



OPTIMIZING MOBILE DEPLOYMENTS

ABSTRACT

Mobile devices are increasingly powerful and flexible tools for grassroots work. This document offers guidelines for thinking about your deployment, drawing attention to the latent project features that can influence the use of a device you issue for community level or frontline social service work.

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Executive Summary

Mobile devices are increasingly powerful and flexible tools for grassroots work. This document offers guidelines for thinking about your deployment, drawing attention to the latent project features that can influence the use of a device you issue for community level or frontline social service work. Projects we studied deployed CommCare, a popular mobile application used as a job aid and data collection tool in frontline social sector work. Project-issued devices were many users' *only* device, facilitating first interactions with computing technology or the Internet. Allowing personal use, such as visiting Facebook, and work-related but non-prescribed use, such as photographing clients' living conditions, can lead to compromised application, device breakage, or data loss. Further, in the prospect of losing or damaging their devices, end-users perceive a threat of professional setback and the financial burden of replacement. On the other hand, allowing uses beyond CommCare may motivate workers to maintain a device, learn advanced tasks, and invent new ways to use the device in service of the project mission.

Balancing Benefit & Burden. A range of project features and decisions affect use. Many of these are made specifically in relation to a deployment, but others may be made well before or during a deployment, and while they may not be intended to affect it, they can support or undermine a deployment's objectives and the project's mission. We identify these often conflicting program features that affect device use for project mission and/or personal and professional empowerment, exploring tradeoffs for staff morale, mission advancement, and device maintenance. We hope our findings and recommendations will be useful for governments, NGOs, and funding agencies who arm frontline workers with mobile devices as tools to improve service delivery, monitoring, and evaluation.

All projects have implicit policies, unintended consequences, and tensions to overcome. We make these implicit choices and their tradeoffs explicit, and present lessons learned from deployments that have faced these challenges to deploy CommCare in a way that met or exceeded objectives.

Ultimately, mobile devices are too complex to govern by rules, written guidelines, contracts, job descriptions, etc. alone, because social interactions and discussions during training, troubleshooting, etc. about use represent informal negotiations about the rules. Social interactions can override written obligations and technical modifications set to direct device use. One response is to prohibit all non-CommCare uses of a device. We suggest instead that you learn to skillfully navigate this negotiation to promote project objectives, device security, and instances of strategic use by a device-enabled knowledge workforce.

Recommendations. Balance instincts that stem from concerns about device security to control behavior by recognizing and embracing the potential development gains that can accrue from its unrestricted and unplanned appropriation by frontline workers. Enable end-users to understand a device's functions, risks associated with irresponsible use, and basic troubleshooting. Teach principles of your project's mission and professional ethics to guide users as they navigate novel situations and try new solutions. Motivate them through their understanding of the project's importance, the responsibility you place on them, and the risks associated with shirking these responsibilities, and then trust them as the knowledge workers you have created by issuing such a powerful device.

- *Teach project participants the project's principles and theory of change, connecting specific uses of the device to specific goals you hope to achieve.*
- *Teach project staff and frontline workers a range of device functions for professional or personal use.*
- *Encourage device use beyond explicitly prescribed uses but still in the spirit of the project mission.*
- *Teach professional ethics to guide decision-making as participants discover new uses of the device.*

These activities will encourage frontline workers' sense of agency to do one's job and accomplish personal goals, and increase their sense of professional responsibility and personal ownership over the device.

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1. Introduction.

Mobile communications are rapidly being deployed to leverage technology for social service delivery. Many projects adopt mobile devices such as feature phones, smart phones and tablets for frontline workers' use, to reap the potential benefits of improved monitoring and reporting, and reduced data collection costs and loss. These instrumental benefits of a CommCare-enabled device support project goals.

This document offers guidelines for thinking about your deployment, drawing attention to the latent project features that can influence the use of a mobile device you issue for community level or frontline social service work. In projects under study, the mobile device provided is many users' *only* device, facilitating their first interactions with computing technology and the Internet. Allowing personal, or non-instrumental, uses, i.e., visiting Facebook, and work-related, or instrumental, but non-prescribed use i.e., photographing clients' living conditions, can lead to compromised application, device breakage, or data loss. On the other hand, allowing these *non-prescribed* uses of the device—here, uses beyond a prescribed application, CommCare—may motivate workers to maintain the device and learn advanced tasks such as using the phone to collect data about clients, make decisions about health problems, or enhance the counseling experience with the use of audio or visual props.

In some cases described here, CommCare-enabled devices were issued to Indian government health workers, Accredited Social Health Activists (ASHAs), to increase government capacity to deliver health services. Other projects that we studied adopted the tool more for its monitoring and evaluation capabilities, and the primary end users were other frontline development workers—first points of contact for delivering all sorts of village-level social services—or NGO staff. While CommCare has most often been deployed on feature phones, more recent deployments are using smartphones and tablets. Thus, we use the general term *device over phone*.

This work outlines choices relevant to projects initiating or scaling-up a mobile deployment in a resource constrained setting. All projects have implicit policies, unintended consequences, and tensions to overcome. We make these choices, and their tradeoffs, explicit, and present lessons learned from deployments that have faced these challenges to deploy CommCare in a way that met or exceeded objectives. If you are interested in a more detailed discussion of the research that informed this report, please read our academic papers (publications forthcoming; drafts available on request).

This report continues as follows. The next two sections are intended to inform decision-making, first, laying out key terms and their definitions, and second, identifying latent project features that affect even the most committed individual stakeholders' ability to enact change. Reflection upon these salient project features are critical for understanding the tradeoffs associated with the choices described in the third section.

All projects have implicit policies, unintended consequences, and tensions to overcome. We make these implicit choices and their tradeoffs explicit, and present lessons learned from deployments that have faced these challenges to deploy CommCare in a way that met or exceeded objectives.

2. Understand Complexity. The Intersection of Objectives, Rules, Capabilities and Actual Use

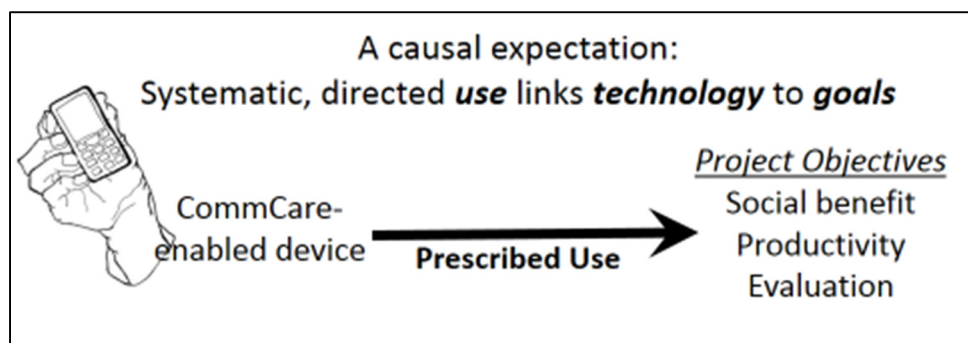
This work probes tensions among a project’s stated objectives, how users are trained to enact those goals through use of their CommCare device, and how users appropriate devices beyond a project’s scope.

