A Framework to Explain the Relation Between ICT and Development: Combining Affordances and the Capability Approach

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Mathias Hatakka[1], Øystein Sæbø[2] and Devinder Thapa[2]

[1] Örebro University, SE-701 82 Örebro, Sweden
[2] University of Agder, Gimlemoen 4604 Kristiansand, Norway
mathias.hatakka@oru.se, {oystein.sabo, devinder.thapa}@uia.no

Abstract. In this paper, we suggest a framework to better explain the relation between ICT and development. The framework combines two theories: The Capability Approach and Affordances. The capability approach defines development as freedom of choice; and the affordances explains the relational aspects of people and technology. These two theories complement each other by connecting the means (technology) to the ends (development). A case study of ICT and study-circle education in rural areas of Kenya is used to illustrate the framework. Using the framework, the study revealed how actualization of affordances of internet-cafe enhanced income capabilities of marginalized people; however, at the same time, shows perception and actualization of affordances were contingent on the availability of resources, skills, socio-cultural norms, and infrastructure.

Keywords: Affordances, Capability Approach, ICT4D, Education, Kenya

1 Introduction

Information and communication technology (ICT) is becoming more and more ubiquitous (Walsham, 2012), being part of a developmental process that is moving the world forward toward a place "with universal literacy. A world with equitable and universal access to quality education at all levels, to health care and social protection, where physical, mental, and social well-being are assured" (United Nations General Assembly, 2015, p. 3/35). Although the field has made noticeable progress in understanding the role of ICT, a key challenge remains in understanding the process by which development "happens" as a result of ICT implementation.

To understand how ICT can contribute to a better world, we need to understand what development is. In recent ICT4D literature, the concept of development is often understood in terms of human development (Andersson & Hatakka, 2013), related to freedoms and individuals' capabilities to choose to live a life that they have a reason to value, known as the capability approach (CA) (Sen, 1999). The core focus of CA is the expansion and assessment of individuals' well-being and how individuals' agency and social arrangements can improve their quality of life. CA, however, does not explain how ICT can make capabilities possible.

One potential theoretical lens to complement this lacuna is affordances. In the information systems context (closest discipline to ICT4D), affordances are defined as "the possibilities for goal-oriented action afforded to specified user groups by technical objects" (Markus & Silver, 2008, p. 622), and suggests that people are more concerned with the action possibilities enabled by the technology than they are with the properties of the technology itself (Majchrzak & Markus, 2012). Following this argument, we propose that integrating the affordances (e.g., Leonardi, 2011; Marcus & Silver, 2008) into CA can provide better explanations as to why and how people interact with ICT, and enhance individuals capabilities. The framework is illustrated using a case study of ICT use in study-circle education on the Kenyan South Coast. The purpose of introducing ICT in the study-circle groups was to give them access to digital learning content, increase members' ICT literacy, and support their study-circle activities and projects. The framework captured the complex process of ICT intervention and development, furthermore identified challenges that can hinder the process.

Rest of the paper is organized as follows. Section two elaborates more on CA and affordances, thereafter, we present the proposed framework that combines the two theories. Followed by research design, and case analysis. Finally, we concludes the paper with discussion on implication for research and practice.

2 Theoretical Background

2.1 Capability Approach

CA defines poverty as the deprivation of individuals' capability to live the kind of life that they have a reason to value (Sen, 1999; Zheng 2009). Individuals are not seen as passive recipients of development, but as an active agent of change. CA further argues that individuals who are provided with opportunities have the power to shape their own lives and help others shape theirs (Sen, 1999). Two main concepts in CA are capabilities and functionings. Capabilities are a person's freedom to achieve and represents the various combinations of functionings that the person can choose from. Functionings are a person's doings and beings, e.g., his or her participation in political discourse or education. Functionings represent a person´s realized achievements and include various aspects of how individuals live their lives (Gasper, 2002; Hatakka and Dé, 2011). The conversion of a means such as ICT into capability is determined by three types of conversion factors (Robeyns, 2005): personal (such as age, literacy, and health), social (which include norms, policies, rules, regulations, and cultural issues), and environmental (such as geographic location and climate, as well as infrastructure). These factors influence the realization of potential functioning, and the ability of people to act on that potential functioning.

