Towards the development of sustainable ICT projects in Africa – A Review and Synthesis of Evaluation Frameworks

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Abstract

Information and Communication Technology (ICT) adoption and use is said to have an immense impact on socio-economic development across Africa. Though successes have been identified, there is a body of literature that points to failed ICT for Development (ICTD) projects in Africa. One reason associated with such failure is the apparent lack of evaluation frameworks present during the design, planning and implementation phases of many of these projects. In this paper it is argued that sustainability of ICTD projects is intrinsically linked to evaluation and assessments of the technology and its intended impact. A literature review of concepts and theories employed for ICT evaluations in a variety of sectors is presented and discussed. It is shown that evaluation frameworks have been adapted from an original quantitative assessment to an increasingly qualitative assessment. The complexity of evaluation frameworks has increased with a changing understanding of development and impact. The authors argue that evaluations should assess impact of ICT interventions by evaluating tangible and intangible aspects using a pre-and post assessment approach. The notion of evaluation must be driven by a development agenda.

Keywords: Evaluation, Assessment, Frameworks, ICT

1. Introduction

ICT has been touted as one of the most important tools to put Africa on the path to rapid growth and development. Several authors make a case for ICTs use or espouse the transformational abilities ICTs offer. Case studies highlight the successes of implementations in multiple environments (Dodson, Sterling, & Bennett, 2012; Milek, Stork, & Gillwald, 2011; Olise & State, 2010). There has been a rise in ICTD projects from telecentres to e-health and mobile applications in the agriculture, health, education, finance, government and other sectors (FAO, 2013; Ndung'u, 2007; Shekar & Kate Otto, 2012).

Governments, non-profit organizations and cooperates have made substantial investments on ICT interventions (Heeks & Molla, 2009). The World Bank group provided $4.2 billion for projects in the ICT sector from 2003 to 2010. During the same period, 74% of the World Bank projects involved ICT components (IEG, 2011). Access to ICTs in Africa is increasing and is correlated to the increase of mobile phone usage (GSMA Intelligence, 2013). Latest statistics from ITU (2014) show that mobile-broadband penetration in Africa reached about 20% in 2014 compared to the 2 percent in 2010.

There is however evidence of the ICT project investments not having necessarily met the expected outcome (Dodson et al., 2012). Literature puts the failure rate of ICT projects between 50 to 80 % (Heeks, 2002; Nauman, Aziz, & Ishaq, 2005). One of the aspects highlighted is the under-developed monitoring and evaluation of ICT interventions.

The next section will discuss the concept of failure and success in ICT projects. Section 3 then presents literature of ICT evaluations in the developing country (DC) context. Section 4 discusses the findings and concludes with a synthesis on the evaluation frameworks.

2. The Concept of Failure and Success

The definition of failure and success in the ICTD space is an on-going debate. Naumann highlighted in 2005 the

need to study and understand failures and successes of ICT projects. He argued that this was particularly important for developing countries where resources are scare and investment costs relatively high (Nauman et al., 2005)

Lyytinen & Hirschheim (1987) classify failure into four major categories: correspondence failure, process failure, interaction failure and expectation failure. The authors link these four failure categories to different engagements with the ICT. Correspondence failure occurs when the design objectives of a system are not met. Expectation failure simply refers to stakeholders' not having the original expectations fulfilled after the system implementation. Process failure occurs when the implementation of the ICT fails due to misaligned budget, design and implementation costs. Interaction failure is broadly described as the failure that occurs when there is low end-user engagement and no or very limited performance improvement.

Heeks & Molla (2009) observed in an assessment of ICT projects that the changing focus towards development resulted in a shift towards assessing impact. Projects were classified into five categories: total failure, largely unsuccessful, partial success or partial failure, largely successful and total success. Total failure is when an initiative was never implemented or was abandoned immediately on implementation, or was implemented but achieved none of its goals. Heeks does not elaborate on the reasons or factors that account for the non-implementation or abandoning of initiatives. Largely unsuccessful projects or initiatives were defined as attaining some goals, however most stakeholder groups did not see their major goals fulfilled and the overall outcome was significantly undesirable. Partial success or partial failure was describing a project where some major goals for the initiative were attained but some were not and there were some significant undesirable outcomes. In largely successful initiative most stakeholder groups attained their goals and did not experience significant undesirable outcomes. Total success is achieved when all stakeholder groups attained their major goals and did not experience significant undesirable outcomes.

