Connecting Those Who Need It Most

ICT Project and Sustainability Primer:

Things to consider when designing ICT projects for low-resource environments

Together with its network of in-country partners, Inveneo has designed, deployed and supported ICT projects in approximately 300 communities in some of the world's most challenging settings. We've learned a lot of lessons along the way. Our goal in this document is to present these lessons to those planning ICT-intensive projects in low-resource settings in order to help them avoid common pitfalls. We welcome your feedback.

Project Management

Technology is sometimes the *least* important factor in determining whether a project becomes sustainable.

- Set clear objectives - Whether the goal is to improve healthcare, increase income for farmers or promote awareness of the plight of people living in refugee camps, ICT projects should be designed to achieve specific, measurable objectives. If the project's goals are hard to measure directly, find proxy metrics that *can be*.
- Establish managerial "ownership" – Nothing is more important to a project's success than the genuine commitment of at least one individual with appropriate incentives to succeed. ALWAYS identify specific individuals to be responsible for overall program management, implementation and ensuring that ICT and power equipment are kept in working order (sometimes the same person). Make sure that you communicate clearly and honestly with these individuals and other staff about specific roles and expectations. Whenever possible, have a local project manager/representative available in country.
- Secure community buy-in and interest – Be sure to secure local buy-in for the project, both among system users and, wherever possible, within the wider community. This process often takes time, but can be a critical factor in overall project sustainability.
- Set realistic expectations and budget – ICTs can have impressive short-term impacts, but their impact is more often gradual as users build their skills and become comfortable with new systems. Projects sometimes fail due to donor impatience during this "ramp up" period. Ensure that funders have realistic expectations around project budget. Give yourself plenty of time for things like clearing equipment through customs or processing formal applications for licenses. Delays are all too common in many developing countries.
- Understand the regulatory environment – Make sure you understand how technologies such as WiFi and VOIP are regulated. Factor in total costs of equipment, including duties that may be assessed by customs.
- Plan use scenarios, but expect to improvise – Good system design depends on a clear understanding of how users will interact with new systems. It is crucial that local stakeholders - including actual users - are involved early on in the process of designing the system. Even when users are directly involved, expectations may be wrong, especially where users are not experienced with computers. Be prepared to improvise and to adapt to actual needs/uses once the system is in place. This requires a proactive process for evaluating project outcomes and changing course as needed.

- Proceed incrementally – Take a phased approach, starting with key infrastructure and basic capacity building and then add program elements piece-by-piece. This approach helps avoid coordination problems and simplifies troubleshooting if (when) something goes wrong. Rushing a project or trying to do everything at once is likely to lead to big mistakes.

ICT Infrastructure

The choice of appropriate ICT equipment for a given project is based on a number of factors including the availability of power, environmental conditions, the specific applications that the hardware must support and the skill of both users and administrators. In low-resource settings, the following factors can be critical to project success:

- Use hardware with the lowest possible power draw – In off-grid settings, power infrastructure can be much more costly than the hardware itself. For this reason, "free" or donated (second-hand) computers, which usually draw *lots* of power, are often the most expensive option. Select hardware that has the minimum possible power draw that supports required applications. Computers are now available that support excellent performance for most applications but that draw only 10% of the power of an average desktop.
- Use equipment with as few moving parts as possible – Another benefit of low-power-consuming hardware is that it creates less heat than standard equipment, which increases sustainability by eliminating the need for fans (in extreme conditions), a common failure point for computers running in humid and dusty environments.
- Use field-serviceable and locally available parts – If parts are not available locally, they are difficult to replace. For computers, use standard off-the-shelf parts, such as standard laptop hard disk drives, wherever possible. For peripherals, especially printers, it is wise to use locally available brands.
- Use virus protection – Viruses are a major challenge for Microsoft-based ICT projects. Typical virus control measures don't work well in unconnected settings where definition updates happen too rarely and USB drives are almost always infected. If using Microsoft's Windows operating system, products such as Faronic's DeepFreeze and Microsoft's SteadyState can prevent viruses from being written to system files.
- Make sure that software is designed for reality – Software developers often assume broadband connectivity and high-power computers, neither of which exists in most low-resource settings. Make certain that developers design and test software for conditions that actually exist in the field.
- User-appropriate software and hardware interfaces – Simple is almost always better, especially with low-skill and first-time computer users. Intuitive, uncluttered interfaces facilitate learning and encourage system use.
- Avoid purchasing your *own* VSAT (satellite) link – Sometimes VSAT is the only option for Internet connectivity. Often, however, there are better options. Consider extending locally available connectivity from service providers through technologies like WiFi to your project area(s).
- Focus on solid local connectivity – Even where Internet bandwidth is slow and expensive, local connectivity between sites (e.g. district hospital and health clinics) can be fast and cheap. Private (or shared) WiFi networks provide reliable and affordable broadband links between sites to support shared applications, content, Internet, Voice over Internet

Protocol (VoIP), etc. Benefits of this approach include high speed, extremely low reoccurring costs and full control over the network.

Power Infrastructure

An ICT system is only as reliable as the power system that supports it.