In ICT4D, CA has frequently been used to explore the link between ICT and development (see e.g., Hatakka & Dé, 2011; Zheng & Walsham, 2008; Madon, 2004). However, to improve the applicability of CA for ICT4D research, we need to address the following issues. First, ICT in CA (within ICT4D research) is often seen as a neutral commodity (Zheng & Stahl, 2011). Implementing ICT does not automatically lead to increased capabilities. We need to be able to explain under what circumstances

the action possibilities of ICT lead to individual improvements. Second, to explain individual and contextual factors that affect the development process, we need to include an individual's characteristics, preconditions, and the context in which he or she interacts.

An individual's context consists of his or her resource portfolio (which constitutes her agency) and the social structure (Kleine, 2013). The social structure includes e.g., formal and informal laws and social arrangements for policies and programs. Likewise, agency, defined as "agency-based capability inputs", refers to an individual's resource portfolio (which includes assets such as material, financial, and cultural resources), which also includes an individual's personal characteristics, such as gender and age. Agency, together with "structure-based capability inputs" (seen as the structures that aid or constrain an individual's agency), determines how resources can be converted into capacities (Kleine, 2013).

2.2 Affordances

We derive the definition of affordances from IS perspective. In IS, affordance is defined as the potential for behaviours associated with achieving an immediate concrete outcome, arising from the relationship between the properties of an object and characteristics of a goal-oriented actors (Volkoff and Strong, 2013). From this perspective, affordances are an ever-present potential for action, while the details of their actualization in a specific instance are contingent on aspects of the techno-organizational context. Thus, the outcome is indeterminate (Volkoff & Strong, 2013). Affordances need to be perceived by an actor before being actualized (Bernhard, Recker, & Burton-Jones, 2013; Strong et al., 2014; Volkoff & Strong, 2013), however, perceiving an affordance does not necessarily mean that the actor realizes the offered action possibilities (Stoffregen, 2003). The perception and actualization of the affordances depend on the relationship between the system and the actors, in the context in which IS are used (Bernhard et al., 2013; Leonardi, 2011).

Our analysis shows that all affordances are not necessarily perceived or actualized. Sometimes people may not understand the complexity of the technical functionalities, or they may lack proper information or some intermediaries who can explore the action possibilities of the technology, which can result in the affordances being hidden from the individuals, or they may perceive them falsely. In some situations, the affordances are actualised without the outcome being achieved. In such conditions, goal-oriented actors would try to actualize the affordances they perceived, but the outcome would differ from the actors' expected goals. It is also possible that in the absence of appropriate information, the affordances may remain hidden or latent (Gaver, 1991).

3 Proposed Framework

In this section we provide the rationale for integrating CA and Affordances, thereafter we present the integrated framework.

CA originates from the field of development economics. Focusing on the agency and well-being of individuals as the end of development, it is concerned with social

arrangements that can enable individuals to live the kind of lives that they can value. In ICT4D, CA is most often applied following a step-wise process, in which ICT is seen as a commodity that leads to new opportunities for individuals (Hatakka & De', 2011; Zheng & Walsham, 2008). However, ICT in itself is often "black-boxed" and seen as something neutral that can lead to positive outcomes (Zheng & Stahl, 2011). Since CA does not include ICT explicitly, we argue that another conduit for understanding ICT´s role in development would be beneficial. The affordance theory could be such a conduit. Affordance theory originates from the field of ecological psychology and is concerned with the action possibilities afforded in the relationship between individuals and the environment (Gibson, 1979). It focuses on individuals' perception of what is possible, given the context and resources available, and individuals' abilities to perceive actions that can lead to goal fulfillment.

While it has been argued that affordances and capabilities can be seen as synonymous, we argue that affordances precede capabilities and are on a different "level". A capability is a much broader concept compared to affordances (Zheng & Thapa, 2019). If a capability is to be able to make a living, the affordances are than the action possibilities that enable the capability.

Combining these two theories has previously been attempted (Hatakka, Thapa & Sæbø, 2016; Faith, 2018) to help explain the phenomenon in which people interact with technology (from affordances) to achieve an increase in agency and well-being (from the CA). The affordance conduit can complement the CA through an enhanced understanding of how the relationship between ICT and an individual lead to perceptible or hidden affordances, and how that may influence the actualization of affordances. But at the same time, while affordances center around action possibilities of an object and goal-oriented actors, the theory pays less attention to the outcome of an actualization and on the different socio-cultural and individual factors that can enable or inhibit the affordance from being perceived and actualized. Hence, we also need to understand the factors that influence the interaction between an individual and ICT, as well as the process and conversion of a means (a commodity) to an end (a functioning).

