To this end:

  i. Assemble a list of identified community needs.

  ii. Brainstorm ideas on how any or all of these needs can be addressed via a technology solution.

  iii. Determine whether an existing prototype, if available, is applicable in the given context and environment.

  iv. Create a list of potential technology solutions, based on information from the field.

  v. Contemplate a realistic timeline for development of a given design.

  vi. Decide whether the given project’s timeline is sufficient to develop the chosen technology design.

  vii. Pick a solution that is feasible given the available time and resources; and/or determine a method for extending the project in order to develop a more involved technology design.
• **Iterative development of technology**
  Regardless of whether researchers are modifying a working prototype technology or building a technology from scratch, there should be some level of customization to specifically address the local needs. Building the technology in stages while incorporating user feedback at each stage (also known as iterative development), reduces the danger of creating a final product that is ultimately not adopted by the user.
  
  i. Designate milestones for technology development and seek user feedback at each of those stages.
  
  ii. Consult with users on a regular basis (e.g. bi-weekly or every three weeks) to provide the community with a progress update and also obtain their input. This will help keep the end user actively involved in the project.
  
  iii. Be sure to regularly reevaluate development goals to ensure that they are realistic, given the project timeline and resources.
  
  iv. Manage community expectations of the technology by clarifying any misconceptions as they arise and continually reiterating the actual capability and function of the technology.

• **Local community input**
  During the iterative development of the technology, it is critical to obtain user feedback on each version of the prototype and to discuss and incorporate suggested changes where relevant. However, keep in mind that users are typically not technology experts and might not have a grasp of changes that are realistic versus those that are beyond the scope of the project or technologically infeasible. Thus, researchers must discuss suggestions in a respectful and accessible manner, and manage expectations by narrowing the scope of the technology in terms of what is feasible for the given project.
  
  i. Before meeting with users develop a list of types of modifications that can be realistically incorporated into the technology during the pilot phase. This will help guide the discussion with users.
  
  ii. Address all comments made by the community by providing an honest assessment as to whether that suggestion can be incorporated within the scope of the project.
  
  iii. Avoid making promises; limit discussions to what researchers hope to deliver on and be open about any obstacles that have arisen.
  
  iv. If possible, ask users to interact with the technology at each stage of development and record any significant observations made during those interactions.
Many projects in ICTD are not sustained once researchers leave the field. Therefore, it is important to take necessary steps to help ensure that the technology solution continues to yield results in the long-term. During this final stage of the project, the main objective is to understand the potential for sustaining the intervention beyond the scope of a pilot study.

- **Monitoring**
  Develop a plan to monitor progress post-pilot study, including:
  i. A communication plan – whereby researchers work with community members to decide on the mode and frequency of communication once researchers leave the field.
  ii. A data collection plan – to facilitate longer term assessment of outcomes resulting from use of the technology. For example, this can take the form of administering regular surveys, monitoring test scores at different intervals, and/or tracking usage levels post-pilot study.

- **Technology Integration**
  Work with the local community to design a method to integrate use of the technology into users’ typical activities. For example, if it is an educational tool, the technology can be used once a week during class time.

- **Technology Maintenance**
  Devise a plan for maintaining the technology solution once researchers leave the field. This includes:
  i. Identifying a local expert to provide technical support; also brief this expert on the technology so they are better equipped to assist users
  ii. Providing users with a method for contacting researchers when they experience technical problems or have questions about the technology
  iii. Developing a manual that users can refer to for questions on how to utilize the technology
II. Technology (Output) Assessment

Technology output can be divided into two broad categories: hardware and software. Hardware can be defined as the physical technology output such as equipment, machines and devices (e.g. a computer); whereas, software takes the form of executables or programs that encode a sequence of commands coded to operate hardware in a desired manner (e.g. Microsoft Windows). Typically, ICTD projects produce technology systems that include both hardware and software components, which work together to produce a desired result. Since technology is a key product of ICTD projects, it is important to understand whether it is performing well enough to accomplish the overall goals of the project. Yet the majority of prototype technology resulting from pilot level ICTD projects is often not assessed. This chapter outlines a set of considerations to be made for technology assessment in ICTD projects, and proposes criteria and metrics that could be used for this endeavor.

Technology Assessment Criteria

Below are seven major classes of assessment criteria for technology innovations.\textsuperscript{8} While each criterion is valuable, the ranking of importance should vary based in the type of project, audience and location involved.