As cited by Goldfinch (2007), Wilson & Howcroft (2002) summarize failure of projects into three categories – project, system and user failures. In project failure, agreed standards such as functions provided, budgetary constraints, or completion deadlines, are not achieved. System failure refers to a system not performing to expectation, not being operational at the specified time or not being used for the intended purpose. User failure occurs when a system is not used due to user resistance, lack of skill or usability factors.

Authors cited above highlight the complexity of defining failure and success. The varying categories and classifications are often presented as the best attempt to assess success and impact. Literature elaborating on the causes for failure discuss in the developing country context particularly aspects such as the so-called "donor syndrome" (UNIDO, 2008) and the lack or slow pace of ICT policy development (Isabalija, Mayoka, Rwashana, & Mbarika, 2011; May, Karugia, & Ndokweni, 2007).

3. Pre- and Post Implementation Evaluations

Throughout literature, evaluations of ICT implementation are broadly observed at two different stages of an ICT project: pre- and post-implementation evaluation (Al-yaseen, Al-jaghoub, Al-shorbaji, & Salim, 2010; Carcary, 2009; Pather, Remenyi, & Harpe, 2006).

Pre-evaluation are a forecasting tool for stakeholders and organisations to maximise scarce resources prior to an implementation (Al-yaseen et al., 2010; Odhiambo-Otieno, 2005). Al-Yaseen et al. (2010, p. 9) state that ICT " project managers require accurate and reliable evaluation to allocate and control project resources". Financial, technical, spatial and human resources have to be managed during a project implementation. ICT implementation in the developing world are additionally often impacted by unforeseen challenges, such as political, organisational and structural environments (Shrafat, Al-Zawahreh, Al-madi, & Zeglat, 2013).

As Berghout et al. (2005, p. 33) posits, pre-evaluation is a "traditional formal-rational ideal view" where the assumption is made that outcomes of an ICT investment can be determined by the evaluators and managers. It then follows that an objective decision regarding the commencement of an ICT project can be made.

Evidence from literature suggests that this type of evaluation is often dominated by financial, technical and immediate organizational aligned benefits like readiness, efficiency, effectiveness and competitive advantage (A. Alghamdi, Goodwin, & Rampersad, 2011; Walter & Spitta, 2004).

Post-implementation evaluation is performed when the implemented ICT system becomes fully operational and the organisation or stakeholders are interested in knowing whether the intended benefits of the system have been realized and resources have been utilized (Al-yaseen et al., 2010; Irani & Love, 2008; Odhiambo-Otieno, 2005; Remenyi & Sherwood-Smith, 1999). Aspects that this type of evaluation is usually assessing are financial benefits, functional benefits, tangible and intangible system benefits, intended and unintended benefits (Al-yaseen et al., 2010; Carcary, Long, & Remenyi, 2007; Heeks, 2011; Love & Irani, 2001).

4. Perspectives of evaluations in the developing country context
Of the evaluation types, varying theoretical perspectives and methods are adhered to. (Berghout & Remenyi, 2005; Hedman & Borell, 2005; Lagsten, 2011).

If success and failure of ICTs are indeed linked to impact, evaluations of ICT implementation have to measure such impact. The definition of impact is equally complex as the definition of failure and success. A number of authors highlight that evaluations of impact have to assess qualitative and quantitative factors, which speak to value-adding aspects such as social and economic development as well as technical and financial factors. (Brown, 2005; Gichoya, 2005; Hallikainen & Chen, 2012; Shrafat et al., 2013; Smithson & Hirschheim, 1998; Walter & Spitta, 2004).

ICTD is in its nascent phase and according to Khene (2010, p. 74) "…still a 'working hypothesis', including the research associated with it". Nonetheless, the ICT evaluation have evolved from using simple approaches based on cost, project goals or objectives and outcomes to more complex evaluations that combine social, economic, environmental, political and other indicators (Heeks & Molla, 2009; C . Pade-Khene, 2012).