CA includes the concept of conversion factors (Robeyns, 2005). However, the concept is underspecified and only provides us with a limited understanding of the conversion process. Here, we instead argue for the inclusion of resource portfolios, agency, and social structures from the choice framework (Kleine, 2013). There is an assembly of various factors, both in an individual's resource portfolio and in the social structure, that determine whether an individual will perceive and actualize an affordance or not. In addition, when an individual lacks agency, or when the social structure is inhibiting, the result can be that the affordance will be hidden. Our study shows that even in situations when there are seemingly no results due to limitations related to agency and structure, something may still happen, e.g., affordances may be perceived, but not actualized, or the affordances may be hidden.

Affordances can exist without users' perceptions, whereas capabilities depend on making affordances perceptible and providing a conducive social structure and resource portfolio. For a capability to be available for individuals to act on, they first need to be able to perceive the affordance based on their goals. This provides us with

a more nuanced explanation of the process of moving from ICT to a capability. Therefore, we argue that to better understand the interplay between ICT and people, and its effects on societal change, we need to examine how interactions between ICT and actors in a specific context affect actors' ability to perceive and actualize affordances, consequently, enable or inhibit individual capabilities.

The integrated framework is presented in Figure 1. The framework shows the process and relation between ICT and development; depending on the actor's goal, the actor's ability to perceive affordances of ICT; and the context of the actor such as resource portfolio and social structure. The actor may perceive an affordance and actualize it, which can lead to new functionings. The actor may perceive an affordance, but cannot actualize it, or an actor may be unaware of the affordance, if it is hidden or latent.

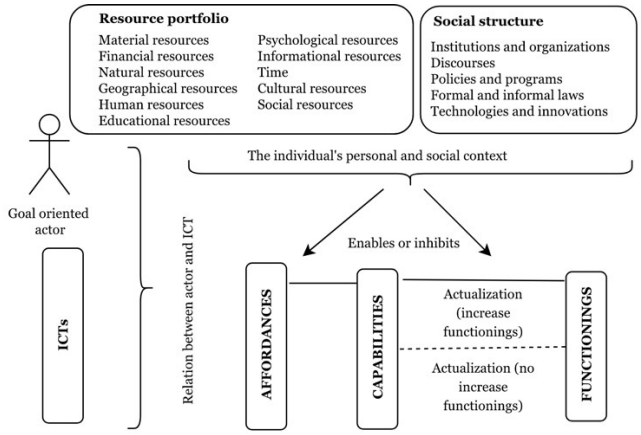

Figure 1. Integrated framework

4 Research design

In this section, we describe the case, data collection, and data analysis as follows.

The case concerns the use of study circles to improve the livelihoods of rural communities. The study-circle project took place in the Kwale district, on the South Coast of Kenya. The area is diverse, with most of the population sustaining a livelihood through fishing, agriculture, or forestry. The project was implemented by Coastal Oceans Research and Development – Indian Ocean (CORDIO) and aimed to address the educational needs of rural poor to help support their livelihoods and other income-generating activities (Wamala, 2012). The overall objectives of the project were to introduce ICT into poverty-alleviation activities to support environmentally sustainable livelihoods by introducing adult education that follow the "folkbildning" concept of education. "Folkbildning" is the use of self-organized study circles where the groups decide on topics to discuss and activities to conduct.

Given this study's emphasis on understanding the phenomena investigated within a real-life context through a rich description of particular instances (Yin, 2009), it is appropriate to adopt an explorative case-study approach (Kirsch & Beath, 1996). Our

study is based on a single case-study approach that aims to establish patterns of relationships among the constructs and identify their underlying logical arguments (Eisenhardt & Graebner, 2007), retrieved through recursive cycling among the case data.

The data were collected during two field visits to the Kenyan South Coast in 2012 (in May and October). Most of the field work was done in rural areas, visiting study-circle groups, local governments, other ICT actors (e.g., people in local Internet cafés), or with the project-management team. A trip to Mombasa also was taken to conduct interviews with system developers and personnel from the company that handled the technical ICT support for the groups. During our field work, we conducted focus-group discussions (FGDs) with study-circle participants (12 FGDs with 109 participants), government officers (two FGDs with six respondents), and project managers (one FGD with six members of the CORDIO staff). Furthermore, we conducted individual interviews with nine people and observations of the groups' activities.

