Understanding Best Practices for ICTD Projects: towards a Maturity Model

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Abstract

The implementation of Information and Communication Technologies in developmental contexts presents specific social and technical challenges. Understanding the lessons learned and documenting best practices under extreme conditions, such as the ones found on the African continent, can provide valuable insights for ICT deployment in developing countries. At the same time, the experience in use cases and technical know-how of developed countries can help regions such as Sub-Saharan Africa in harnessing the full potential of ICT for social and economic development. This paper describes the preliminary results of an international project based on the exchange between two European institutes and two South African universities, whose goal is to define a set of best practices to improve the success rate of ICT for Development projects. This led to the definition of a Maturity Model to evaluate performing organizations with respect to what characterises a successful ICTD project to guide them in the improvement of their processes towards becoming more effective in addressing the needs of rural communities. The practices and maturity goals included in the maturity model have been collected through an extensive literature review and interviews with project managers.

Keywords
Project management, maturity model, ICT4D

Introduction

Despite the obvious connection between the discipline of ICT for Development and technical disciplines, a common recommendation given by scholars is that project development should not be technology but, rather, user driven (Heeks 2008). This is mainly due to the fact that ICTD research is often evaluative and led by social scientists
Only recently, computer scientists have taken a more prominent role in the field and in the literature, proposing architectural and methodological approaches to develop technologies and software for the “Bottom Billion” (Dörlinger & Gross, 2011). The initial trend of considering the technical aspects of ICTD secondary has led to a lack of technical documentation, metrics and tools to evaluate solutions. As a result, customisable, reusable and sustainable methodologies to address the problems of the “Bottom Billion” are rare, leading to a continuous re-implementation and repetition of very similar projects that die when their funding period is over (Aker, 2011).

The project management approach in ICTD is often unstructured and rarely documented (Golini & Landoni, 2012). However, the mere application of a standard process is not enough as these projects have to face multiple challenges simultaneously such as limited resources, harsh environment, large cultural gaps among stakeholders and significant sustainability needs that are not addressed by traditional project management and software development processes (Silvius & Schipper, 2011).

In this paper, we propose a Maturity Model to guide the improvement of the quality of ICTD interventions at the organisational level. This work is inspired by the Capability Maturity Model Integration (CMMi Product Team, 2006) and aims at providing a set of standards that organizations can use to define processes that address ICTD challenges. This work is based on a wide-range literature analysis to identify successful practices and reasons for failure, which has been combined with structured and unstructured interviews with ICTD project managers and practitioners.

The Maturity Model takes into account not only the software development and project management aspects of ICTD but it considers all the dimensions of development: the definition of a strategy, the implementation of the intervention, sustainability and impact evaluation. Sustainability is a critical aspect of development interventions and it has been further broken down into three dimensions: social, technical and economic. This is due to the disruptive effect of ICTs in rural communities and the fact that ICTD projects are mostly not for profit.

This is not the first time that the idea of certifying organizations appears in International Development. For example, PM4Dev and have been offering training and certification programs for years to NGOs involved in International Development (Golini & Landoni, 2012). However, our approach is innovative by presenting a complete set of guidelines for all the aspects of ICTD projects in an effort to standardise the practices adopted by organizations while also providing the basis for a tool to evaluate projects. The main benefits of this work are twofold:

- Organizations involved in ICTD projects will be able to tailor a set of standard practices to their needs, increase their probability of success and of delivering a positive impact to marginalized communities.
- These guidelines will provide a new and standardised way to evaluate projects and organizations, which could be used by researchers and practitioners but also by donor agencies to better direct funding.