The relationship between technology and user in a project setting differs from that in a consumer setting where one’s use of a given device is voluntary and unrestricted. In contrast, development projects deploy CommCare for a specific use intending to systematically affect a social objective. Projects demand tasks on a device that end-users may not otherwise undertake, and demand alterations in their behavior in ways that can, for example, change communication patterns among project stakeholders. Every project features rules, activities, and participants often from multiple partners, including the government. In faithfully carrying out project activities and objectives, project leaders direct, constrain, and often supersede individual preference or behavior.

The dynamics of information and communications technology use in resource-rich work settings are well-described, for example in work by Orlikowski [7]. However, non-prescribed use in the work setting has not been systematically studied in development settings that use CommCare or similar applications, though some work highlights its importance. One project to increase medical communications among remote doctors in Ghana observed many new, purely social, conversations, despite the medicalized design of the deployed interface, finding unexpectedly fluid “barriers between profession and person” [5], p. 8]. Studies have also noted non-prescribed but instrumental, or work-related, uses, as in the BulkSMS deployment described in Densmore [3]. Further, frontline workers have been observed to use phones’ recording capabilities to cajole reluctant service providers into treating patients [6]. These studies motivate us to explore tensions between how users are instructed to use a device and how they appropriate it, and how conflicting realms of power and control over user and device affect empowerment and mission.

Lessons presented here resulted from systematic, qualitative comparison of 11 deployments of CommCare. Early data collection featured two intensive case studies, including document review, field observation, and semi-structured interview of all relevant decision-makers and many end-users. These two intensive case studies informed the questions for our later data collection, consisting of semi-structured interviews of up to four participants in each of eight additional deployments. For each deployment, we questioned the technology partner (the Dimagi staff member responsible for the implementation), the funding partner, and/or the implementing partner—we sought out the person who championed the deployment and someone who worked closely with project staff and end-users.

As you know, technology doesn’t achieve social outcomes on its own. However, technology used systematically in a certain way can be an excellent tool for advancing social goals. The assumption



implicit in all mobile deployments is that the prescribed *use*, somehow, links the *technology* to the *goal*. Projects we studied use CommCare as a job aid to improve frontline workers’ counseling sessions with clients, and/or use

CommCare as a tool for collecting and analyzing data on the populations they care about. Improving productivity and evaluation, projects believe, will ultimately help them achieve greater social benefit.

Many technology deployments, including CommCare implementations, distribute devices with capabilities well beyond the particular use they hope will achieve the social objective. The below table describes functions of CommCare devices that Dimagi staff, end-users, and program staff find salient, and reported actual and aspirational work-related and personal uses identified by Dimagi staff, end-users, and program staff. Even the simplest phone on which CommCare has been deployed has the capability to make and receive calls and SMS, and has an address book, a calendar, a calculator, and a camera.

Device Function	Possible Uses of Device Functions	
	Instrumental Uses	Non-Instrumental Uses
Focal application: CommCare	CommCare	Text entry & reading practice, sharing info with family
Calendar	expected date of delivery	scheduling
Phone	call/misssed call/SMS clients, supervisor, project staff	call/misssed call/SMS family, friends, grocer
SMS		
Contact list		
Camera	photograph pregnant moms, healthy babies	photograph their own family
Share media	vocational research; share attractive, relevant content with clients	entertainment; education; professional development; information gathering; personal and professional communication; etc.
Radio		
Video player		
Music player		
Games		
Download media		
Internet		
Email	manage relationship with clients, supervisor, project staff	
Facebook		
Video recorder	share locally relevant content with clients	
Money transfer	get paid	transfer payments, remittances

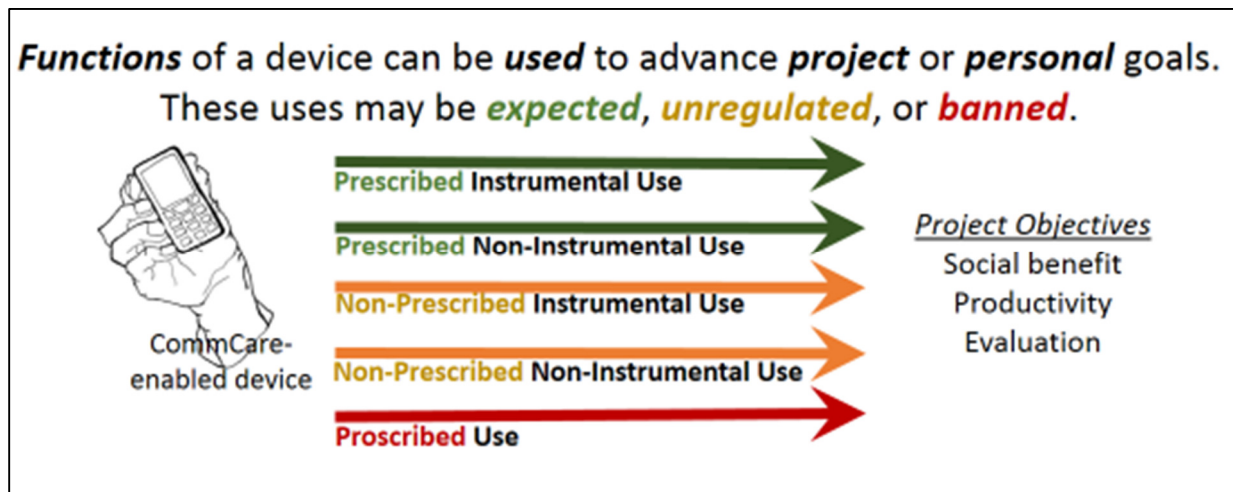
All of these uses—calling, SMS, using the calendar, taking photos—can be done *instrumentally*, for work, or *non-instrumentally*, for personal reasons. End-users may call or SMS their clients or their family; or use the camera to document clients’ stage of pregnancy or to photograph her kids. Frontline workers are continuously coming up with new ways to use CommCare devices for purposes other than CommCare, and projects may take a stance over whether instrumental or non-instrumental use is allowed or encouraged. It is very difficult to monitor or enforce rules about use, however. Deployments find it easier to enable or disable particular *functions*, or device capacities, rather than particular *uses*. What we mean by this is that while a project team may deem a camera function useful for work, it will not be easy to monitor, let alone enforce, frontline workers’ using the camera only for work and not for personal purposes. It is easier though not necessarily better to eliminate a camera function (by choosing a device without a camera, by hiding the camera from the start screen, etc) entirely than to regulate its use.