I. Functionality – Does it work well?
   This includes determining whether both hardware and software properly execute intended tasks, as well as how they carry out target operations.

II. Reliability – Does it work every time you use it?
   This helps determine the consistency in function and typically entails calculating error or failure rates of the technology.

III. Usability – Is it user friendly, particularly for novice users?
   This is an important assessment criterion since it provides insight as to whether users find the technology accessible and comprehensible. If not, the technology will most likely be left idle.

IV. Suitability – Is it a good fit for the given context and locality?
   This measure will gauge how well the technology suits the intended audience and their environment. For example, a computer based program that uses visual cues will not be applicable to a community of visually impaired students.

V. Robustness – Can it operate in the required environment under prevalent conditions?
   This is a measure of how well the technology can function within the given setting or environment where conditions maybe volatile and hostile. For example, hardware might be dropped and software might be subject to viruses.

VI. Maintainability – Can it be easily maintained?
This is another important criterion for sustaining the technology solution. If the technology is very complicated or difficult to maintain using local or remotely available expertise, the project is not likely to sustain itself post-pilot project.

VII. Cost – How much does it cost to build, use and maintain?
Cost is a significant barrier to deploying technology in developing communities. Thus, keeping track of costs associated with the technology solution will be valuable when assessing whether it can be made affordable to the community of end users.

**Metrics for Technology Assessment**
Table 1 lists factors that should be considered when assessing ICTD technology innovations. Note however, that these metrics may need to be modified or adapted for different projects, depending on the actual technology itself as well as conditions in the field.

**Table 1: Metrics associated with assessment criteria for technology output**

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
<th>Metrics</th>
<th>Applicable Technology</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Functionality</td>
<td>Set up time</td>
<td>Hardware</td>
<td>This will provide some idea of how difficult a task it is to set up the technology. It will be useful to time researchers as well as end users within the community, as they set up the hardware.</td>
</tr>
<tr>
<td></td>
<td>Time to power on or start</td>
<td>Hardware and Software</td>
<td>Understand whether the technology works right away or takes a long time to power on and start working. For software, installation time should also be considered.</td>
</tr>
<tr>
<td></td>
<td>Power source options</td>
<td>Hardware</td>
<td>Number of options available to power hardware (e.g. grid, batteries, solar power, etc.).</td>
</tr>
<tr>
<td></td>
<td>Power usage</td>
<td>Hardware</td>
<td>The amount of power utilized in order for the hardware to function.</td>
</tr>
<tr>
<td></td>
<td>Performance level</td>
<td>Hardware and Software</td>
<td>Proportion of functions actually performed, relative to expected performance level.</td>
</tr>
<tr>
<td></td>
<td>Battery quality</td>
<td>Hardware</td>
<td>Battery life and time require to fully</td>
</tr>
<tr>
<td><strong>Output quality</strong></td>
<td><strong>Hardware and Software</strong></td>
<td>Quality of sound, picture, etc.</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------------------</td>
<td>---------------------------------</td>
<td></td>
</tr>
<tr>
<td>Working/Processing speed</td>
<td>Hardware and Software</td>
<td>Determine whether technology is slow or fast in terms of executing tasks. Can compare to similar devices or researcher objectives for speed of operation. Also, can determine whether tasks are completed more efficiently with the technology than without (if applicable).</td>
<td></td>
</tr>
<tr>
<td>Technical specifications</td>
<td>Hardware</td>
<td>These are physical characteristics (e.g. weight, size, number of megapixels, etc.) that can be used to gauge how that technology compares to other commercially available hardware, in terms of functionality. Also, some specifications might be requested by users or necessary for the given context (e.g. device needs to weigh less than 2lbs).</td>
<td></td>
</tr>
<tr>
<td><strong>Failure/Error rate</strong></td>
<td><strong>Hardware and Software</strong></td>
<td>Number failures/errors experienced during a specified period of time or number of sessions.</td>
<td></td>
</tr>
<tr>
<td>Mean time to failure</td>
<td>Hardware and Software</td>
<td>Average time between failures or errors.</td>
<td></td>
</tr>
<tr>
<td>Up time</td>
<td>Hardware and Software</td>
<td>Time required to repair or rectify a problem so as to make the technology available for use once again.</td>
<td></td>
</tr>
<tr>
<td>Error density</td>
<td>Software</td>
<td>Coding errors per line of code.</td>
<td></td>
</tr>
<tr>
<td><strong>User complaints</strong></td>
<td><strong>Hardware and Software</strong></td>
<td>Number of user complaints, regarding difficulty of use.</td>
<td></td>
</tr>
<tr>
<td>Learning time</td>
<td>Hardware and Software</td>
<td>Average time required for users to learn how to use technology.</td>
<td></td>
</tr>
<tr>
<td>Mastery rate</td>
<td>Hardware and Software</td>
<td>Proportion of users who achieved mastery of the technology.</td>
<td></td>
</tr>
<tr>
<td>Comprehension failure rate</td>
<td>Hardware and Software</td>
<td>Percentage of users who failed to understand how to use the technology.</td>
<td></td>
</tr>
<tr>
<td>Resource access</td>
<td>Hardware and Software</td>
<td>Availability and accessibility of a &quot;Help&quot; system or user manual.</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------</td>
<td>---------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>User interface comprehension rate</td>
<td>Software</td>
<td>Percentage of users who understood how to maneuver through the user interface, in terms of language used and any pictorial, audio or video instructions provided.</td>
<td></td>
</tr>
<tr>
<td>Infrastructure fit</td>
<td>Hardware</td>
<td>Available vs. required technical infrastructure to operate technology.</td>
<td></td>
</tr>
<tr>
<td>Technology applications</td>
<td>Hardware and Software</td>
<td>Number of potential applications of technology within the given user community (e.g. use device to administer homework and exams to students, and also use as a practice tool for students - i.e. three possible applications).</td>
<td></td>
</tr>
<tr>
<td>Suitability rating</td>
<td>Hardware and Software</td>
<td>User rating of technology in terms of its suitability for the given user population, location and context.</td>
<td></td>
</tr>
<tr>
<td>Content rating</td>
<td>Hardware and Software</td>
<td>User rating of technology content. For example, ask users whether content is repetitive or redundant, dynamic, suitable, challenging enough etc. Also consider whether content can be easily modified based on user needs - this will improve sustainability of content.</td>
<td></td>
</tr>
<tr>
<td>Material strength</td>
<td>Hardware</td>
<td>Tensile strength of material used to build hardware. This will provide some insight as to whether the device will break from a fall, for example. However, if the device is commercial (e.g. a computer) there should already be some knowledge of fragility.</td>
<td></td>
</tr>
<tr>
<td>Failures in the field</td>
<td>Hardware</td>
<td>Number of failures experienced while operating in local environment, due to dust, humidity or other environmental factors.</td>
<td></td>
</tr>
<tr>
<td>Corruptibility</td>
<td>Software</td>
<td>Number of viruses accumulated over a given period of time.</td>
<td></td>
</tr>
</tbody>
</table>
### VI. Maintainability