This paper is organized as follows. Section 2 provides an overview of the state of the art and a brief commentary of related work; Section 3 motivates the need for a maturity model in ICTD; Section 4 gives an outline of the Maturity Model and Section 5 presents our conclusions and the way forward.
State of the Art

International Development (ID) projects have been carried out for far longer than ICTD projects and the latter can be considered as a subset of the former. However, most of the common shortcomings in terms of project management can be noticed in both domains. Golini & Landoni (2012) reported a limited attention to the discipline in the literature and limited diffusion of PM techniques in NGOs. According to the same authors, there is an inherent difficulty in applying PM techniques as-is in “non-Western” cultures, which applies to receivers as well as donor countries. Additionally, the intangibility of the project outputs makes them difficult to measure and can lead to scope creep and unexpected costs. This is confirmed by ICTD literature, in which the ineffectiveness of “Western” methods and the need to adapt them to the African context (or that of other developing regions) is frequently reiterated (see, for example Blake, 2010).

Methods and tools for managing ID projects have been available at least since the 1970s (Cracknell, 2000). However, these methodologies often present various limitations. More importantly, they are often used because they are imposed top-down by the project sponsor and not as a tool to improve project results.

Private guidelines by PM4Dev and PM4NGOs tried to address the shortcomings of the methodologies mentioned above by proposing adaptations of the Project Management Body of Knowledge (PMBOK). Both organizations provide training material and certification for NGOs and individuals with respect to the application of PM techniques in ID projects.

Extensive research has been conducted by Pade-Khene (2007) with respect to the management of ICTD projects. We mention, in particular, the identification of Critical Success Factors (CSFs) for sustainability and project evaluation (Pade-Khene, Mallinson and Sewry, 2009), an iterative process and methodology to manage rural development processes, a process for conducting baseline studies in rural communities (Pade-Khene, Palmer and Kavhai, 2010) and a framework to set up an evaluation process throughout the duration of a project (Pade-Khene and Sewry, 2012). Surprisingly, while best practices and success stories are abundant in literature, only few accounts are detailed enough to inform future projects.

Sustainability is often overlooked in project management (Gareis, Huemann, & Martinuzzi, 2010). Silvius and Van den Brink (2011) addressed the integration of sustainable development with project management practices by noting the incompatibilities between such practices and the characteristics of sustainable development. For example, while project management is short-term oriented, sustainable development requires long-term orientation as well as interest in the life-cycle of products after their delivery. Silvius and Schipper (2010) proposed a maturity model for the integration of sustainability in projects and project management that integrates economical, environmental and social aspects in the management and delivery of projects by looking not only at the project life-cycle but also at the product’s life-cycle and decommissioning.

Software engineering and software development processes do not seem to find a place in ICTD literature, with the exception of a few documented cases. Only a few examples of clearly defined methodologies and architectures that somehow relate to software engineering can be found.

The use of Scrum has been reported by Van Greunen, De Louw, Dörlinger, Friedland, & Christian (2009) in a rural Living Lab project in South Africa led by SAP. In addition to Scrum, the Living Lab methodology has been used to conduct participatory activities such as requirements elicitation, testing and experimentation. The Scrum framework helped giving all developers a clear picture of the whole project, by mapping the functional design obtained through interaction with the target community onto the product backlog. The authors also reported that Scrum allowed them to identify possible project obstacles earlier.

Dörlinger & Dearden (2013) reported of a more recent iteration of the same set of methodologies that led to the definition of a standard software development process called DRAMATICS. The process provides a reusable user-centered and participatory approach that has been refined, reused and evaluated over six years by SAP.

Blake (2010) and Winschiers-Theophilus, Chivuno-Kuria, Kapuire, Bidwell, & Blake (2010) proposed a mix of action research, participatory design and user-centric development and design called “Socially Aware Software Engineering”. This application development methodology is intended for community-oriented development (and, by similarity, for Open Source Software) and is a customisation of the Action Research process. Action research cycles are used to interact with the target community and to guide the design of the solution, which is performed by applying Human Computer Interaction (HCI) methods and participatory design. Furthermore, Blake advocates the involvement of “local champions” in the short term in order to bridge the gap between developers and the target community, while in the long term he proposes a revision of academic curricula in developing countries that emphasises Software Engineering. This process allows for a tight interaction with the beneficiaries of the software solution but it requires a significant amount of time to be carried out as it includes training activities aimed at giving community members the right tools to interact with the developers. Moreover, Socially Aware Software Engineering does not define generic indicators and metrics for measuring the success of a project, which need to be defined on a per-project basis.