A particular use is *prescribed* if a project encourages it or intends that the use is taken. We use this word as we would in case of medical prescription. If a doctor hopes to heal a person (promote social benefit), she gives him a medicine (offers a technology) to use in a certain way (prescribed use) as a tool to help heal him as he enacts other good practices that will also help him improve, such as exercising or drinking water. For all CommCare

deployments, using the CommCare application is a prescribed technology that the project hopes will promote social benefit. Uses not been prescribed by a project are **non-prescribed**.

All uses of a device are prescribed or non-prescribed, not both. This is true even if a project hasn't been explicit on all uses. Because project managers do not designate each use as prescribed and non-prescribed, it may be difficult for an outsider, project staff, or end users to really know whether a particular action is prescribed or not. Just because they are not explicitly prescribed does not mean that these uses are prohibited, or **proscribed**.

As noted, any given use, such as SMS, may be done for *both* professional *and* personal purposes—**instrumentally** and **non-instrumentally**. However, not all instrumental use is prescribed. For example, one community health worker photographs healthy hospital-delivered babies to show pregnant clients the benefit of hospital delivery. Depending on a deployment, this use of the camera may be prescribed, non-prescribed, or proscribed. But depending on the contexts in which the camera is used, an individual's use of the camera may be instrumental, non-instrumental, or *both*.



Precautions help maintain a device's capacity to run applications like CommCare. It must be in good working condition and the memory card uncompromised. For security, a project may **proscribe**, or forbid, certain uses. Proscribed uses fall entirely in the category of non-prescribed uses. We consider four categories of prescription and proscription—physical, technical, contractual, and social. Here, we define each category, and discuss each in more detail in the section on mutually enforcing decisions.

Physical proscription is the surest proscription method. With physical proscription, a certain use is proscribed simply because it is not a capacity of a deployed device. Weapons, for example, would not enhance CommCare use, and distributing devices with a weapon feature may contradict project objectives. How might a project prevent its users from using their CommCare device as a weapon? We can think of two modes of physical proscription. The first is the **technological frontier**—while developers are surely working to include weapons as standard in mobile devices, at this point one cannot buy a CommCare device that also features a weapon. Only your imagination can stop you from identifying all the features detrimental to your project mission that you successfully prevented your staff from using because it hasn't been invented yet. It is possible, however, that weapons will be as standard on mobile devices as cameras.

Another way to physical proscribe, then, is via **device selection**; simply choose a device lacking unwanted features. Limited capability devices that can run applications like CommCare are decreasingly available, so this is not always

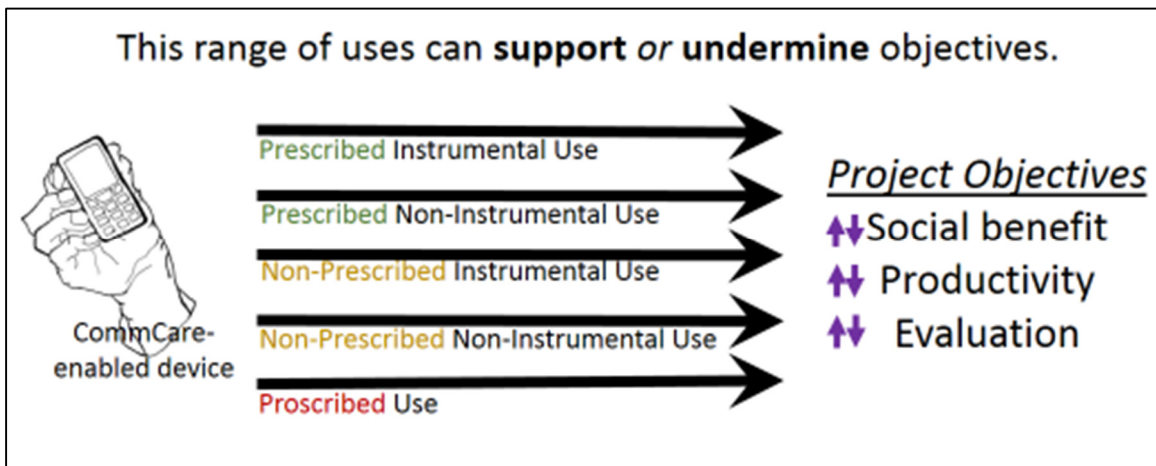
practical either. Further, in choosing, project managers may not consider proscription, focusing instead on identifying a device that runs CommCare well. Despite a passive stance on proscription, device selection and technological frontier effectively proscribe functions that may benefit project or users.

An alternative to physical proscription is **technical modification**—altering the device to disable certain features. There are a variety of ways to do this, including password-protecting the memory card, hiding menu items, or installing an application that blocks features an administrator chooses. This proscription method will deter use of proscribed functions by everyone except very motivated and savvy end-users.

Another alternative is **contractual prescription** and **proscription**, which entails encoding rules about utilizing a certain function, or using it in a certain way, in documents to which end-user are held accountable. One simple way to formalize required and prohibited uses is to introduce a contract that clearly outlines how a device should and should not be used. This may also be affected through altering existing staff’s job descriptions or performance evaluations to explicitly require proper use of CommCare. Rules may also be informally coded into a project’s rule-set through the use of informative posters displayed in the office or in other written communication such as a memo or an email that specifies that staff are bound to follow the rule. Contractual prescription and proscription can be strong or weak depending on how it is encoded and the monitoring and enforcement a project undertakes.

Social prescription and **proscription** may affect use via spoken rules, training procedures, and social and professional pressures. Social conventions such as norms and understandings about ‘the way we do things’ may exert strong pressure on individual participants to conform to rules. Nevertheless, rules imposed through this mode of pressure may be broken, and are the most difficult for project managers to monitor or enforce. Further, informal rules, social pressures, and culture, including abundantly positive ones such as a collaborative work environment or encouragement of learning, frequently contradict and undermine rules documented in a project’s formal and informal code.

Decisions on what uses should be prescribed, non-prescribed, or proscribed can be complicated. It may not be clear at the outset what effect certain uses may have on objectives, so **rule-making** can be difficult.



We use the words implicit, explicit, formal, and informal. When we say that a rule, objective, or perception is **explicit**, we mean that it has been stated clearly. The clearest statement of rules, objectives, and perceptions is found in **code**, written statements that outline expectations. Organizational or project code may be found in mission statements, training manuals, contracts or memoranda of agreement, job descriptions, and performance scorecards that projects often include in proposals and reports. These documents are often official, binding, or **formal** documents. Unofficial, non-binding, or **informal** venues for code, or written expectations, include office

posters and unofficial correspondence. Explicit, informal expectations may also be expressed through strict or weak *enforcement* of code. **Implicit** rules, objectives, and perceptions are not written down, but can be expressed formally or informally nonetheless. In the context of a CommCare deployment, some binding, formal rules about proscription may be expressed implicitly through the selection of a device or modification to it. Implicit rules may also be introduced more informally in the project setting—these rules develop during interactions among project participants when working together directly on the project or in the larger organizational setting.