<table>
<thead>
<tr>
<th>Vulnerability to damaging user manipulation</th>
<th>Hardware and Software</th>
<th>Number of ways and ease with which users can alter components, such that the technology is rendered dysfunctional. Can gauge ease of altering software or hardware by estimating number of steps needed to alter the technology such that operation is halted.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backup availability</td>
<td>Software</td>
<td>Number of backups available/accessible to users and researchers in the event of file corruption or the like.</td>
</tr>
<tr>
<td>Hazardousness</td>
<td>Hardware</td>
<td>Number of long wires, sharp edges and other potentially hazardous or accident prone aspects of hardware.</td>
</tr>
<tr>
<td>Portability</td>
<td>Hardware and Software</td>
<td>In the case of software - number of other devices that the software can operate on and are available to users (i.e. is the software compatible with multiple platforms?). In case of hardware - ease with which device can be moved, if necessary; can rate this based on weight, fragility and other physical factors.</td>
</tr>
<tr>
<td>Monthly checks</td>
<td>Hardware and Software</td>
<td>Anticipated number of monthly checks or modifications for hardware and software, in order to maintain operations.</td>
</tr>
<tr>
<td>Potential problem ratings</td>
<td>Hardware and Software</td>
<td>Difficulty level of resolving common or potential issues that may occur with the technology. Base this on technology expert opinions. For example, if problems can be resolved remotely they ought to be of a low rating. Should track number of technical issues resolved via remote vs. in-person consultation.</td>
</tr>
<tr>
<td>Local technical support</td>
<td>Hardware and Software</td>
<td>Number of available local resources for technical assistance. Should take into account distance of technical experts from user community as well as ease or difficulty of accessing these local experts (i.e. available transportation and communication options).</td>
</tr>
<tr>
<td>Remote technical support</td>
<td>Hardware and Software</td>
<td>Remote access to technical experts for assistance. Should take into account ease or difficulty of accessing these technical experts (e.g. available and affordable communication options, speed of response, etc.).</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td>Local technical expertise</td>
<td>Hardware and Software</td>
<td>Expertise level of local technical assistance relative to what is needed to maintain the hardware and software. Should interview/converse with local experts to gauge skill and experience level.</td>
</tr>
<tr>
<td>Problem solving resources</td>
<td>Hardware and Software</td>
<td>Number of available resources in the form of documentation, manuals or contact person that users can consult in case of problems with the technology.</td>
</tr>
<tr>
<td>Backup and spare part access</td>
<td>Hardware and Software</td>
<td>Proportion of software backup files and hardware spare parts available locally.</td>
</tr>
<tr>
<td>Adaptability</td>
<td>Hardware and Software</td>
<td>Availability of options for growing or improving on current design of technology such that it can continue to be applicable to the given community/context.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VII. Cost</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Product/Component cost</td>
<td>Hardware</td>
<td>Cost of hardware material or entire (assembled) product.</td>
</tr>
<tr>
<td>Maintenance cost</td>
<td>Hardware and Software</td>
<td>Anticipated maintenance costs per month for hardware and software.</td>
</tr>
<tr>
<td>Development labor cost</td>
<td>Hardware and Software</td>
<td>Labor costs involved in developing software or hardware.</td>
</tr>
<tr>
<td>Backup cost</td>
<td>Software</td>
<td>Cost to purchase software in the event of file corruption or the like.</td>
</tr>
<tr>
<td>Power cost</td>
<td>Hardware</td>
<td>Cost of power required to operate hardware.</td>
</tr>
<tr>
<td>Repair cost</td>
<td>Hardware</td>
<td>Potential cost to fix faulty or defected components of hardware.</td>
</tr>
</tbody>
</table>
III. Outcome Evaluation
The purpose of an outcome evaluation is to render a summary judgment on the program’s performance. This section provides guidelines on steps needed to set up and execute an outcome evaluation for an ICTD pilot project.