A different approach by Veldsman & van Greunen (2013) takes a Change Management perspective. The authors report of two interventions conducted by Nelson Mandela Metropolitan University in South Africa in the rural area of Rietfontein and in the township of Motherwell in which Change Management theory and participatory techniques have been used to introduce access to new services. The process described has the beneficiaries at its center and the establishment of a trust relationship as first step. The process emphasises the following phases: examining the landscape, determining the needs of the community, community readiness, community participation, technology adoption and managing resistance. The process advocates participatory design to address resistance and the cultural challenges of ICTD projects. This approach is coherent with the recommendations commonly found in literature and, while it present a seemingly “Western” methodology – Change Management, it presents successful case studies of its adaptation in two rural contexts.

We can observe various commonalities in the aforementioned processes. Firstly, none of them is highly structured or strictly formalised. Secondly, all processes are participatory at different degrees, including the end-users and the beneficiaries at least in the design phase. Finally, all these processes are incremental and based on prototypes to some degree. This is in line with the recommendations found in ICTD literature and with the
constraints and obstacles that can be found in ICTD projects.

A concept that is not very often cited in literature but that underlies most of the recent works in ICTD is “Agility”, which has dramatically grown in popularity in software development. Agile methodologies are characterised by a stronger focus on individuals and interactions, working products, collaboration and response to change (Fowler & Highsmith, 2001). The works described above show how these concepts are becoming consolidated in ICT for Development as well, suggesting that Agile methodologies could be very effective in this particular domain.

Finally, another issue that emerges from the state of the art is the lack of a framework or methodology that encompasses all the aspects and the challenges of ICTD. It is clear that best practices are already out there but so far there has been no work to combine them and elaborate success metrics and indicators to determine how to set up a “good project”. This is due to the fact that projects are often considered unique due to the extremely different cultural and technological gaps found in different target areas.

The Need for a Maturity Model

According to Dodson, Sterling, & Bennett (2012), “despite being designed and implemented with the best intentions, most ICTD interventions fail.” The reasons for failure are complex and not always depend on the team implementing the intervention. However, the main causes relate to perspective (top-down vs. bottom-up) and focus (technology vs. community). Adopting the recommended bottom-up perspective with a balanced focus on technology and community is clearly difficult and it requires appropriate management choices.

It is often said that ICTD projects are in various ways different from other types of projects (Tongia & Subrahmanian, 2006) because of the number of simultaneous challenges that must be faced and for the ill-structured goals they usually have. van Stam, Johnson, Pejovic, Mudenda, Sinzala, & van Greunen (2013) argue that qualitative constraints are largely more prominent than quantitative engineering aspects and this has to be taken into consideration during research, planning and evaluation. In addition, the following characteristics of International Development projects apply also to ICTD projects (Youker, 2003):

• Large number of diverse stakeholders with different agendas and perspectives influenced by national and cultural values.
• Social and (mostly) no-profit nature.
• Intangible development results that are difficult to measure.
• Multiple challenges to be faced simultaneously such as infrastructure, education and literacy, cultural differences, language barriers, etc.

It must be pointed out that measuring development and impact is also challenging, although many theoretical frameworks have been devised (Heeks & Molla, 2009). The goals and requirements of the donors and the other stakeholders involved in an intervention are frequently misaligned with the complexity of actual development. For example, some actors focus only on the economic aspects of development while others focus more on technical aspects. Social impact is often explored but it is more difficult to quantify due to its nature. Impact is also something that can be observed only long after


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the end of the project, which often results in assessments being performed too early (Heeks & Molla, 2009).