Shadrach & Summers (2002) characterized two main approaches to evaluating impact of ICTs – conventional and participatory approaches. Conventional approaches focus on whether stated project objectives were met and contributed to established goals. Examples for these type of assessments were donor-focused. The authors stated that, the evaluation is carried out to "fulfil a management and accountability requirement [rather] than to respond to the project needs". Participatory evaluations primarily takes into account the information needs of the stakeholders. It is suggested that the scope of participants should include all stakeholders, beneficiaries as well as non-beneficiaries and key to this is that participant's views should be taken into account. The authors suggests that although participatory approach is more favoured than the conventional approach, the Sustainable Livelihood (SL) framework should guide the methodology in combination with human rights approaches that auger for participation, inclusion and obligation fulfilment.

Heeks & Molla (2009) presented an overview of existing impact assessment frameworks in Figure 2. This is one of the most elaborate documents prepared on ICT evaluation. The overview classifies impact assessment frameworks into six categories namely generic, discipline-specific, issue-specific, application-specific, method-specific and sector specific. The study further explores the focus of four of the six categories that are identified in literature.

Generic frameworks are used in the assessment of development projects in the domain of which the literature identified two main focus areas in their analysis – Cost-Benefit Analysis (CBA) and project goals. Discipline-
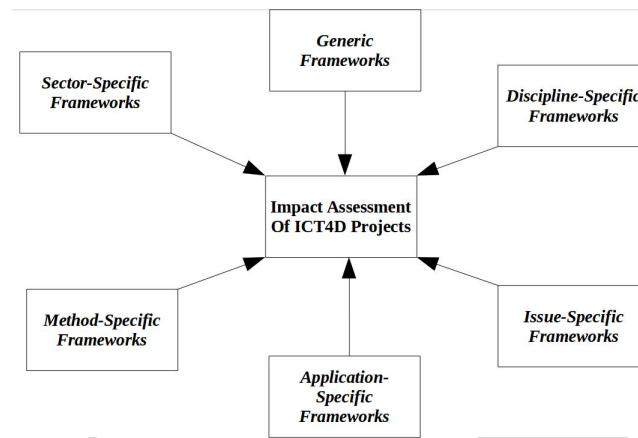

Figure 1: ICT4D Project Impact Assessment Frameworks Overview (Heeks & Molla, 2009)

specific assessment relies on a particular academic discipline with the key focus areas being communication-for-development, capabilities, livelihoods, information economics, information needs and cultural-institutional. Issue-specific frameworks focused on a particular development goal with two main focus areas – enterprise (growth) and gender. Application-specific assessment focused on a particular ICT4D technology of which the main focus identified in literature were telecentres. Method-specific assessments used a particular approach to data gathering and the finally sector-specific assessments centre on an individual development sector. Heeks & Molla explain in that context that ICT project move through stages, which are referred to as the ICT value chain. The stages are described as readiness, availability, uptake and impact. Each of these stages measure different aspects depending on the focus at each stage.

Gigler (2011) applied Sen's capability approach (Sen, 1999) to develop an alternative evaluation framework for ICTs. This type of evaluation placed human well-being at its centre rather than technologies. Better access to information and enhanced informational capabilities are correlated to choice making capabilities in different spheres – economic, social and political. The author presents his evaluation framework as an impact chain as shown in Figure 2.

CONTEXT	LIVELIHOOD RESOURCES	INSTITUTIONAL PROCESSES	CAPABILITIES	LIVELIHOOD OUTCOMES
Socio-Economic Conditions Informational	Economic/financial capital	Existing social structures	Individual - Psychological	
Demographics strengthened	<=> Natural capital <=>		<=> - Social => Capabilities - Economic	
Cultural Context	Human capital	Level and degree of	- Informational - Political Human <=> - Cultural =>	
Political Context	Social capital	ICT intermediation	Capabilities strengthened Collective - Social	
ICT diffusion	Informational capital		- Economic => Social - Political	
Capabilities ICT policy strengthened Framework			- Organizational	
			- Cultural - Informational	