	Formal rules	Informal rules
Explicit rules	<ul style="list-style-type: none"> • Project code: contracts, job descriptions, training manual, mission statement, scorecard 	<ul style="list-style-type: none"> • Project code: office posters, email, branding • Rule enforcement
Implicit rules	<ul style="list-style-type: none"> • Device selection • Technical modification 	<ul style="list-style-type: none"> • Interactions during project work and the time between • Norms

Our original picture of use promoting the achievement of objectives was too simple. Instrumental, non-instrumental, prescribed, non-prescribed, and proscribed uses are supported and constrained by formal and informal rules. Frontline workers often deploy devices in unexpected ways, including new, strategic, non-prescribed uses that help them do better work. Office norms and actions of project staff can contradict encoded rules.

Goals may differ by stakeholder, and implicit goals may conflict with primary or explicit goals. Project staff and frontline workers may also relate personal goals, including improving their availability and entertaining themselves and their families, to an ICT deployment. Before a project settles on rules about use, it should reveal implicit, and potentially competing, goals of a deployment. The following section makes explicit some of the most salient goals that we uncovered.

3. Reflect. Latent Supports and Constraints to Use

a. Implicit Deployment Objectives and Perceived Benefits

CommCare is deployed most typically a) as a tool to improve and standardize frontline worker's counseling messages to clients; b) to digitally monitor clients across counseling sessions to improve the accuracy and speed with which frontline workers record and retrieve information, and for more efficient and personalized counseling; and c) to enable speedy analysis of project impacts. Our research revealed a larger set of goals, many of which are implicit or not shared by all project participants. Here we list these potential benefits to deploying CommCare devices. Some projects lack explicit objectives, and stakeholders articulated them as to "experiment with a mobile health tool" or to "help improve government capacity to deliver services," and specific outcomes that CommCare should affect are, perhaps intentionally, unarticulated and up to implementers' interpretation. Explicit project objectives are also subject to interpretation, and all project participants may have additional goals that they hope the devices will promote.

Evaluation. An evaluation specialist may use CommCare data to identify a vulnerable population or indicator that needs intervention, or to demonstrate a project's impact. This project participant, or other stakeholders, may also use it to assess performance of individual frontline workers, to give them feedback on their work, and to identify technical problems with individuals' CommCare devices. Health officials also often use evaluation data in their meetings, to mobilize stakeholders or to publicly assess the progress of their frontline staff or of a target population.

Vocational Literacy. While deployments aim to improve a client population's knowledge and behavior, many often find that frontline workers' use of CommCare also improves frontline workers' knowledge of counseling topics.

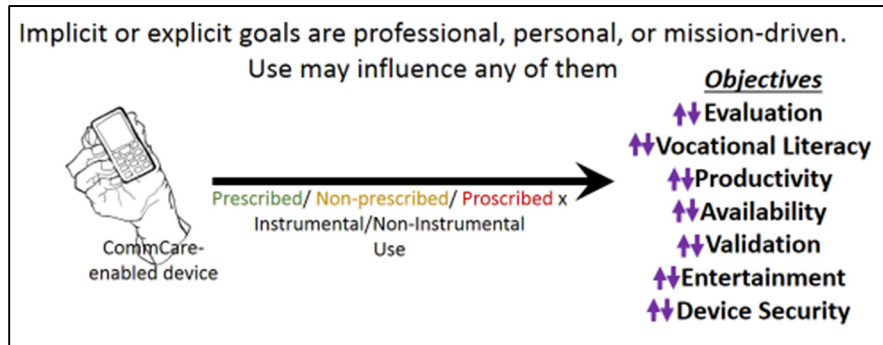
Productivity. CommCare's monitoring feature enables easy input of new client data and quick data retrieval. Gains can also appeal outside the workplace. For instance, one mother-in-law excitedly reported that before, her daughter-in-law spent evenings writing notes on client visits. Now, she had time to cook. This implies that professional responsibilities can infringe on personal time and that professional tools can create personal time. Other functions can also enhance productivity; some users report photographing healthy hospital-delivered babies to demonstrate to later clients the benefit of following advice.

Availability. CommCare devices' phone and SMS functions allow better communication among client, frontline worker, and others. Clients in need can easily reach phone-enabled staff, who can respond appropriately and quickly. Moreover, the project device is a first personal phone for many frontline workers, who describe calling mother without having to ask permission, ordering groceries when husband is away, and receiving messages from friends, family, or clients without their speaking with her husband first.

Validation. Improved vocational literacy, productivity, and availability, and visibly carrying a work-issued device, combine to give frontline workers new credibility and authority in the eyes of their clients and clients' families. This has boosted frontline workers' confidence and professional agency; they now actively include family in counseling when prior, they typically counseled clients privately. Frontline workers' own families' perceptions have changed as well—children and husbands report that the device signals that she does important work and has been trained.

Access to Entertainment and Information. End-users play games during downtime or share devices with family for gaming, watching videos, and listening to music. They often photograph their children and personalize the devices with wallpaper or ringtones. They also occasionally surf the Internet—one end-user asked to be shown how to look up a niece’s school test scores online.

Device Security. To enable each of the above goals, each device must be in working order. Even frontline workers who reject the device as a tool to advance professional or project goals, but who appreciate its value to personal life, must act in a way that maintains her access to it. Explicitly or implicitly, the project and all stakeholders aim to prevent device loss or damage, and maintain its integrity and CommCare’s.



So, implicit in any deployment are multiple and overlapping theories about how a CommCare device will enable stakeholders to achieve a range of goals that may not be explicit at the project level, and that may not pertain directly to a deployment’s primary goals.

b. Threats & Perceived Burden

All deployments devote time and funds that could have been used in other projects, so some may view these allocations a burden, but we consider them normal project costs. Even for committed stakeholders, however, real and perceived threats could restrain behavior that supports above-noted goals. Here, we report on these threats to project mission and to individuals. All relate to asserted authority and control.

Threats to Mission. Projects upheld the importance of maintaining their investment, not only because sunk costs should have social impacts, but also because projects we studied seem overwhelmingly demonstration projects—this speaks to the novelty of mobile device use in community development work. Earliest concerns related to frontline staff motivation and behavior—that they could not learn to use the devices and CommCare, and if they did, that they would not use them in their work. In deployments we studied, these fears were not realized, and were put aside early.

More serious concerns relate to device security. *A priori* expectations of device damage, theft, and loss weighed heavily on decision-makers, as frontline workers might not treat devices responsibly, or could sell them for profit. In projects we studied, damage and loss happened in 1-2% of devices and related to device faults *and* user conduct. More frequently, memory cards were compromised, subject to virus and erasure, and users in these circumstances required CommCare reinstallation, typically by a project staff who visited them in the field. This is not reported a burden by project staff who traveled less than ~30km to meet users. In more remote regions with difficult terrain and poor roads, this is a more serious concern for project staff and frontline worker, who often cannot work properly for a week or more while awaiting reinstallation.