Many best practices are available to address the common problems and reasons for failure of ICTD initiatives. However, they are not systematically applied and they have not been formalised like in other more mature domains. Project Management standards and modern approaches like Agile software development can help improving the effectiveness of ICTD projects through the definition of a set of standard practices that influence the maturity of an organization involved in ICTD projects.

**Maturity Model Outline**

A common problem of ICTD projects is the lack of replicable results. One of the goals of maturity models is to shift from an ad-hoc approach to project development to a replicable, and subsequently a defined, set of processes. Introducing a maturity model based on experience allows us to pave the way for this shift also in ICT for Development without re-inventing the wheel by devising new processes but rather by developing a taxonomy of existing practices and an ideal evolutionary logical path for organizations dealing with ICTD to institutionalize and consolidate ICTD-specific practices.

Following the example of the Capability Maturity Model (CMMI) (CMMi Product Team, 2006), we defined 3 maturity levels to provide a way for organizations involved in ICT for Development to improve the quality of the outputs and impact of their projects by systematically introducing best practices into its processes.

We chose the CMMI as template, together with the practices described in the PMBOK since they can already provide guidance to improve the development and managerial processes of an ICTD project. The reason for this choice is also due to the fact that the CMMI is a recognised standard and it represents the basis for most maturity models (Becker, J., Knackstedt, R., & Pöppelbüß, D. W. I. J. 2009). However, in general, maturity models are very specific to areas related e.g. to project management and to software development while ICT for Development projects have to be considered as multidisciplinary endeavours that involve different and almost orthogonal domains.

Differently from industrial or business projects that don't have *development* as one of their explicit goals, we are more interested in proposing a logical path for ICTD organizations to achieve repeatable results rather than optimised results. The field is probably in too early a stage for us to be able to foresee a future in which development can be “optimised” and the concept of optimising development itself could be the subject of a long debate that we leave to international development experts and sociologists.

The complexity and multidisciplinarity of ICTD requires us to take a step back and look at ICT-mediated development from a higher level, considering not only the activities needed to produce specific project deliverables but also the context in which the project is carried out, the strategic vision of its sponsors and the sustainability of the outputs of the project itself (i.e. what happens after the project has ended). Therefore, we have to look at different and interdependent maturity areas that must be assessed and addressed simultaneously.

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Research and Design Methodology

The design of the Maturity Model has been structured in the three main phases suggested by Becker et al. (2009):

1. **Understanding current state of the practice**: a thorough analysis of the available literature of the last decade has been conducted, focusing on articles that describe sets of projects or that describe whole ICTD initiatives. Scholarly papers describing projects in a process-oriented fashion or with a perspective closer to software engineering have been favoured as they tend to be more descriptive and precise. Also, we collected articles listing failure and success factors of ICTD projects. This has been integrated with semi-structured interviews with project managers of ICTD projects and direct experience in projects taking place in Sub- Saharan Africa (South Africa and Mozambique).

2. **Develop a vision of the desired process**: based on the information collected in the first phase we identified the ideal process to follow, mapping it to the PMBOK knowledge areas.

3. **Establish a list of required process improvement actions in order of priority**: based on the data collected in the first phase and the process vision elaborated in phase 2, we collected a set of high level goals that have been further decomposed into lower level goals that can be satisfied by the introduction of specific practices. These practices and goals have been categorised according to the four stages of the ICTD value chain proposed by Heeks & Molla (2009) and formulated following the structure of the Capability Maturity Model for Development (CMM-DEV).

![Figure 1. Conceptual Model for the ICTDMM.](image)

The design of our maturity model follows the conceptual model depicted in Figure 1. We consider the achievement of success in ICTD as the achievement of several Critical Success Factors (CSFs). The model is based on CSFs from literature and interviews which have been subsequently broken down into requirements and practices. This allowed us to identify four maturity that can be considered as additional process areas for the CMMI or that can be used independently. Our maturity model is therefore structured as a progression of three maturity levels and four maturity areas. Maturity is to be achieved along the two dimensions of the table by introducing the practices specific to all the four areas and by institutionalising such practices (i.e. achieving level 3).