ICTD efforts are generally directed towards the common end goal of addressing needs in developing communities via the application of technology solutions. Therefore, the PREval framework focuses on outcomes related to the user experience; i.e. how the technology innovation affects its population of users.

Outcome Logic Model
Components of an outcome evaluation can be mapped out by employing an outcome logic model similar to that presented in Figure 1. The elements of this logic model are: Identified Needs, Project Output, Outcomes and Metrics. First, community Needs are identified through the needs assessment process and those needs are met via Output or Technology that is developed for the project. Implementing this technology solution results in Outcomes, which are represented in the logic model by project objectives that researchers expect to accomplish through application of the technology. It is useful to break them out into short versus mid-to-long term outcomes. Finally, outcomes can be assessed by collecting data on Metrics.

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**Metrics Selection**

Metrics are measures used to help ascertain the extent to which project objectives are achieved. There are two considerations that can be made to aid the process of deciding on metrics to employ in an outcome evaluation:

a) **Match each project objective (expected outcome) with at least one metric**

Once a list of objectives has been compiled, researchers need to think about how those outcomes can be assessed. It is vital to ensure that each objective can be captured by at least one metric so that there is a method for measuring progress on all project outcomes.

b) **Think of metrics in terms of numerators and denominators**

To capture effects of the technology intervention, it is often useful to think of metrics in terms of numerators and denominators. This would show a statistic relative to a base value and allow for facilitated interpretation of an effect’s magnitude and/or existence.
Data Collection
Once metrics are identified, the next step is to determine how data on these metrics will be collected. Collecting a mix of both quantitative and qualitative data is generally necessary to evaluate all objectives.