Some projects address these concerns by blocking devices’ non-CommCare functions, locking feature phones’ memory cards or hiding menu items. Android devices are blocked more efficiently with [AppLock](#), an application

that allows an administrator to disable the functions he selects. These projects to some extent made CommCare devices into CommCare machines—disabling some, most, or all use but CommCare. Projects also encoded expectations of use in organizational documents, such as contracts and training materials. Finally, some projects used social interactions such as training sessions to teach end-users project objectives and principles, and to understand how to troubleshoot problems or recognize risks and opportunities associated with each device function and use. Most deployments combined these physical, technical, contractual, and social solutions.

Threats to Project Staff may depend on staff roles and responsibilities. A project evaluator, for example, depends for her data on frontline workers (who may not be under the project's authority) to use CommCare properly, and on technical personnel (over whom the evaluator may have no authority) to swiftly address technical issues.

Likewise, frontline workers must learn and change their work practices. Reported early resistance was based on their worry that they would not be able to navigate the device, of particular concern for older users and those who had never had their own mobile phones. As mentioned, these concerns dispelled quickly as end-users indeed learned well and recognized the usefulness of the tool.

Especially in projects where government frontline-workers collaborate with an NGO, frontline workers are asked to accept instructions and performance feedback from someone who is not a formal supervisor. Further, their actual supervisors may also use CommCare data to assess their performance, which is reported as acceptable to frontline workers, but of concern when CommCare malfunctions—at these times, neither completed work nor performance data are reported, and end-users appear to shirk. Professional reputation is also at stake in instances of device loss or damage, which also comes with an expectation of financial burden and the possibility that their device will be taken away altogether.

Threats to Non-Participants. The transparency that CommCare enables or appears to enable can also threaten privacy and reputation for non-participant stakeholders in a CommCare deployment, through the manipulation of knowledge. We have observed this sort of occurrence for individuals in three roles: end-user's collaborator, end-user's client, and government. First, in projects where government volunteers collaborate with an NGO to use CommCare, volunteers' government supervisors are occasionally coerced to act in ways that they did not want to. For example, CommCare users have purposed phones' recording capabilities to cajole their reluctant peers into treating patients [6].

Further, devices can be used as a tool for soft intimidation of clients and clients' families. The device itself was often viewed by clients as an authority, its messages respected as information from radio or television [2]. ASHAs reported that clients' families may shush each other—'The phone hears everything!' Instead of discouraging these views, ASHAs used the misconceptions non-maliciously to encourage clients' behavior change. ASHAs sometimes asked clients to speak directly into the device, though the application lacks voice recognition capability, and ASHAs must type responses manually. As ASHAs guided clients through questions, they often encouraged honest responses because authorities in India or America will check.

Finally, knowledge creation and manipulation can pose a threat to government stakeholders. For instance, evaluation data may reveal that conditions in an area are worse, or that services are having less impact, than previously reported. This improved accuracy is critical for government to adjust its programs, but can also be a serious burden if neighboring regions overstate achievements and understate challenges—one region's accurate reporting under these conditions would unfairly lower its relative ranking.

4. Act. Maximizing Benefit & Minimizing Burden

Moving forward, we assume that social benefit is the primary goal, and other goals may be pursued to the extent that they advance or do not hinder the social goal. Advancing some objectives like device security simultaneously advances the primary goal. Advancing other goals, for example entertaining frontline workers in their personal time, may be accomplished in a way that does not hinder project goals, but may also unintentionally disable CommCare. Finally, as described above, frontline users frequently find new ways to strategically deploy devices in their daily work, in ways that advance the project mission beyond the initially expected usefulness of the device. **How might deployments maximize the benefit of the device while minimizing the sacrifice of the project and the user?**

Here we present a range of actions that can act as potentially conflicting rules that constrain or promote use, and the perceived tradeoffs that may guide debate about these choices. Deployments make a combination of physical, technical, contractual, and social choices, which are summarized in the table below. Because decision-makers can neither prioritize nor control everything, some identified *choices* may really be project *features* already in place or passively decided. For example, while a project may have some influence over critical features of infrastructure, such as availability of power or Internet, many features of a project’s environment are beyond a project’s control, such as the dispersion of the beneficiary population, the quality of roads to them, and the political and economic environment. Whether chosen or accepted, project features can direct project participants’ device use. It is less important to be able to categorize each feature into its respective category than it is to be aware of the place, or venue, of each salient feature.

Project Features that Influence Use	
Environmental	<ul style="list-style-type: none"> • Venue: among beneficiaries, donors, government stakeholders • Features: infrastructure, topography, stakeholder buy-in, politics, economy, etc.
Physical	<ul style="list-style-type: none"> • Venue: The market, the office, users’ pockets and homes • Choices: Device selection and possession, solar panels, protective device covers
Technical	<ul style="list-style-type: none"> • Venue: The phone itself • Choices: Password protection, settings, memory card lock, hiding folders, AppLock
Contractual	<ul style="list-style-type: none"> • Venue: Written items including contracts, job descriptions, training manuals, memos, signs, mission statement, scorecard, performance indicators • Choices: Device/SIM ownership, rights, responsibilities, prescribed and proscribed use, top-up policies, device maintenance, contingency for damage and loss
Social	<ul style="list-style-type: none"> • Venue: The project setting, interactions among participants and other stakeholders • Choices: Training; monitoring use; rule enforcement; reputational threat; validation; branding; informal messages; knowledge manipulation
<p><i>Each feature or choice has tradeoffs for client user capability, user motivation, actual use, device integrity, and client data privacy.</i></p>	

Remember, it is easier to regulate the presence certain functions than it is to regulate the use of certain functions—the device itself is controllable, while behavior is much less so.

a. Device selection, possession, and branding. Broadly, projects may choose to deploy CommCare using a feature phone, a smartphone, or a tablet. The only way to create the potential for encouraged use of a device is to

select a device with the relevant function. Similarly, the surest way to proscribe a particular use is to keep the relevant functions out of the hands of end-users.

One choice that seems to weigh heavily on projects at the outset and in readying for scale-up or government handover of projects is the choice among a feature phone, a smartphone, and a tablet. There are many trade-offs in making this decision.

Cost. Early deployments found that upfront costs of feature phones were significantly lower than smart devices, but these costs seem to be converging. However, maintenance can still be costly, especially as local service centers may not yet have the capacity to deal with smart devices, so servicing those requires mailing them away.