Achieving maturity in the four areas is not an alternative to achieving maturity in CMMI (or other MM's) terms. The ICTD Maturity Model addresses the goals and practices that characterise "good" ICT for Development projects and it inevitably intersects with other domains due to the multidisciplinary nature of the area.

**Maturity Areas**

The four maturity areas correspond to four high level phases through which an ideal project should go.

1. **Strategy:** the purpose of this area is to indicate the goals to be achieved and the practices to be performed in order to develop a shared vision of the intended future among the initiators, the developers, the sponsors and the beneficiaries of the project. This area is more relevant at the organisational level as it refers to actions that must be taken by the initiators of the project and transmitted to the team(s) and to the beneficiaries.

2. **Implementation:** this area refers to the activities to be conducted during the development of the deliverables of a single project and is the most similar to what is found in existing maturity models. A project can be the only one in a development program or one of many projects that aim at achieving certain goals defined by the initiators of the program. This area is more relevant for the development team and the project manager as it addresses the issues related to the development and deployment of a technical solution. It is also relevant for the beneficiaries as its ultimate goal is to smoothly introduce an ICT-based solution in a community where the necessary competences may have to be developed together with the technical components of the project.

3. **Sustainability:** this maturity area is intended as a set of goals and practices that address sustainability from the strategic planning to the phase-out of the project. Attention to sustainability is in fact considered a necessary condition for the success of the project (although not a sufficient condition) (Heeks, 2005). This area is further divided into economic, social and technical sustainability categories, which must be addressed simultaneously.

4. **Evaluation and Impact:** this area includes the goals and practices needed to account for the implementation of an ICT-based solution, namely evaluate the performance of the project and its impact. Impact assessment is one of the most explored areas of ICTD, with many frameworks defined in recent years (Heeks & Molla, 2009). However, evaluation should be performed as an ongoing process rather than as a one-time activity (Pade-Khene & Sewry, 2012) and, therefore, this area describes goals and practices that apply to all the phases of the project, ultimately leading to impact assessment. The results of the practices described under this area are used by the organization to measure the effectiveness of its efforts (and the effectiveness of the investments), communicate the results of the project and collect lessons learned for future projects.

**Maturity Levels**

The three levels of our model have been adapted from the first three levels of the Project Management Maturity Model (Crawford, 2007) and are described below with respect to the four maturity areas presented above. The maturity model supports both a staged and continuous representation as an organization could be at different levels with respect to the different maturity areas. Below we summarise the progression of a performing organisation along the three levels and the four areas.

1. **Ad-Hoc:** at this level, processes are carried out ad-hoc and chaotically. No particular methodology is followed but there is awareness of their existence. At this stage usually the organization has insufficient International Development competences, which could lead to underestimating crucial aspects such as cultural and political issues.

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2. **Structured**: At this level, the organization introduces basic and documented processes for each area but organisational standards are not defined. This level has usually a project-centric focus and is achieved when:

   1.1. **basic and documented processes** are in place to define a strategy with respect to the organization's values and motivations, the agenda of the project's initiator or sponsor and the current baseline conditions of the target community.

   1.2. the organization has switched from an informal development methodology to a **formal and documented methodology**. This does not have to be a heavily constrained methodology that produces thousands of pages of documentation but it needs to be structured enough to respond to the ever changing environment of ICTD projects.

   1.3. the organization includes **sustainability considerations** since strategic planning throughout the duration of the project and in planning the development process itself.

   1.4. the organization uses a **structured process and appropriate frameworks to assess the impact of a project** that takes into consideration the goals of all the project stakeholders at a basic level and it uses general indicators biased towards the goals of the organization.