Techniques
Below are different techniques available for data collection.10

i. Surveys: Commonly used in many research efforts, where users respond to a set of predetermined questions that typically require short answers. Can be used to collect quantitative and qualitative data.

ii. Interviews: Popular technique used to elicit in-depth information from participants. Primarily results in qualitative data.

iii. Focus groups: Fairly commonly used in many arenas including in businesses such as advertising. Allows for obtaining a variety of opinions from a representative group of participants in one setting. Primarily results in qualitative data.

iv. Observations: Widely used method to collect data from the perspective of an observer outside of the participant or research subject pool. Primarily results in qualitative data.

v. Tests: Perhaps the most commonly used approach for collecting quantitative data for statistical analysis. Includes popular methods such as pre- and post-testing. Alternatively, existing data may be used as a baseline for comparison with test results from a given intervention. Primarily results in quantitative data.

vi. Document studies: This is a less common technique used for data collection and involves an examination of project records or any written documents. Primarily results in qualitative data.

vii. Key informant: Another less frequently used approach when gathering information. This entails finding a trustworthy source within the target community who can provide context and more far-reaching details about participants and the research location. Primarily results in qualitative data.

viii. Case studies: This is yet another infrequently used method that can be complicated to apply and maybe better suited for projects that have already been implemented at a broader scale, unlike pilot studies. It involves conducting a descriptive study of different locations or setting in which the project or program is ongoing. Primarily results in qualitative data.

Field Testing

There are two conventional approaches to field test design: an experiment, which is widely accepted as the most scientifically rigorous approach, and a quasi-experiment, which requires less precision but is not as rigorous.

a. Experiments require the following elements:
   i. **Random assignment**: Where participants are randomly assigned to two groups, one of whom experiences the intervention (treatment group) and another that does not (control group).
   ii. **Pre-testing or using available prior data as a baseline measure**: This entails collecting outcome data on participants prior to the intervention, in order to establish baseline outcome levels.
   iii. **Post-testing**: After the intervention is implemented, outcome data for all participants is collected to compare to pre-intervention results.
   iv. **Statistical analysis**: Once data is collected, statistical methods can be utilized to measure the effect of the intervention.

b. Quasi-Experiments satisfy some but not all of the requirements for an experiment. For example a field test with the following criteria would be considered quasi-experimental:
   i. Non-random assignment
   ii. Pre-testing or using available prior data on outcome variable
   iii. Post-testing
   iv. Statistical analysis

Conducting an experiment is considered ideal because it is the most reliable way to associate outcomes to a particular intervention and minimize or eliminate the effect of biases. However, in field research controlling the environment enough to satisfy requirements of an experiment is not always possible. Therefore, most ICTD field tests tend to be quasi-experimental rather than experimental. However, outside of these approaches, researchers also have the option to conduct field testing by way of gathering constructive user feedback on the technology. While quantitative data is valuable, incorporating qualitative measures such as user viewpoints into the analysis can offer valuable information to help interpret the quantitative data.

Sample Selection

When recruiting participants for an ICTD study, it is naïve to assume that everyone in the developing world will be enthusiastic about ICTD work in their community. Additionally, in smaller scale pilot studies (e.g. studies that focus on one school or one village) the number of participants needed for statistical significance may not be available due to the small population size from which participants are drawn. Often times the only plausible option is to select a
convenience sample; that is, recruit those who are available. In general there are two categories of sampling strategies.\textsuperscript{11}

a. Probability sampling (e.g. simple or stratified random sampling), which involves randomly selecting participants from the population. This sampling method allows for generalization of results.

b. Non-Probability sampling (e.g. convenience sampling, heterogeneity sampling), which does not entail random selection. With this method results cannot be generalized.

Sample Size
With larger samples, internal validity or findings are more robust and there are a greater number of appropriate statistical tests available. As the sample size decreases it becomes more difficult to associate an effect with a specific intervention because small samples are more “noisy.” This leads to much greater statistical error and wider confidence intervals (i.e. less accuracy in findings). A sample size of 30 is typically used as a rough cut-off to distinguish between small and large samples. This is primarily because it has been noted that by the Central Limit Theorem, with a sample size of roughly 30 or higher, the sample mean approximates a normal sampling distribution, regardless of the population distribution.\textsuperscript{12}

The necessary sample size for a study will be determined based on the type of analysis to be conducted. For this calculation, the first steps are to estimate the variance of the measure, and decide on the probability of a type I error (i.e. $\alpha$, which is typically set at 0.05) and the power of the test (i.e. 1 - $\beta$; 80% is usually the goal). In the case of testing difference in means, we would also want to know the means under the null and alternative hypotheses (or the expected difference in means). For example, when comparing two population means ($\mu_0$ and $\mu_1$) that have the same variance ($\sigma^2$), the formula for calculating the required sample size ($n$) for a two-tailed test is as follows (note, $z_\alpha$ represents the $z$-score corresponding to an area under the Standard Normal curve equal to $\alpha$):\textsuperscript{13}

$$n = \frac{2\left(z_{1-\frac{\alpha}{2}} + z_{1-\beta}\right)^2}{\left(\frac{\mu_0 - \mu_1}{\sigma}\right)^2}$$

Similar formulae can be found for other types of analyses.\textsuperscript{13} Although these calculations can be useful, while in the field, researchers are at the mercy of prevailing conditions and therefore

\textsuperscript{11} Research Methods Knowledge Base: http://www.socialresearchmethods.net/kb/sampprob.php


may not be able to control sample size. However, having a target sample size in mind can aid the participant recruitment process.