Stages of ICT project

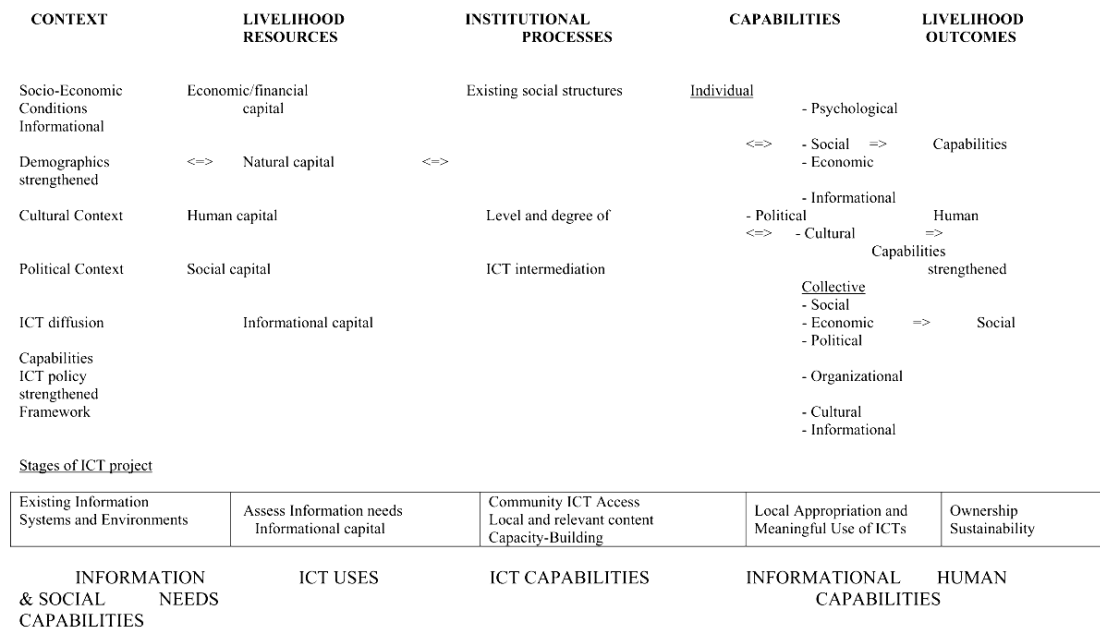| Existing Information Systems and Environments	Assess Information needs Informational capital	Community ICT Access Local and relevant content Capacity-Building	Local Appropriation and Meaningful Use of ICTs	Ownership Sustainability
INFORMATION & SOCIAL NEEDS CAPABILITIES	ICT USES	ICT CAPABILITIES	INFORMATIONAL CAPABILITIES	HUMAN

Figure 2: Empowerment through ICTs framework (Gigler, 2011, p. 12)

Principal factors and processes are linked to describe how human well-being can be enhanced across multiple dimensions through ICT. The stages illustrate that intermediation is an essential factor in achieving the level of enhanced capabilities, which is equal to highest impact of the ICT.

Gomez and Pather (2012) draw parallels with ICT in business and highlight that ICT for development should still focus on tangible measures. Whilst economic, social and political impact are important there is an associated difficulty as these type of benefits point to a deeper and more pervasive effect on individuals and communities, which is often difficult to measure. It also highlights the requirement for long-term assessments of intangible impact.

In another assessment, Osah et al. (2014) elaborated on an assessment framework for rural ICT4D projects they termed Rural ICT4D Project Process Assessment Framework (RICTP-PAF). The authors present a systematic approach to identifying critical themes for process assessment of ICT4D projects, which result in the suggested framework. Their study concludes that process assessment of rural ICT project is critical for the accomplishment of development goals.

5. Discussion and Conclusion

ICT evaluations and assessments are closely linked to the concept of failure and success. The review showed that the notion of success was redefined to include impact when ICTs became a key driver for development. A number of theories, concepts and frameworks of ICT evaluations have since been created.

Evaluation frameworks have been re-evaluated continuously as the overall knowledge and understanding of the notion of development changed. Originally evaluation frameworks were adapted from the business and cooperate sector in order to respond to analysing the cost-benefit. This was partially driven by the need of donors to assess how funding translated into benefits based on project goals. Shadrach et al. (2002) argue for

participatory frameworks with an SL guiding framework with input from a human rights approach. The elaborate frameworks presented by Heeks & Molla (2009) start highlighting complexities of assessing ICT implementation which turn the design of evaluation frameworks into a science that is often beyond the ICT project frames set by donor agencies or governments.