Based on the proposed framework, we started the analysis by identifying affordances and capabilities that had resulted from ICT use in the study circles. In this paper, we select one capability "to improve the livelihoods by launching Internet cafés" as an example. It was one of the frequently mentioned capabilities by the respondents as well. Next, we identified the affordances that were directly related to the selected capability. For example, "accessibility to various service using ICT." After identifying the affordances, the focus of the analysis was to find the structural and agential factors that either enabled or inhibited participants from perceiving and actualizing the affordances. In the next section, we discuss the case analysis.

5 Case analysis

The case analysis shows that with the introduction of computers, printers, Internet and basic computer training, the groups perceived several afferences with the ICT that could help them gain the capabilities needed to improve their choices on how to make a living. The groups perceived the affordances of using computers to offer access to the communities, to learn basic computer skills, to virtually communicate and market their activities. All groups had previous experience with technology (mainly smartphones) and the cities in the areas had Internet cafés that several of them had visited. However, none of the study circle group villages had public access to computer and Internet so the groups saw an opportunity to launched Internet cafés and let the rest of the communities use their computers, printers, and Internet for a small fee:

> *When we started this program, we know that people were poor so we ask of them a very little amount to learn and take the studies. If it is a member, he will pay 100 KES for enrolling per month and then 200 per month, but that is also sometimes impossible. For non-members, it is 500. Because if you take the classes in the center instead to learn, it's more than 500 because going there and returning home, but here we made it cheap so that people will learn how to use the computer* (a study-circle member in a group offering computer lessons in their Internet café).

When the groups perceived affordances relating to starting Internet cafés, the individuals needed to have the required skills, and the context needed to be enabling for them to actualize the affordances. The individuals needed the education required to start a micro-business; knowledge about the needs in the communities; material resources, such as access to technology and facilities to start the cafés; and the financial resources to cope with the start-up costs until the cafés become financially sustainable. The social structure that they needed to navigate includes identifying a market need for the services, infrastructural programs that provide the communities with electricity and access to the Internet, and the required ICT needs to be affordable for the groups. Furthermore, there should be educational programs available so that members can gain necessary IT and other skills.

The success of the groups' Internet café businesses varied greatly. Although the groups were able to start a business that offered public access to computers in these communities, different factors regarding group members' agency and the social structures restricted some groups' ability to profit from the businesses. For example, lack of Internet access severely restricted the usefulness of services offered, the members' own IT skills limited what services they could provide, and the high cost of ICT-related supplies meant that group members were unable to afford maintenance expenses:

> *The printer cartridges are very expensive, and the printers are very slow. And the cartridge can only produce very few copies. So, if they use it for a business, they see that the cartridge is finished, but whatever they have paid, they cannot pay for the cost of the printing. There are other printers that have cheaper cartridges that they could use to earn some profit* (study-circle member in a women's group).

Hence, they tried to actualize the affordances, but the resulting outcome did not correspond to the goals they had for their action. In addition, some groups overestimated the community's ability, or willingness, to pay for these services:

> *The committee (study circle) members decided the fee. We have to see the economic abilities of the community members. That's why we set the fee of 200 KES for registration and 200 per month. Now, from experience, because of the (economic) environment, still the low fee could not be met. The economy is a problem, and the fear is that the finances will be problematic* (study-circle leader in a group focused on forestry and eco-tourism).

The groups also faced difficulties regarding the Internet infrastructure. One group, for example, tried to access the Internet by using mobile Internet service provided by Safaricom, but there were no mobile towers nearby. Therefore, the group was unable to connect. The group did not have the financial resources to acquire satellite Internet service, and affording it would have required external funding. Along with infrastructure problems, the group's lack of financial resources, and low community demand, the group was unable to navigate the restrictive social structure and enable any functionings when they tried to actualize the affordances. The group tried to offer a service that the context and ICT did not support, and the result was that the expected results from the affordance of improving group members' livelihoods by generating an income from the Internet café was not achieved.