**Data Analysis**
The type of analyses utilized will depend heavily on the type of data collected. Below are considerations that should be made in the data analysis effort for an ICTD project.

**Types of Data**
Typically, data is classified as quantitative and qualitative. Quantitative data generally equates to numeric information (e.g. test scores, weight, salary, etc.), which is deemed objective. On the other hand, qualitative data is usually thought to be subjective and in general comprises of text-heavy information resulting from surveys, interviews and focus group discussions. However, there are types of qualitative data that can be assigned a numerical value – e.g. asking people to rate their opinion based on a Likert scale, coding categories of responses with a corresponding number, etc. Thus, some qualitative data is amenable to quantitative data analysis techniques. When faced with text data alone, rigorous analysis can be challenging. Still, such qualitative information can be especially useful in interpreting quantitative results, and therefore should not be discounted. Figure 3 depicts the different kinds of data.
Equivalent vs. Non-Equivalent Comparison Groups or No Comparison Group

In order to successfully isolate a cause-and-effect relationship between a technology intervention and a given outcome, having access to equivalent comparison groups is required. The most rigorous method for selection of comparison groups is through random assignment, where subjects are randomly assigned to be in the control (not exposed to intervention) and treatment (exposed to intervention) groups. Groups ought to be equivalent in the sense that their background characteristics are similar enough to justify attributing changes in outcome to the intervention, rather than other factors. If random assignment is carried out correctly and the sample size is large, there would be no need to collect data on other variables that might also affect the outcome. Yet, even with random assignment there may be imbalances between the two groups such that there are, for example, disproportionately more weak students in one group than the other. Thus, checking for balance across certain criteria is important before testing so that control variables can be included in the analysis when necessary. In the event that random assignment is not possible, non-equivalent comparison groups are still useful, although in that case a multivariate analysis would be necessary to control for confounding variables that may also affect the measured outcome. If no comparison group is available then the selected analysis would have to measure changes in participant outcomes within the single group by comparing scores before and after the intervention. This is an inferior design because it mixes the effect of the intervention with the learning that routinely occurs from other concurrent efforts.

Pre & Post vs. Just Post Testing

Conducting a pre-test (or collecting pre-intervention data) allows researchers to gather baseline data, against which post intervention results can be assessed. Whether a comparison group is available or not, a pre test is extremely useful to understand the current or pre-intervention state of participants. When only a post test is possible (or only post-intervention data is available), attributing outcome effects to a specific intervention becomes almost impossible. In such an event one would have to compare post intervention results to comparable national averages or another standardized measurement that is available.

Accounting for Confounding Factors

There may be outside factors or events that also influence measured outcomes of the project. Accounting for these confounders is important in summative analysis. For example, there might be some students whose life circumstances degraded drastically during the course of the project and as a result performed poorly on post-tests. Such an effect might be misconstrued as a failure on the part of the project, if not identified. Conducting interviews with participants is
an effective method for understanding aspects in their lives that are not obvious but have a significant effect on project outcomes. Additionally, dividing the sample into strata (i.e. stratified sampling), based on important distinguishing factors can control for some confounding variables.

Data Analysis Algorithm
This algorithm provides options for analyzing the different types of data given in Figure 3.

**Step 1: Univariate Analysis**

Univariate implies studying one variable individually. This kind of analysis will allow researchers to determine whether the assumptions necessary to conduct further analyses are satisfied or not. For example, by examining the distribution of outcome data, researchers can establish whether it is normally distributed and thus would qualify for a t-test. Additionally, univariate analyses can provide a better understanding of participant demographics (age, gender, socio-economic status, etc.). So, researchers will be able to determine whether their sample population is representative of the larger population targeted by the study.