Usability. On one hand, for projects we studied, feature phones were most familiar to frontline workers, who, even if they did not have their own personal device, had had some experience with, or exposure to, one. For this reason, most decision-makers thought that feature phones were most usable. Those who nonetheless chose smart phones or tablets thought that the touch screen would be a challenge, especially for text entry. All end-users learned these skills well and in acceptable time. One deployment was able to identify, between pilot and scale-up, a smart phone with a physical keyboard, and introduced this to pilot participants, who ultimately preferred touch-screen text entry over the keyboard.

Functionality. It is currently possible to deploy feature phones that support multi-media and Hindi text entry. The most relevant functions that smart devices have over feature phones are reported as greater memory, which supports a larger case load, and a larger screen, which is preferable if data collection activities are extensive, making scrolling through surveys on a feature phone cumbersome.

Some view the fact that Android-based devices can be deployed only for CommCare using Applock as a benefit, and others see this as a threat to the project and the agency of frontline workers. For example, some worry that personal use of a device will distract end-users from their work. Unrestrictive Android deployments observe frontline workers using Facebook in the field¹. Applock allows administrators to block internet use, if they choose, forcing end-users to use CommCare or nothing, increasing their ability to visit more clients each day, and preventing untimely depletion of the battery. On the other hand, some decision-makers appreciate the benefits that accrue to mission as well as to end-user in her professional and personal capacity when they leave the device functions unrestricted. For example, an unrestricted device allows potentially high-performing end-users to learn, better and more quickly, to type, read, browse the Internet, watch videos, etc. This empowerment, as we note below, contributes to validating the end-user to her family, clients, clients' families, and to herself, and increases her agency to accomplish personal and professional goals. Decision-makers who held this view almost universally viewed Android phones, and the ease and attractiveness of AppLock, as a quite dangerous option.

Project purpose and duration. The importance of agency, empowerment, and device security seem to vary with a project's purpose and duration. One month-long deployment of CommCare was undertaken using tablets for the purpose of conducting a survey. In this case, use of CommCare as a survey tool was included in enumerators' job descriptions, and any compromise of CommCare meant a complete halt of work until CommCare was working again. Therefore, decision-makers prioritized device security, integrity of CommCare's media files, and ensuring that the device's battery lasted through the work day. In light of these priorities, enumerators had to check devices into the office each night for charging, and absolutely no non-CommCare use was allowed at any time, a rule strictly enforced using technical modification to the device. Project staff trained enumerators on CommCare only,

¹ Please note that non-Android smartphones, such as the Nokia ASHA, can be deployed with CommCare. All smartphone deployments in our study were Android deployments.

and employed a strict user-contract (SC1 in appendix) that stated that enumerators would not be paid for their work until the project ended and devices were safely returned. Resulting use was 100% survey-related, with no loss or damage to devices.

Those same project decision-makers, on the other hand, later deployed CommCare on feature phones for a project of indefinite duration during which end-user empowerment was actively if informally encouraged during the project's duration. Initial formal training and ongoing informal training taught end-users the principles of the project, risks of certain uses to the device, and encouraged responsible personal use. For these users, the device represented an important source of communication and entertainment, in addition to an important job tool. End-users frequently discovered and employed new ways to use the device to improve their work, their counseling sessions with clients, and their communication with other project stakeholders. They also required occasional reinstallation of CommCare, and, rarely but truly, their devices required repair or replacement.

Device possession. Projects must also decide where the device resides when CommCare is not in use. In some deployments, the end-user is fully responsible for securing a device issued her. Other projects share responsibility by locking devices at project headquarters overnight. This reduces the likelihood of damage or loss during non-work hours, and this may strengthen users' sense of the project's importance and/or the importance of protecting device and application. For users who do not typically visit the office twice a day, however, it may reduce their ability to manage a full workload. It may also engender resentment by enabling close contact with a device that could provide enjoyment or other benefit but does not.

Branding. Projects may choose to brand their devices—one easy way to accomplish this is to fasten a sticker featuring the project's logo to the back of the device; an alternative is to etch an image or word into the device. Branding serves as a soft reminder to the end-user of the project's asserted control over user behavior and over device, and of the threat of consequences in case of compromise to the device.

b. Technically modifying the device. Though little data is stored on CommCare devices—as data are collected, they are transmitted to a cloud-based server few data are retained on the device—password-protecting devices and CommCare can protect the privacy of patient data. Further, these password protections can help prevent unauthorized users' access to the device's functions. Password protection can be a challenging concept for end-users for whom this is their first device [4]. Consider end-users' prior experience and available training resources prior to password-protecting device, CommCare, or both, and as you make decisions on password composition requirements.

Downloading external media on CommCare devices often results in virus infection or accidentally erasing CommCare media. Users expressed clear interest in activities that could compromise CommCare, i.e., downloading music and video. To minimize disruption, one project's staff added a password to protect memory cards to prevent unauthorized downloads; another hid CommCare media folders from end-users' view. For Android devices, the AppLock application only reveals functions that a device manager chose.

These solutions put the prescribed functions of a device front and center so they are easy for users to find. They can also technically proscribe functions viewed as hazardous to CommCare. To the extent that users want to do their jobs well, these measures are appreciated by even those they restrict. But they also restrict personal uses of these devices. Balancing benefits that accrue to project, device, and ASHA, with potential disappointment in being excluded from certain activities, can be a challenge.

c. Encoding rules and contingencies for damage or loss. As noted, to encode means to *write it down*, or to code a requirement or a policy into a project. Specific issues that may be addressed by this category of solution include device ownership, SIM ownership, responsibilities for topping up, control over device use and maintenance, and contingencies for damage and loss. Relevant code may be located in documents to which users are held accountable.

One simple way to formalize required and prohibited uses is to introduce a contract that clearly outlines how a device should and should not be used—see the appendix for two very different samples, SC1 and SC2. Code may be introduced into a project’s rule-set by altering staff’s existing job descriptions or performance metrics. A contract or altered job description can formally reflect new expectations, but the latter may only be practical when users are project staff. Less formal code may be enacted in informative posters displayed in the office or in other written communication such as a memo or an email.

Projects can own devices (as in SC1) or assign ownership to users. This may be finalized during deployment, or may defer transfer of ownership, for example, to project end, leaving that decision unmade (as in SC2) conditional on program adherence. Advance agreement via contract often assigns device recipients financial responsibility to repair or replace devices. Some staff expressed that end-users should bear some cost to encourage a sense of ownership and duty. On the other hand, this burden can be severe for some users. Projects can address this variously, including using device warranties or device insurance, and enforcing modified versions of the contract, described in more detail in sub-section “Social Solutions”.

Some projects also find it useful to encode rights and responsibilities of SIMs’ ownership and use. SIM ownership is a liability if a SIM is abused, a major security concern in India and increasingly in Africa as states require users to register their SIM. One benefit to project SIM ownership is that topping up prepaid airtime can be done en masse. But if security overrides convenience concerns, careful selection of a carrier can minimize difficulties topping up devices individually. India Airtel’s website, for instance, currently allows anyone to remotely charge any device. Some projects give users a flat amount for her to allocate to data and talk; others top up only data. This decision affects the consistency with which devices are topped up and thus how regularly CommCare data are sent. Further, if users are encouraged to call clients or peers or to keep a minimum balance, but projects do not fund these objectives, frontline workers bear the burden.