Table 1. Summary of findings

Affordance	Resource portfolio	Social structure	Capabilities	Functionings
Accessibility to various services and communities	**Enabling resources** *Educational resources:* - Individuals in the groups have basic training in ICT and management. *Financial resources:* - The groups have collective financial capital to start the Internet cafés. *Material resources:* - The groups have the facilities (space) for Internet cafés. *Time:* - Individuals in the group have time to devote to managing the Internet cafés. *Information resources:* - The groups have collective knowledge about public access and community needs.	**Enabling structures** *Policies and programs:* - There is a market need for the service. - There are sufficient infrastructure programs (electricity and Internet access). *Technologies and innovations:* -The groups have access to ICT for the services they aim to provide. - The needed ICT is affordable for the group.	The capability to start Internet cafés to: -generate income for the group members -support a community need -offer computer training to the community	By choosing to actualize the perceptible affordance, the choice leads to: -financial support of their families (through added income), resulting in an increased standard of living (although minor) -increased ICT skills in the communities (through computer training)
(with no increase in functionings)Accessibility to various services and communities	**Enabling resources** *Educational resources:* - Individuals in the group have basic training in ICT and management. *Material resources:* - The groups have the facilities (space) for Internet cafés. *Time:* - Individuals in the group have time to devote to manage the Internet cafés. *Information resources:* - The groups have collective knowledge about public access. **Restricting resources** *Financial resources:* - The groups lack the financial capital to provide the services that the communities request. *Information resources:* - The groups lack knowledge about the community's willingness to pay for ICT access.	**Enabling structures** *Policies and programs:* - There is a market need for the service. *Technologies and innovations:* - Individuals in the group have the skills to provide the services. **Restricting structures** *Policies and programs:* - There is a lack of infrastructure programs (electricity and Internet access). *Technologies and innovations:* - There is a lack of access to ICT that they aim to provide - The needed ICT is not affordable for the group.	They have a false belief that they can start Internet cafés to generate an income and support a community need.	While the groups try to actualize the affordances, the actualization does not result in increased functionings for the group members.

Table 1 summarizes the process by which the groups could perceive and actualize the affordances, and the resulting functionings from the actualization, as well as an exam-

ple in which the affordances were actualized without the achievement of the expected outcomes, and the Internet cafés did not result in increased functionings for the groups.

6 Discussion

The CA is frequently used in ICT4D studies and has, to a certain degree, changed the focus of ICT4D research from mainly looking at economic development to more human-centered development (Andersson & Hatakka, 2013). Affordances, however, are rarely used to understand the interplay between ICT and goal-directed actors in fostering development. We argue that affordances allow us to examine how individuals interpret the material properties of ICT, with the objective of enhancing capabilities for individuals' agency and well-being. This distinction is important in the context of ICT4D because it allows for the specification of how ICT contributes to changes in developmental practices, which, in turn, constitute human development.

In this paper we propose a framework to explain *how* ICT affordances leads to increased capability sets for the individual, and *how* individuals' resource portfolios influence the perception and actualization of affordances. The affordances also need to be in line with the goals that users have, since people do not use a form of technology if they do not see any action possibilities to achieve their goals (Leonardi, 2011).

Combining theoretical conduits may have the negative impact of adding complexity to our framework. However, we argue that the positive aspects outweigh eventual negative effects. In the analysis, our framework increases our understanding of the impacts, and potential impacts, of ICT for development. In our evaluation of the case, we go beyond describing the interplay of structure and agency, and add to the explanation of how agency and social structures, interacting with ICT, influence an individual's ability to perceive and actualize affordances, as well as what happens when the affordances are hidden. By applying the proposed framework, we explain what needs to be changed (in individuals' resource portfolios or in social structures) to increase individuals' choices from an ICT intervention in which the resulting outcomes are not as expected. It further enhances our understanding of why the same technology interventions result in different outcomes when implemented in different contexts or among different individuals; how contextual factors can limit (or enable) individuals' ability to perceive affordances and expand their capability sets, and why ICT interventions do not lead to perceptible affordances or increases in individuals' choices.

The analysis also shows that ICT-enabled capabilities can be converted into functionings only if perceptible affordances are actualized. In some situations, individuals may choose not to actualize affordances, or be unable to actualize them. For example, while most of the groups perceived Internet cafés as a means to increase their livelihoods, not all groups had made the choice to, or was able to, actualize it. For some there were contextual factors (e.g., infrastructural issues, or lack of computer skills) that prevented them from actualizing a perceptible affordance. Depending on which factors in individuals' resource portfolios and in the social structure that hinders the achieved outcomes, there are different ways to change the situation. Changes might

be made to material properties to align with affordances, or their expectations may need to be changed to align with the material properties, e.g., by providing the groups with more cost-effective printers (which were suggested by the groups themselves), or by getting them to offer services in their Internet cafés that are available to them.

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