3. **Defined**: at this level, all processes have been institutionalised and standardised. The focus at this stage is the organization, which is able to instantiate large ICT for Development initiatives that orchestrate several sub-projects by selecting the appropriate processes and tools based on a clearly defined strategy. More in detail, this level is achieved when:

   1.1. the organization has **institutionalised** the processes through which it defines a **strategy and a sustainability plan** for the implementation of a set of temporary endeavours (projects), given a set development goal, the values and motivations of the organization and the needs of the intended beneficiaries. The institutionalisation of the Strategy area includes a **documented structured approach** to identify the community of beneficiaries, create a relationship and collect relevant data about the needs and the potential for an ICTD intervention. The application of assessment frameworks and baseline studies is institutionalised and documented in order to take advantage of lessons learned from previous projects and to collect comparable data.

   1.2. the **development process** for the implementation of the technical solution is **standardised** and for the organization of the necessary support activities (such as training). These standards are used to tailor the implementation process according to the plan and the development context. A process is also defined to identify key people that can play the role of champions or intermediaries for the introduction of the solution.

   1.3. the organization has defined and adopted **processes to identify sustainability objectives** and to draft sustainability plans together with the project charter. At this stage, sustainability management is integrated with the planning and execution phases of the project and sustainability activities are planned following standard guidelines that are appropriately adapted to the deployment context.

   1.4. the organization uses standardised practices based on **consolidated frameworks to perform impact assessment** and it is able to compare the results of multiple projects and inform the strategic planning of subsequent initiatives. An internally standardised process must also be defined to systematically identify the indicators for the impact assessment of a specific program or project so that the goals of all the project's stakeholders are taken into consideration. Assessment activities are planned according to an organisational standard that provides guidance on how to schedule relevant milestones for impact assessment. This avoids the problem of conducting assessment too early, too late or too irregularly.
Conclusion

Despite the experience of many decades of international aid with and without ICTs, millions of dollars are still invested by international donors in initiatives that fail to have a positive development impact on marginalized communities. The reasons for failure are many and are often due to the multiple challenges that must be faced simultaneously and which include (but are definitely not limited to) geographical, infrastructural, cultural and political constraints.

Recommendations and best practices have been suggested in experience reports and publications by ICTD researchers and practitioners. However, the systematic replicability of these practices has never been addressed. While each project has its own peculiarities and constraints, our work attempted to generalise a set of goals and practices that fit to all ICTD projects.

In this paper, we provided the outline of a Maturity Model for organizations involved in ICT for Development interventions. The complete Maturity Model presents 33 goals and 57 specific practices derived from the experience of researchers and practitioners collected through an extensive literature review and interviews (Ciaghi 2014).

To our knowledge, this is the first attempt at providing such standardisation for ICTD projects. This is probably due to the fact that so-called “Western” approaches are usually frowned upon by the ICTD community as they are considered to be inappropriate, unable to react to the uncertainty and unpredictability of developing countries, and mainly because they have failed in the past. The Maturity Model has been designed with this fact in mind but without the aversion to standard technical processes and methodologies commonly found in ICTD literature. This work attempts to balance technical concepts with those of other disciplines although it adapts an approach coming from technical project management. More importantly, it provides a complete view of the actions that should be taken during the whole ICTD value chain.

The intended use of our Maturity Model is the definition of organisational standards that can be tailored to different environments, not much differently from what organizations developing “traditional” ICT projects do. This allows organizations to assess their ICTD maturity and introduce the practices they need according to their objectives.

The Maturity Model can also be used as a basis for the evaluation of projects and organizations, with the potential to become a tool to certify organizations with respect to their capability to carry out a successful project. However, these have been mostly focused on the traditional Project Management skills and frameworks that, while being essential to successfully managing ICTD projects, do not directly address the challenges specific of this domain. Another possible application scenario is thus the benchmarking and assessment of organizations seeking funding from development agencies, large donors and investors. This requires the definition of a standard assessment procedure to certify the maturity and capability of organizations, which could become a useful tool to better select the recipients of funds.

Future work to be carried out to make these use cases possible includes the definition of a standardised assessment process to classify organizations in the framework of the four
areas and three levels. Additionally, a large scale experimentation of the application of the model will provide validation for the model itself and further refinement of its specification.

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