- Use a skilled electrician – Poorly designed systems are unreliable and can cost more in the long run. For example, systems that allow batteries to discharge completely will dramatically shorten their lifespan. Worse, improperly designed systems can be dangerous, especially with the high currents that DC systems generate. Batteries should be properly protected and vented. Unless they have proven competence in both computing and power technologies, avoid using an ICT professional to install your power system.
- Think low maintenance – In off-grid settings, low-maintenance often means solar, since fuel and maintenance costs for generators quickly offset upfront savings and are a major failure point for projects. Batteries should be maintenance-free, sealed lead-acid gel (SLA), preferably the AGM reinforced type. These are somewhat more expensive than the "wet" or "flooded" cell batteries that require regular maintenance and checkups, but are much more reliable in the long term.
- Consider hybrid systems – Hybrid systems allow batteries to be charged by more than one power source; for example, both solar panels and a generator, or generator and intermittent grid power. Although hybrid systems are slightly more complicated and expensive to deploy, the redundancy makes them more reliable. Reliability is usually quite important for projects that involve critical services, such as in healthcare or microfinance.
- Include surge protection and voltage stabilization – Generator or partial-grid power can easily damage computers and networking equipment. Spikes in power or low voltage are the most common cause. The equipment to protect against this danger is relatively inexpensive, readily available in most places and offers cheap insurance against damage to more costly equipment. Therefore, these components should *always* be used with an AC power source.
- Size systems carefully and conservatively – Where power is scarce, it is valuable. Design systems such that unintended power draw is minimized. Consider isolating ICT power systems from others, reducing or eliminating extraneous outlets or powering equipment directly from DC. If possible, size the system to support phone charging stations, electric lanterns or other important needs. Always budget at least 10% "headroom" for expansion or unintended overuse.
- Build around locally available inputs – As with ICT components, imported parts that are not available locally tend not to be replaced if they fail unexpectedly stop working. Develop relationships with several suppliers of high quality batteries, chargers, solar panels, etc.

Support

Qualified and timely support can make the difference between success and failure. Few organizations have the internal skills to repair ICT or power equipment, so external support can be critical. In general:

- Budget for support and maintenance – Annual maintenance cost is usually 5% to 15% of the original total budget, as a rule of thumb, but costs will vary significantly based on terms of contract.

- Define a tiered support strategy – Train system administrator(s) on basic troubleshooting and give them a direct link to 2nd tier support. Simple troubleshooting cheat sheets can help in settings where system administrator turnover is high. Make sure system administrators know how to maintain power systems as well. For example, to keep solar power systems working properly, it is important to clean panels regularly.
- Teach users about proper equipment care – New computer users may inadvertently mistreat equipment. User training should include basics about how to keep equipment in good working condition (e.g. to be careful not to spill food or drink on keyboards, not to cut power to equipment while it is running, etc.) The overall goal should be to make users feel a degree of ownership of the equipment.
- Purchase pro-active site visits – These visits are especially useful during the first 3-6 months, when misuse or equipment failure is most likely. Support providers can often be enlisted to provide training, as needed, for system users.
- Buy support from whoever installed the system – It can be hard to identify the source of ICT problems, much less to assign responsibility for fixing them. Purchasing support from the equipment provider helps to avoid this challenge. Make sure you negotiate for both up front.

Facilities

The physical infrastructure in which ICT systems are used can be an important factor in project outcomes. Here are some key lessons in the areas of design and location, construction and security:

Design and location:

The design and location of physical infrastructure can have a significant impact on how ICTs are actually used and, therefore, on project success.

- Conform to local design principles and use local materials.
- Location can impact connectivity options (e.g., for wireless shots or use of VSAT) as well as power options (e.g., reduced insolation — sun exposure — due to vegetation coverage). Site your facility carefully.
- Design for airflow – both building design and location – this helps with comfort as well as cooling of equipment.
- Consider room layout carefully – for example, in a school setting simultaneous classes may require multiple/separate rooms. If so, interior doors should be lockable to improve security when rooms are not in use.
- Assign dedicated space for power equipment – this space should be ventilated, at least to the rest of the interior space and, if possible, to exterior (if possible without compromising security). The best solution is a lockable internal room/closet.
- For teaching facilities, design classroom so that instructor can supervise what students are doing on the computers (screen visibility).
- Position facility manager near main entrance to control access.
- Consider providing two chairs per computer to enable shared learning and maximize the use of scarce computers.

Construction:

- If building from scratch, install chases for electrical and/or Ethernet to get through cinderblock or concrete walls.
- Install a steel chase for electrical drop from the roof array.
- Roof should be engineered to support solar array (as needed).
- Avoid metal mesh products, which can block wireless signals.
- If solar is needed, it is important to plan for sufficient south-facing roof space for the solar array.
- Avoid roof pitches that are too flat or too steep.

Security:
Some projects require significant investment to protect ICT and power infrastructure, while others do not. Consider the context. Only local knowledge can guide this decision.

- Security should be as "passive" as possible (e.g. bars versus locking shutters).
- Metal, locking doors and bars on all windows.
- Avoid glass, especially at ground level.
- Relatively public locations can help minimize theft, but only if solid basic protections are in place.
- Solar arrays should be secured with locking frames. Based on local conditions, wire mesh or other screening may be required to protect glass from rocks, etc. If available, use impact resistant panels.
- Widespread community support for the ICT system and/or the services they support can help to minimize the likelihood of theft or vandalism.