Gigler (2011) attempt to combine ICT implementation to the assessment of increasing capabilities takes into account the notion of tangible and intangible aspects, but there is a certain assumption that ICT projects have a lifespan long enough to show such impacts. That said, the framework is complex and the measurement of aspects such as individual empowerment are inherently contentious. Gomez and Pather (2012) respond with a framework that returns to the tangibles in order to make the measurement itself easier.

When reviewing examples of ICT projects, the need for evaluating potential impact prior to the implementation is often highlighted as a key factor to sustainability. Pade-Khene (2012) conducted for example a needs assessment in a project determining the potential of ICT4D for two rural schools in South Africa. According to the study, " the needs identified were based on an understanding of the existing operation of local schools, from perspectives of local representatives who are more familiar with their environment and its challenges." The author suggests that the solutions required to address the needs should develop solutions that cover aspects such as sociology, government, education and the like and not only the ICT. Similarly, in a project developing an evaluation for district health management information systems in Kenya, Odiambo-Otieno (2005) confirmed this when respondents – stakeholders, users and designers – identified policy and objectives, technical feasibility, financial viability, political viability and administrative operability as key criteria for pre-implementation.

It can be inferred that context is critical in driving the content of the evaluation. This is evident from the frameworks presented by Pade-Khene (2012), Heeks & Molla (2009), Gigler (2011) and others. Social aspects should be central to evaluations since the ICT interventions aim at progressing the development agenda. According to Shrafat et al. (2013, p. 120), "the contextual dimensions direct attention to the forces within the environment which has an effect on the evaluation process". Evaluations in the development context must go beyond mere technical and economic impact, i.e. ICT interventions are mediation tools to improve social and economic change.

In looking at the context in which the ICT intervention is placed, it is important to consider both inherent and associated factors, such as physical, economic and social dimensions. The data that evaluators collect for this purpose should come from multiple sources in order to ensure validity and reliability. Often collecting such data is highly complex and costly, however, since ICT interventions are complex, care must be taken to understand how the intervention interacts with its environment.

The stage of the evaluation is important as can be seen from the ICT for development value chain presented by Heeks & Molla (2009). It defines how the evaluation should be conducted: type of evaluation to be performed, suitable framework and methods, relevant data to collect and a host of other parameters. As observed from literature, evaluations at the pre-implementation stage is critical in that it provides evaluators and stakeholders the ability to forecast and assess aspects such as technical feasibility, financial viability, and others such as the needs, capabilities and potential impact of the beneficiaries of the ICT intervention (; Odhiambo-Otieno, 2005; C . Pade-Khene, 2012). At the post-implementation stage, the evaluations measure the impact of an ICT project. The impact could be financial and non-financial – social, political and it could be goal-oriented, tangible or intangible, capabilities and others (Al-yaseen et al., 2010; Gigler, 2011). These have a direct bearing on the sustainability of ICT projects and must be seen a continual process.

Literature shows that frameworks for evaluation must incorporate ICT policy guidelines and goals. This will allow evaluators to measure interventions against implementing guidelines and furthering the goals (Osah et al., 2014). This is essential in achievement of a number of things:
- The ICT intervention helps shape the sector-specific policies
- Producing better ICT interventions since there will be an intertwined relationship existing between the

ICT intervention, organizational structures and the set policies

The interdisciplinary nature of the ICT sector means elaborate contextual frameworks are favoured, which are not always coherent (Goldkuhl & Lagsten, 2012). ICT evaluation in the development context have not generated enough knowledge – perspectives and theories – that addresses the evaluation challenges. ICT research should strive to develop rigorous theories that are practical, easily quantified and qualified and operationalised.

If the intention of evaluation frameworks is to assess impact, it is paramount to understand the pre-implementation situation. The solution for developing a subsequent impact evaluation may then lie in a "pre- and post evaluation framework". This would also address the fact that evaluation frameworks are currently designed for either pre-implementation or post-implementation, but rarely combine the two aspects into one framework. Gigler (2011) addresses that to a point by evaluating existing information ecologies, but does not take into account aspects such as existing human and social capabilities. Evaluation frameworks are however only as good as the data that can be collected to assess environments, context and impact. Such data collection processes are often very costly and time-consuming, which results in evaluations having a lower priority in project implementation than the development of the ICT. Until the development agenda drives the notion of pre-and post evaluation more forcefully, evaluation and impact assessments will be a half-hearted attempt of high complexity of justifying ICT implementations.

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