⇒ If linear data, then
  o Calculate descriptive statistics (mean, median, standard deviation, etc.)
⇒ If time-to-event data, then
  o Calculate average, standard deviation, median, maximum and minimum
⇒ If count data, then
  o Calculate average, standard deviation, median, maximum and minimum
⇒ If categorical data, then
  o Calculate frequencies with which each category occurs

**Step 2: Bivariate Analysis**

The next step is to investigate relationships between two variables – typically between the outcome variable and a hypothesized predictor variable. This will provide researchers with an understanding of how different factors may independently influence an outcome.

⇒ If linear data, then conduct:
  o Correlation analysis
  o T-tests
  o Median and quantile regression – understand how median and other quantiles (10th, 25th, 75th percentile, etc.) of outcome variable are affected by predictor variables. This analysis is robust to outliers.
If time-to-event data, then conduct:
  o Kaplan-Meier Survival curve
  o Log-Rank test
If count data, then conduct:
  o Bivariate Poisson regression
If categorical data, then conduct:
  o Chi-Squared test to determine whether outcome is independent of categorical variables

Step 3: Multivariate Analysis

Although bivariate analyses can provide clues as to how different predictor variables affect the outcome, it is important to understand whether this observed effect is influenced by factors other than the hypothesized predictor variable. To account for any confounding effects, conducting multivariate analyses can be very useful since they enable researchers to better isolate the effect of a particular predictor on the given outcome.

If linear data, then conduct:
  o Multiple regression analysis
  o ANOVA (Analysis of Variance)
  o Median and quantile multiple regression
If time-to-event data, then conduct:
  o Cox proportional hazards model
If count data, then conduct:
  o Multi-variable Poisson regression
If categorical data, then conduct:
  o Logistic regression
  o Probit analysis

Step 4: Analyzing Text Data

With text data, it is important to organize results such that documents are searchable for key words and are catalogued according to type of interviewee or data collection method. This organization will facilitate analysis, particularly when contending with a large volume of information or documents. Text-heavy data is often disregarded as subjective or biased. However, there can be great value in this information because it generally reflects the opinions or sentiments and behavior of a target population. This type of understanding of the human element of a project should not be discounted, especially in ICTD work, since ultimately, the end user will determine whether the technology solution is used and perhaps bears fruit, or is
left idle and rendered useless. Therefore, there is a trend in the evaluation field toward utilizing both objective and subjective information when analyzing project findings.

To decipher text-data, a researcher can pose and attempt to answer the following questions:

⇒ Are there common themes or key words within the data?
⇒ How many times are certain words and themes encountered?
⇒ How frequently do certain words and themes occur?
⇒ What are the most common answers to different questions?
⇒ If, pre- and post- intervention data is available:
  o Is there a significant change in the frequency with which certain key words or themes are encountered (proportions tests)?
  o Is there a significant change in the average number of times different words and themes are encountered?
⇒ What outcomes are associated with intervention according to interview transcripts?
⇒ What are commonly cited outcomes associated with intervention?
⇒ What percentage of sample population believe the intervention was effective?

**Step 5: Interpretation of Findings**

This is perhaps the most important step in analysis. Giving meaning to compiled results informs the concluding chapter of a project’s story. Decisions will be made based on such conclusions, thus, it is vital to consider all findings when deciphering results, so as not to emphasize findings that eventually prove to be unimportant in successfully implementing the project. As such, researchers should not only focus on statistically significant results, but also determine whether such seemingly objective data is in line with what participants report on their experiences.

The following questions are useful to consider during the interpretation step in analysis:

⇒ Did hypothesized results materialize?
  o Were they statistically significant?
⇒ Did quantitative findings agree with reports from participants and other qualitative/subjective findings?
⇒ Were there surprise/unintended outcomes as a result of the intervention?
⇒ What were the outliers in the collected data? How can these outliers be explained?
External Resources

**Linear Data Analysis:**


**Time-To-Event Data Analysis:**


**Count Data Analysis:**


http://www.amazon.com/Regression-Analysis-Count-Colin-Cameron/dp/0521632013/ref=sr_1_1?s=books&ie=UTF8&qid=1290916695&sr=1-1

**Categorical Data Analysis:**


Section 2: Reporting Project Results to Decision Makers

Typically, ICTD program directors and other decision makers will want to answer four major questions about a pilot project, before proceeding further with the work:

I. Is the technology useful or effective?
II. Will the target audience use the technology?
III. Can the technology be integrated and sustained within the pilot community?
IV. Should the project be scaled up, abandoned, or modified and re-launched?