As implied above, contractual prescription and proscription can be strong or weak depending on how it is encoded and the monitoring and enforcement a project undertakes. In the following section, we see why *code* used in this way is not an analogy for computer programs—project staff, unlike computers, can decide for themselves whether to follow lines of code, and can act in ways that support or contradict it.

d. Promoting mission, rule-adherence, and professional responsibility. Project staff may also prescribe or proscribe uses, intentionally or not, through their actions and interactions. Implicit rules related to CommCare device use may relate to existing norms; for example, if it is already taboo to take calls during client visits, then this proscribed use of the phone function may not be addressed in training on a new device. Rules may also be explicit but informal. For example, one user repeatedly erased CommCare media as her children downloaded new games, and staff asked her to limit her gaming. Rules may also be explicit, apply to an entire group, and yet unencoded, such as verbally instructing users to maintain a minimum talk time balance (which is often required to send data). Here we describe features of the project’s social setting that could affect use, including monitoring use, enforcing compliance to rules, reputational threats, validation of end-users, informal project messages, branding, and manipulation of understanding.

Monitoring and enforcement. Strict or weak monitoring and enforcement of compliance further constitute policies that support or constrain device use—encoded rules only direct use to the extent that rules are followed. For example, SC2 states that users may not allow family to use CommCare devices. Despite this, frontline workers in this deployment consistently admitted that family use them. Though all were trained on contract details, they did not mention the rule. When asked why, program staff expressed the seriousness with which frontline workers view the responsibility of possessing a device, and the consequences if it were damaged. Because of this, staff did not see fit to closely monitor use, and in fact often actively introduced them to new device functions.

Reputational threat. In two observed deployments, when CommCare required reinstallation, all project staff reported that all frontline workers expressed concern, often panic, with urgent requests to reinstall. All project staff reported few consequences to this situation: no cost, no annoyance, and no penalty. But if CommCare is disabled, end-user cannot work, and this poses a reputational threat that may constrain use in unobserved ways. First, ASHAs' performance is announced monthly at government meetings, which seems to affect them deeply—ASHAs publicly defend peers if they think unavoidable circumstances such as a family death prevented her from working. Further, program staff reported their own and frontline workers' sense of responsibility to protect the devices with which they had been trusted, and their expected feelings of failure in breaching that trust if they were to lose or damage the device.

Validation. We found, and many others report, frontline worker's improved status in the eyes of their own families, of their clients, and of their clients' families, after they being using a CommCare device. This validation of frontline workers, their newfound sense of authority, agency in personal and professional life, and availability, may motivate them to maintain the device and to use CommCare properly, at worst out of a fear that the device will be taken away.

Informal project messages. Before deployment in some observed projects, end-users' general knowledge of devices' affordances or how to use them was minimal. During training, staff demonstrated calling, typing and sending SMS, using contact lists, etc. Even during one project in which non-CommCare use was clearly outside objectives, staff trained and encouraged frontline workers to use these functions. They gradually asked staff about other uses, including how to photo, share a song, or surf. Frontline workers and project staff seemed to have agreed implicitly or explicitly on the import of protecting the devices and on activities that would truly endanger them. Staff and frontline workers also recognized the importance of a) advancing the spirit of the project mission beyond explicit objectives, b) uplifting frontline workers' status in the eyes of clients, clients' families, and supervisors, and c) improving frontline workers' lives through a sense of, and actual, independence.

Also program staff in this deployment actively promoted a learning culture and a family culture among project participants. Many project staff lived together, and all participated in daily morning prayers, taking turns leading them, before starting their visiting the frontline workers they respectively support, many of whom they also cultivate familial ties with. Further, all project staff in this deployment expressed the importance of the frontline worker in a) identifying technical problems with devices or CommCare, b) identifying counseling topics that could be added to CommCare to improve its usefulness, and c) generating ideas based on their field experiences for how to improve service delivery.

Further, project staff expressed concern to promote frontline workers' sense of ownership over devices, despite their not actually owning devices, by emphasizing the project's importance and frontline workers' role in achieving its mission, and maintaining a relaxed stance to non-prescribed and explicitly proscribed device uses. Finally, their contract, SC2, promotes the fortune of the project, a sense of responsibility, and peer responsibility for monitoring device use (see labeled "spirit" clauses). These messages that encourage frontline worker independence, responsibility, and agency to enact the project's mission seemed to override much of the seemingly strict overall nature of SC2 and its seemingly strict rules, which were reinforced during a day's training.

Knowledge manipulation. Decision-makers in deployments reported occasionally taking advantage of information asymmetries between project staff and frontline workers. This was reported by staff in multiple projects in two types of situations.

First, on rare occasions frontline workers' phones would need replacement, and the rule that they had to pay for replacement came into effect. In all reported cases, the project paid part or all replacement costs, and in instances in which projects paid part, they allowed end-users to pay the balance according to a schedule negotiated at the time of the incident. This represents a quite flexible and weak enforcement of the most stringent contract provisions (see, for example, SC2 "tough clauses"), and those which represent a reportedly serious threat of heavy financial burden to frontline workers. After these instances, project staff did not tell other end-users about what had happened to the one who had replaced her device—in this way, projects maintained a threat of burden that could be flexibly realized on a case-by-case basis.

Second, project managers reported that end-users were unaware of the range of features of devices they deployed, which, especially in Android and tablet deployments, they thought explained much of why end-users did not request to use non-CommCare features, or resent that those features were blocked. Project staff thought that especially in the case of tablets, devices were not well-recognized, and users therefore did not realize their functionality similar to a smartphone. This eased project decision-makers' use of the CommCare devices solely for CommCare, thereby promoting device security and application integrity. As smartphones and tablets become more widespread, however, we expect that knowledge about devices will increase, and that project will have to better justify blocking attractive functions, or more actively teach responsible use of them.

5. Further Recommendations

Decisions at the organization or project level can advance or undermine project goals and the objectives of a deployment. These decisions are complicated, and rule-making in one area may support or conflict with priorities or rule-making in another. Policies, including informal ones that stem from attitude and actions, can promote empowerment and encourage active and thoughtful participation in a project's mission—that is, develop personal and professional agency, and credibility to faithfully implement a project. Members in an organizational unit advance objectives in ways not encoded in plans and make the most of their devices despite the rules. This ongoing negotiation between rule making and rule breaking can be a productive part of an iterative and increasingly successful implementation process.