Results of an ICTD pilot project evaluation should assist managers in answering these questions by reporting findings in a format that directly addresses these specific questions. The PREval framework provides a template for creating such a summary report.
[Insert Project Name] Project Evaluation Findings: Summary Report

Background

[Provide a summary of the project idea, field study location, target user(s) and the proposed technology.]

Project Goals

[Describe the main goals of the project.]

Process Evaluation Findings

[Summarize results of the process evaluation conducted for this project. Highlight any process changes made during the course of the project, processes that were executed well, and those activities that were not successfully carried out; including reasons (if known) for these findings. Listing findings in bullet-point form should be suitable here. Results can be organized based on the following categories of key processes.]

a) Preparatory Work

[Comment on assessment of activities conducted as preparation for the field work; e.g. conducting background research and establishing partnerships with local contacts.]

b) On-Site Research

[Summarize evaluation of activities conducted once in the field; particularly focusing on the needs assessment and observation processes.]
c) Technology Development

[Comment on assessment of activities related to the technology development for the project; in particular, describe how well user input was incorporated into the technology design.]

d) Project Sustainability Management

[Summarize evaluation of activities directed towards enabling project sustainability. Specifically, describe steps taken for this endeavor and an assessment of whether these measures have been effective thus far.]

Technology Assessment Findings

[Comment on the following topics based on findings regarding the technology innovation employed for this project.]

**Technology Name:**

[Provide the name given to technology involved in the project, if any. This will help when referring to the technology in further communications.]

**Technology Type:**

[Describe the technology in terms of whether it is software, hardware or a system involving both hardware and software.]

**Technology Purpose:**

[Summarize the main purpose(s) of the technology within the context of this project.]

**Technology Design:**

[Describe the design of the technology and its functions.]
**Technology Assessment:**

[Summarize results from the technology assessment conducted for this project, based on the following assessment criteria, in order of importance or pertinence for the given project.]

I. *Functionality*
[Summarize technology specifications and findings on how well the technology functions.]

II. *Reliability*
[Summarize findings on how consistently the technology functioned over the study period and during follow up checks, if any.]

III. *Usability*
[Summarize findings on how accessible the technology was to the user.]

IV. *Suitability*
[Summarize findings on how suitable the technology was to the given user community, project location and context.]

V. *Robustness*
[Summarize findings on how well the technology adapted to field work location dynamics and challenges.]

VI. *Maintainability*
[Summarize analysis of how easy or difficult it could be to maintain the technology in the long run within the given location.]

VII. *Cost*
[Summarize cost data related to the technology product itself, and its development, use and maintenance; juxtapose with estimates on what would be affordable to the target user(s). Also, include data on cost of practice that the technology was designed to replace or improve.]

**Target Community Outcomes**

[Summarize results of the outcome evaluation conducted for this project, focusing on the following topics. Note, that this section is dedicated to commenting on outcomes affecting the
target community. However, if the audience for this summary report is interested in researcher outcomes (for example), or other outcomes of the project, include sections summarizing those results as well.]

**Evaluation Design**

[Describe how this evaluation was designed, including information on how participants were selected and assigned, data collection techniques used, and field tests conducted, if any.]

**Quantitative Findings**

[Provide a summary of quantitative findings, such as pre and post test scores. Also, describe the type of data analysis conducted using this data and the interpretation of those results.]

**Qualitative Findings**

[Provide a summary of qualitative findings, such as user feedback. Also, describe how this information was analyzed and interpreted.]

**Conclusions**

*Key Findings*

[Provide answers to the following key questions about the pilot study. If a question is unanswerable with available data, provide reasons as to why and avenues for how to find an answer or reach a conclusion about that question.]

1) Will the target users actually use the technology?
2) Is there the necessary technical infrastructure to house and maintain the technology?
3) Does the technology effectively improve conditions in the given community?
4) Can user data and feedback be collected remotely from the field?
5) Were there any unique factors that contributed to the success and/or failure of any or all components of this pilot project?
Recommendations

[Provide recommendations for how to continue this work, based on pilot project results as well as researchers’ experiences in the field. In particular, comment on how the technology can be improved to be more effective and propose the next step for this project. Use the following sections and questions as a guide.]

Technology Modifications

What modifications, if any, could improve the design and effectiveness of the technology?

Project Continuation

What should the next phase of this research endeavor entail, and why?

a. Scale up
b. Gather more data/evidence prior to scaling up or down
c. Abandon the project