For researcher, project staff, and user, conflicting policies, actions, and priorities make lines between prescribed, non-prescribed, and proscribed uses often quite fuzzy. A CommCare device is too complex to govern by code (written guidelines like contracts or training manuals) alone, because discussions (during training, troubleshooting, etc) about use represent informal negotiations about rules. Social interactions can override written obligations and some technical modifications, both intended to direct use of a CommCare device. One frequently used solution is to prohibit all non-CommCare uses of a device.

Recognizing and facilitating the achievement of a range of goals could bolster a project's primary goals *or* divert attention from them. For example, allowing or encouraging non-CommCare use of devices may undermine device security: downloading music, videos, and games regularly compromises CommCare's media files, and increased use also increases opportunities for damage, loss, or depleted battery during work. On the other hand, allowing or encouraging non-CommCare use of a device promotes individual frontline workers' sense of ownership over it, their likelihood of learning advanced tasks on it, their understanding of tradeoffs associated with using it in particular ways, their likelihood of learning to independently troubleshoot problems, and the possibility that they independently develop new ways to strategically deploy it in service of a project mission.

This tradeoff is not an easy calculation. However, we suggest that project managers counter instincts to completely control a device and its uses and instead embrace the potential benefits that can accrue from relatively unrestricted and unplanned appropriation by frontline workers. Enable end-users to understand a device's functions, the risks associated with irresponsible use, and basic troubleshooting. To do this,

- **Teach project staff and frontline workers the project's principles and theory of change, connecting specific uses of the device to specific goals you hope to achieve.**
- **Teach project staff and frontline workers a range of device functions for professional and personal uses.**
- **Encourage device use beyond explicitly prescribed uses but still in the spirit of the project mission.**
- **Teach project staff and frontline workers your project's principles of professional ethics, to guide their decision-making as they discover new uses of the device to achieve project objectives.**

These activities will encourage frontline workers' sense of agency to do one's job and accomplish personal goals, and increase their sense of professional responsibility and personal ownership over the device.

To maximize use of a device in support of a project mission, learn to skillfully navigate this negotiation to promote project objectives, device security, and instances of strategic use by a device-enabled knowledge workforce. Balance an instinct to control the device and its uses that may stem from concerns about device security by recognizing and embracing the potential benefits that can accrue from unrestricted and unplanned appropriation by frontline workers of a device. Enable end-users to understand a device's functions, the risks associated with irresponsible use, and basic troubleshooting. Teach principles of the project's mission and professional ethics to guide project staff and frontline workers as they navigate novel situations and try new solutions. Motivate them through their understanding of the project's importance, the responsibility you place on them, and the risks associated with shirking these responsibilities, and then trust them as the knowledge workers you have created by issuing them such a powerful device.

List of Appendices

- Acknowledgements
- References
- Sample Contracts

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Sample Contract #1 (SC1). Words in [brackets] imply redacted identifying content

Tablet Handover Contact

Name of Receiver.....
ID Proof Type/ID Proof No. of Receiver...../
Tablet No.....
Date of receiving.....

I receive the Samsung Galaxy along with the charger for the use of protocols on the field and will return it back after completion of the [Project] baseline survey. I take the responsibility of the proper use of the tablet and charger for the time period of the pilot. I understand that I will only receive full compensation for my work as a data collector upon return of the tablet and charger in good working condition.

.....
Signature of Receiver **Ownership** **Tough clause. Encoded threat of burden**
.....
Signature of [iNGO] India Team member **Signatories: employee (device recipient) and employer**

Sample Contract #2 (SC2). Words in [brackets] imply redacted identifying content

Contract with ASHAs regarding Mobile Phones issued under the [Name] Project

Organization – [NGO, Address] hereby issued 1 (one) Mobile Phone (Model - Nokia C2-01, IMEI No _____ and ID No. _____), charger, battery, and 1 (one) 4GB memory card to (ASHA name) _____ address _____.

Rules on the ownership, usage and maintenance of the Mobile Phone:

The Mobile Phone and its accessories are issued to ASHA for use as a job aid in the [Name] Project. Hence, the safekeeping of the same shall be the sole responsibility of the concerned ASHA.

It will be the responsibility of each ASHA to safeguard the mobile phone issued to her and also advise their fellow ASHAs to exercise all caution regarding the safeguarding the phone because any loss of the phone or any kind of damage to the phone will be a ~~un~~ unfortunate for the entire project. Hence it shall not only be the responsibility of each ASHA to safeguard her phone and accessories but also encourage other ASHAs to exercise the same care and caution. If an ASHA observes any instance of misuse of these phones she may report the same to her respective ANM or a staff member of [NGO].

Spirit

Spirit

Spirit

Spirit

Spirit

Tough clause. Encoded threat

1. **Ownership:** The following guidelines will be effective regarding the ownership of the mobile phones-

Ownership

- a. The mobile phone shall be the property of [NGO]
- b. At the time of issue of the mobile phone each ASHA shall have to submit a copy of a self-attested proof of identity.
- c. At the end of the project duration, a final decision will be taken by senior managements of [NGO] and other stakeholder organizations involved in the project, whether the ownership of the phone will remain with [NGO] or it may be transferred to the respective ASHA.

Carrot clause. Encoded potential benefit

2. **Usage:** The following guidelines will be effective regarding the usage of the mobile phones-

Rules on Use

Proscription

- a. The mobile phone shall be used as a job-aid under the [Name] Project implemented by [NGO].
- b. The use of the mobile phone is exclusively for the ASHAs on the [Name] Project. Use of the mobile phone by any other person like a family members and or any person/s of the community/village is expressly prohibited. The sole responsibility regarding the use of the phone shall rest with the ASHA.

Top-up policy

c. The organization ([NGO]) shall be responsible for recharging data pack required for sending information under the [Name] project.

3. **Maintenance:** The following guidelines will be effective regarding the maintenance of the mobile phones-

- a. The ASHA shall exercise due caution while using the mobile phone.
- b. It will be the sole responsibility of the ASHA to safeguard the phone and the other accessories issued along with (charger, battery, and 1 (one) 4GB memory card).
- c. In case of any instance of damage occurring to the mobile phone due to improper/incorrect use of the mobile phone, the same shall be immediately reported to [NGO].
- d. In case of a fault with the mobile phone, please DO NOT approach a non-authorized/local technician for repairs. The repairs shall be carried out through [NGO] at an authorized service centre but the costs for such repairs shall be borne by the ASHA.
- e. The ASHA shall be fully responsible for damage/breakage if any to the mobile phone.
- f. The ASHA shall be solely responsible for loss/theft of the mobile phone. In case of loss/theft of the mobile phone the ASHA shall be responsible for reimbursing the organization the market value of the phone or a new Nokia C2-01 back to the [Name] Project.

Reputational threat

Tough clauses. Encoded threat of burden

Signature

Signature

Signature (With name and Address)

Chief Functionary
[NGO], [Location]

Medical Officer In-charge
Block_____

Receiving ASHA

Signatories include project staff and informal government partner who has some formal authority over device recipient

Date: