Research Article

Framing ICT4D Research Using Activity Theory: A Match Between the ICT4D Field and Theory?

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Abstract

Despite the advancement of the ICT for Development (ICT4D) field over the last decade, it has been argued that its knowledge and theoretical contribution has been weak. It has also been argued that ICT4D lacks appropriate theoretically driven approaches to frame studies to generate insights. This article introduces the use of activity theory in the context of ICT4D, as a theory-based framework, to answer questions concerning how ICT4D has enabled changes at the "activity" level in the development setting. While activity theory has been used expansively in a number of related technology, education, cognitive, and social-psychology disciplines, it has been largely ignored in ICT4D research. Five activity theoretic contributions are identified for framing the study of ICT4D. Notwithstanding the relatively unexplored use of activity theory in ICT4D research, it is argued that there are several appealing ways it may generate insights. It is also argued that the ICT4D field is compatible with the underlying critical and emancipatory commitments of activity theory.

1. Introduction

The ICT[1] for Development (ICT4D) field encompasses a complex and multidisciplinary body of literature covering information systems (IS), economics, information science, and development. Early studies focused heavily on the provision of ICT in developing countries,[2] typically through shared access points (Harris, 2005), to ameliorate the asymmetry in access to ICT that existed spatially and socially and to build subsequent capacity to use ICT. Alongside greater dispersion and ICT use, there has been a wider sphere of research investigating and augmenting understanding of the factors contributing to digital asymmetry (van Dijk, 2006), various activities where ICT use has provided benefit and opportunity such as health (Miscione, 2007), business and entrepreneurship (La Rovere & Melo, 2012), environmental monitoring (Karanasios, 2011), creation of new virtual activities (Heeks, 2009), and the direction and nature of theory in the field (Avgerou, 2008; Burrell & Toyama, 2009; Heeks, 2006), among other areas. The number of special edition journals focusing on various aspects such as design, theory development, regional perspectives, and specific domains illustrate the growth, diversity, and advancement of the field.

In the next section, this article argues that despite advances and growth of the ICT4D field, the theoretical and knowledge contributions have been weak. Following this, activity theory is presented as a theory-based approach for studying ICT4D. This section also serves as an introduction to activity theory, demonstrating its basic concepts and identifying the potential contributions to the ICT4D field. Five principal contributions are described. Each contribution charts how activity theory can be used to frame ICT4D research and how the ICT4D field is both appealing and able to provide more comprehensive use of activity theory in line with its

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1. For simplicity, the frame of reference of ICT is limited to "new" ICT, including the Internet and communication devices (mobile/cellular phones; Kleine & Unwin, 2009).

2. The term "developing countries" is used as a general term to refer to least developing and emerging economies (including low- and middle-income countries), which, while recognized as a heterogeneous group, share common challenges in human development (see World Bank, 2012 for country classifications and definitions).

philosophical underpinnings; in particular, in areas where its application is currently lacking in other fields. The discussion section argues for advancing the use of activity theory and outlines challenges for its use in ICT4D research and directions of future inquiry. The article concludes by summarizing the main points and suggesting that the use of activity theory in ICT4D research may yield interesting results and insights.

2. Theorizing ICT, Development, Change, and Human Activity

Despite the growing body of literature spanning academia and praxis, in-depth understanding and learning of the change, transformation, and impacts of ICT4D remain sparse. This is especially true in the sphere of social impacts, unintended changes, and influence of ICT/information and the transformational and emancipatory potential of ICT/information on human activity (UNCTAD, 2011). It has also been argued that the theoretical contribution of research in the ICT4D field is weak (Avgerou, 2010), and there remains a lack of research focusing on the "D" element of ICT4D (Heeks, 2006). This is perhaps best illustrated by the lack of high-impact studies, particularly at the individual/activity/micro level (as opposed to national level, e.g., Qiang, Rossotto & Kimura, 2009; Waverman, Meschi & Fuss, 2005) and erudite explanations and theories emerging from the ICT4D field to advance knowledge and ideas within the field, as well as a lack of cross-pollination of ideas and insights from the ICT4D field into related disciplines of research. Heeks (2006) noted that this may be a consequence of a bias to action, rather than knowledge, whereby researchers were caught up in the practical contribution (i.e., "how to change") rather than undertaking research for knowledge, learning, and theory building. He also argued that the practical-oriented research has "close-to-zero shelf life" (Heeks, 2006, p. 1), meaning that the findings rarely go beyond the timeframe of the project or initiative investigated. The embedded nature of some of the practical research means that it is overly focused on the success and outcomes rather than generating insights (Hayes, Miscione, Silva & Westrup, 2013), which can lead to naive generalizations. At the same time, this type of research has been important in driving more immediate and practical action, which often underpins the motivation for ICT4D research.

A related theme is that the complexity and rich multidisciplinary nature of the field (Burrell & Toyama, 2009; Parmar, 2009) result in difficulty in identifying and using theoretically grounded approaches to frame ICT4D studies which are of maximum benefit to theory and practice (Walsham & Sahay, 2006). Theory is important as it can deliver knowledge that is analytical rather than descriptive, add generalizability, and extend the life of the analysis by acting as a foundation for future work (Heeks, 2006). The use of a theoretical lens can also guide the research, help researchers make sense of phenomena by privileging certain questions and form of engagement, and force a more critical and reflexive position (Hayes et al., 2013).

Part of the explanation for the weakness in the theoretical approaches used and knowledge contribution may lie in the emergence of the ICT4D field from within the broader IS field. This led to borrowing theories from the IS field for direct application to ICT4D research. This is problematic, as the IS field is concerned with the use, acceptance, and adoption of IS (among other issues) within typically capitalistic, commercial, and organizational settings in Western countries (where most of the research is undertaken), while the ICT4D field is concerned primarily with socioeconomic development, empowerment, and poverty reduction enabled through ICT and in non-Western countries (in countries where largely the technology was not designed). The two, it can be argued, are incompatible. At the same time, it should be acknowledged that there is a richness and variety of theories used in IS and ICT4D research, and there have been attempts by scholars to contextually fuse approaches (Slavova, Venter & Baduza, 2013).

In this article it is argued that activity theory can work to address these challenges by (1) providing a relevant and appealing approach to study the interrelationship between ICT and actors within the cognitive, cultural-historical, and sociopolitical context, which is well aligned with the field of ICT4D and (2) strengthening insights concerning change, development, and the evolving interaction between human activity and ICT.

Anderson and Hatakka (2013) analyzed articles from 2005 to 2012 in ICT4D journals and provided what is perhaps the most comprehensive classification of the theoretical approaches used. Their analysis revealed a lack of reference to theories outside the IS domain. They argued for greater use of theories from development,

gender studies, and education and for the development of ICT4D-relevant theories. In line with this, they called for a reduction in the use of the positivist frameworks. In terms of social theory, two of the dominant approaches used to frame studies were noted to be Actor-Network Theory (ANT) and Structuration Theory; ANT, in particular, remains popular (Andrade & Urquhart, 2010). Several differences between ANT and activity theory have been noted (Miettinen, 1999; Spinuzzi, 2008). For instance, ANT avoids using concepts such as subject, object, and culture and holds a flat ontology (where people and objects are given equal emphasis), among other differences. However, both consider that tasks, activities, etc., do not exist in a vacuum but are influenced by a range of factors, are concerned in some way with networks of aligned interests, and consider that technical mediation matters. How activity theory deals with these is explored throughout this article.

Anderson and Hatakka's analysis also highlighted, indirectly, that activity theory has been largely neglected in ICT4D research, as observed elsewhere (Karanasios & Allen, 2013). This is notable (and surprising) given its use in related fields including IS (Chen, Sharman, Rao & Upadhyaya, 2013), information science (Wilson, 2008), computer science (Thakker, Dimitrova, Lau, Denaux, Karanasios & Yang-Turner, 2011), HCI (Kaptelinin & Nardi, 2006), education (Blin & Munro, 2008), organization studies (Engeström, 2000a), innovation (Miettinen, 1999), and social-psychology (Blunden, 2010). (It also merits mentioning that activity theory appears neglected in general development studies.)

A small body of researchers has employed activity theory in ICT4D contexts in limited ways, predominantly as a lens to operationalize an activity (Mlitwa & Koranteng, 2013), problematize ICT4D using the notion of contradictions and tensions (Karanasios & Allen, 2013), guide systems development (Freitas & Byrne, 2006), and informing HCI design (Ashok & Beck, 2007). The work of Korpela and colleagues on an IS development methodology based on activity theory remains the most comprehensive in the field (Korpela et al., 2004; Korpela, Mursu & Soriyan, 2002).

3. The Contribution of the Activity Theoretic Perspective to ICT4D Research

Despite its name, activity theory is not a "theory" in the sense that it provides scientific theory (i.e., how something works; Kuutti, 1996). Rather, it is a theory-based conceptual framework for inquiry into human activity consisting of a set of basic principles (Karanasios & Allen, 2013) which can help explain certain phenomenon. It therefore best falls within the category of a theory for analysis, study design, and describing (as a theory for describing or understanding how and why things happened), rather than a theory of "prediction" (see Gregor, 2006 for distinctions). Following Heeks' (2006) categorization of theory in ICT4D, activity theory falls under the umbrella of "theory-based work" which makes demonstrative use of a theory and applies it (or tests it).

Activity theory (or cultural-historical activity theory [CHAT], as it is often referred to) is based on the concepts of the cultural-historical school of Russian psychology, which drew largely upon the works of Vygotsky (1978) between 1920 and 1930 (and others, including Luria [1979], Ilyenkov [1977] and Leont'ev [1978]), centering on the unity of consciousness and activity, taking into account cultural and historical influences on human actions. According to Vygotsky's theory (1978), the interaction between the human agent (the subject) and the world (the object) is mediated by tools and signs (Miettinen, Samra-Fredericks & Yanow, 2009); this is a central tenet emphasized in this article, and one elaborated upon in Section 3.1.

Activity theory differs from new social practice theories (such as ANT, structuration theory, and other social theories) that focus on the "habituality of practice," which makes it difficult for them to make sense of changes in human practices (Miettinen, Paavola & Pohjola, 2012). Whereas "classical practice theories"—such as activity theory—emerged as a way of understanding change and development of human practice (Miettinen et al., 2012) when emerging problems or practices are faced (Miettinen, 2006). Therefore, it is well suited to change and development contexts and complements sociological theories of practice by supplying a well-developed model of the dynamics of human activity (Miettinen et al., 2009).

While activity theory has philosophical Soviet and Marxist origins, over the last three decades it has become increasingly internationalized. Rather than describe the history and development of activity theory (see

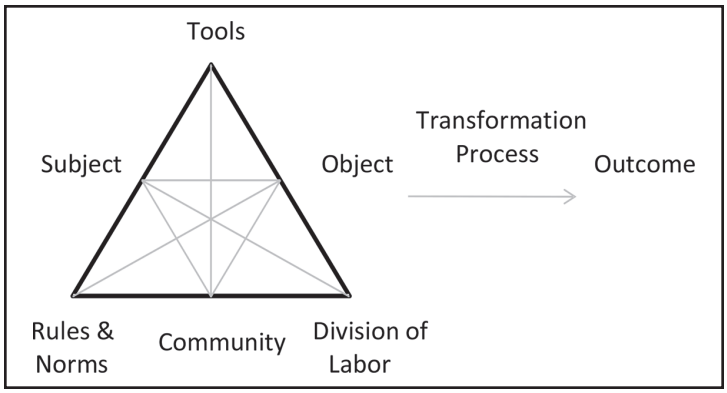

Figure 1. Engeström's activity system (1987, p. 78).

Blunden, 2010; Engeström, 1987; Leont'ev, 1978), this section aims to demonstrate how activity theory is useful and appealing to ICT4D research. Engeström's (1999c) "third generation" activity theory and its related conceptual tools to understand social-action, activity, change, and networks of interacting activity systems are the main focus. The contributions draw upon literature from several disciplines which have a tradition of using activity theory and are considered relevant fields to ICT4D, in particular, IS, information science, social psychology, organization studies, HCI, and education. The contributions of the Centre for Activity Theory and Developmental Work Research (Finland) to activity theory in the context of work activity and the AIMTech Research Group (UK) in the context of information and ICT are heavily relied on.

In the following sections, five[3] multilevel contributions are identified and expanded upon.

3.1. Contribution 1: The Activity System as a Unit of Analysis

The first contribution identified is the notion of an activity system. Leont'ev built on the work of Vygotsky and proposed the concept of "activity" as a specific form of the societal existence of humans, which is object-oriented and tool-mediated. Engeström (1999a) describes the activity system as a strong candidate for a unit of analysis which is "object-oriented, collective, and culturally-mediated" (Engeström, 1999a, p. 9) and as the "root model" of human activity (Engeström, 1987). This follows that a *subject* (a person or group) is driven by a *motivation(s)* to undertake an activity and in this process uses *tools* (technologies, mental tools, language, etc.) to act upon an *object* (a person, group, or thing) to produce an *outcome.* Objects have a life of their own, which is emphasized when objects resist the attempts of the subject to control them (Karanasios & Allen, 2013). This is especially the case when it is a person who is the object (Engeström, 2000b).

Building on this simple expression of human activity, Engeström (1987) added the *community,* the *division of labor* (the division of tasks, power, positions in relation to the object), and *rules/norms* (see Figure 1) to the activity structure. This follows that an activity includes a broader community (relevant actors), is governed by cultural-historical rules/norms, and is executed by a division of labor, which takes place between the subject and community.

Tools act as a focal point in the activity theoretic perspective, playing a mediating role (Kuutti, 1996) toward realization of the object (Allen, Karanasios & Slavova, 2011). Herein lies one of its major advantages in the study of ICT4D. By bringing technology into the unit of analysis (the activity), it does not privilege the social over the technical or overly emphasize technology. It follows the perspective that

> humans can control their own behavior—not "from the inside," on the basis of biological urges, but "from the outside," using and creating artifacts. This perspective is not only optimistic concerning human self-determination, it is an invitation to serious study of artifacts as integral and inseparable components of human functioning. (Engeström, 1999a, p. 29)

Engeström continues to say that "activity theory has the conceptual potential and methodological potential to be a pathbreaker in studies that help humans gain control over their own artifacts and thus over their future" (Engeström, 1999a, p. 29). At the same time, activity theorists argue that tools should not be treated

3. In the original paper (Karanasios, 2013), four contributions were described. Based on feedback a fifth has been added.

as a given (Kuutti, 1996), rather it follows that humans shape tools, and tools can shape behavior (rather than adopting a deterministic view of technology).

It is important to note, however, that *tool* also refers to a different type of mediator, which is not physical, such as signs, symbols, language, etc. While important, in this article these are not explored in detail, as the focus is on ICT. It merits mentioning however that ICT can change, disrupt, and improve mediation of signs, symbols, and language (and vice versa).

By bringing the social and the technical together, activity theory focuses on technology for its ability to transform an activity, enabling, for instance, improved vehicles of information and communication in an activity rather than the artifact per se. Tools are not simply objects that are used, they are the result of a social process and previous activities, embody cultural characteristics (e.g., status, mobility, freedom, or a "panopticon"; Kuutti, 1996), and may later act as a norm and a means of labor in subsequent activities (Blunden, 2010). Further, the use of tools is both governed by rules and norms (scripts of behavior in interacting with technology) and may transform activity rules and norms. In other words, rules/norms are continuously reconstructed and influenced by technology (and vice versa). For example, this is evident in the norms emerging surrounding mobile banking (e.g., M-PESA), whereby transactions are performed using mobile technology, which in turn establishes new norms surrounding trust and money, and interacting with financial institutions (Morawczynski & Miscione, 2008). Similarly, tools are likely to introduce new ways of working and to transform the division of labor, creating new efficiencies and new types of labor or making some labor redundant. Jensen (2007) found that mobile phones allowed fishermen to negotiate prices and transactions while at sea, changing the norms surrounding the activity and reducing the need for some labor, disrupting the community (for instance, intermediaries were less relied upon), while improving outcomes for fishermen. The division of labor within an activity is a powerful notion in the ICT4D context, where researchers are interested in ways that ICT can improve conditions, create efficiencies, and break down power divides.

An activity does not take place in isolation from other actors (and the norms surrounding interactions with actors). Rather, the actors (the community) influence the activity and may have their own related activities. For example, in the case of a remote small tourism business using the Internet to reach new markets (the activity being an operation of the business), the community includes potential customers, competitors, and intermediaries (Karanasios & Burgess, 2008), all with their own norms and behaviors (and tools for mediating the interactions among one another), which are likely to influence the activity. Change in any of the community activities is likely to have a ripple effect on the connected activities. Therefore, the activity system provides the site for analyzing interaction among actors and structures and the use of tools.

Table 1 explains the activity system concepts and how they can be used to frame an activity theoretic analysis.

Table 1. Framing an Activity.

Activity concept	Framing an activity system	Definition
Activity	What is the activity I am interested in?	An object-oriented activity, meaning the most important element of the activity, is the object toward which the subject directs him/herself/ collectively to achieve a desired outcome
Object*	Why is the activity taking place?	The problem, situation, or focus of the activity
Motivation	What is the stimulus for the activity?	The reason(s) for the activity taking place. Activities can be polymotivational
Subject	Who is involved in carrying out the activity?	The individual or group undertaking the activity (and whose viewpoint informs the analysis)
Tools	By what means are the subjects carrying out the activity?	Used by the subject (or community) to achieve the object. Mediates the subjects' activity and actions
Rules/norms	Are there any cultural norms, rules, laws, and regulations governing the activity?	Regulations, norms, conventions (explicit and implicit) that constrain/govern the activity

Table 1. (Continued)

Activity concept	Framing an activity system	Definition
Division of labor	Who is responsible for what when carrying out the activity, and how are the roles organized?	The way tasks are divided and roles and hierarchies structured
Community	What is the environment/who are the actors within which the activity is carried out?	Individuals or groups other than the subject who have the same general object, but are distinct, and with whom the subject interacts
Outcome	What is the (desired) outcome from the activity?	The outcome of the activity

*Adapted from Allen et al. (2011); Engeström et al. (1999b); Engeström and Miettinen (1999); Mwanza (2001). *Debates around the "object" vs. the "motivation" representing the true motive are not discussed here (see Kaptelinin, 2005; Leont'ev, 1978).*

Bringing the concepts listed in Table 1 together into one coherent, object-oriented framework is different from other approaches, such as Archer's analytical dualism where the analytical separation of structure and agency is required to examine their interplay. In activity theory, they are inseparable and form a single unit of analysis, the activity system (Allen, Brown, Karanasios & Norman, 2013). That is, agency/structure can be considered to be "co-constructed," implicitly or explicitly. While each of the six nodes can be analyzed individually, as can the relations among them, it is the analysis of the combined system where the greatest meaning and knowledge can be generated. The analytical lens offered by the activity system also captures the relevant context, in a holistic way, a critical challenge in ICT4D research.

3.2. Contribution 2: The Hierarchy of Activity-Actions-Operations

Below the level of activity are *actions* and *operations.* This follows that an activity is made up of *actions,* which are goal-oriented and contribute to the achievement of the object. That is, actions are accomplished because they realize a specific activity and can be described as subordinate to an activity. *Operations* are distinguished from actions as being undertaken without conscious deliberation. This model is in a state of continuous flux and development as it seeks to portray a reality which is constructed both at, and of, a time and context (see Allen et al., 2011 for a detailed example). Kaptelinin (1996) uses the widely referenced example of building a house (the activity), fixing the roof (an action), and using a hammer (an operation) to illustrate the relationship among the three levels. Table 2 illustrates the interrelationship among activity, actions, and operations.

Table 2. Description of the Basic Terms.

Activity level	Definition/example
Activity—not necessarily conscious, but may become conscious	Governed by motive(s) (collective) (i.e., building a house)
Actions—conscious	Governed by goals (individual or group) (i.e., fixing the roof)
Operations—conscious when learned but can become unconscious or automatic in routine	Governed by conditions (nonconscious) (i.e., using a hammer)

Adapted from: Bertelsen and Bødker (2003, p. 301).

This framing provides a lens to view the actions that lead to the attainment of an object and, importantly, how ICT changes the actions and choice of available actions. For example, within the activity of small-scale agricultural production, the introduction of technology-mediated access to information (e.g., via a mobile device) can change the choices of available actions (with likely consequences and outcomes for the activity), such as when to grow, what to grow, how to trade, interactions with extension workers, and so on. For instance, iCOW (http://icow.co.ke/), an application that runs on mobile phones, prompts dairy farmers using voice/SMS on vital days of the gestation period, helps farmers find the closest veterinarian, stores breeding

records, and provides farmers with best dairy practices. In this case, mobile technology–mediated access to information is likely to lead to changes in actions within the activity of dairy farming. In this process, the use of ICT to access information may initially be conscious and deliberate but over time may become a subconscious operation, showing change in the cognitive process of the activity.

3.3. Contribution 3: Contradictions and Tensions as Sources of Change

An important lens in the activity theoretic perspective is the role of contradictions and tensions in explaining change and development (Engeström, 1987). Contradictions are a sign of richness and complexity and capture the true nature of human activities; that is, of an activity as fluid and developing rather than fixed and static. As such, they reveal the process of development. They manifest to the researcher as problems, ruptures, breakdowns, and clashes within the activity (Kuutti, 1999).

Contradictions exist at several levels: (1) *primary* contradictions are found within a component of the activity (i.e., in the rules/norms, object, etc.); (2) *secondary* contradictions occur between constituents of the activity (i.e., between the community and the tool); (3) *tertiary* contradictions occur between the current activity and its previous form (i.e., before change); and (4) *quaternary* contradictions occur between the activity and related activities (Engeström, 1987). These are mapped in Figure 2. Kuutti (1999, p. 34) refers to them as "a misfit within elements, between them, between different activities, or between different developmental phases of a single activity." Importantly, learning and development are made possible by the accumulation of contradictions as they often lead to a redefinition of the activity object, the activity, or connected activities.

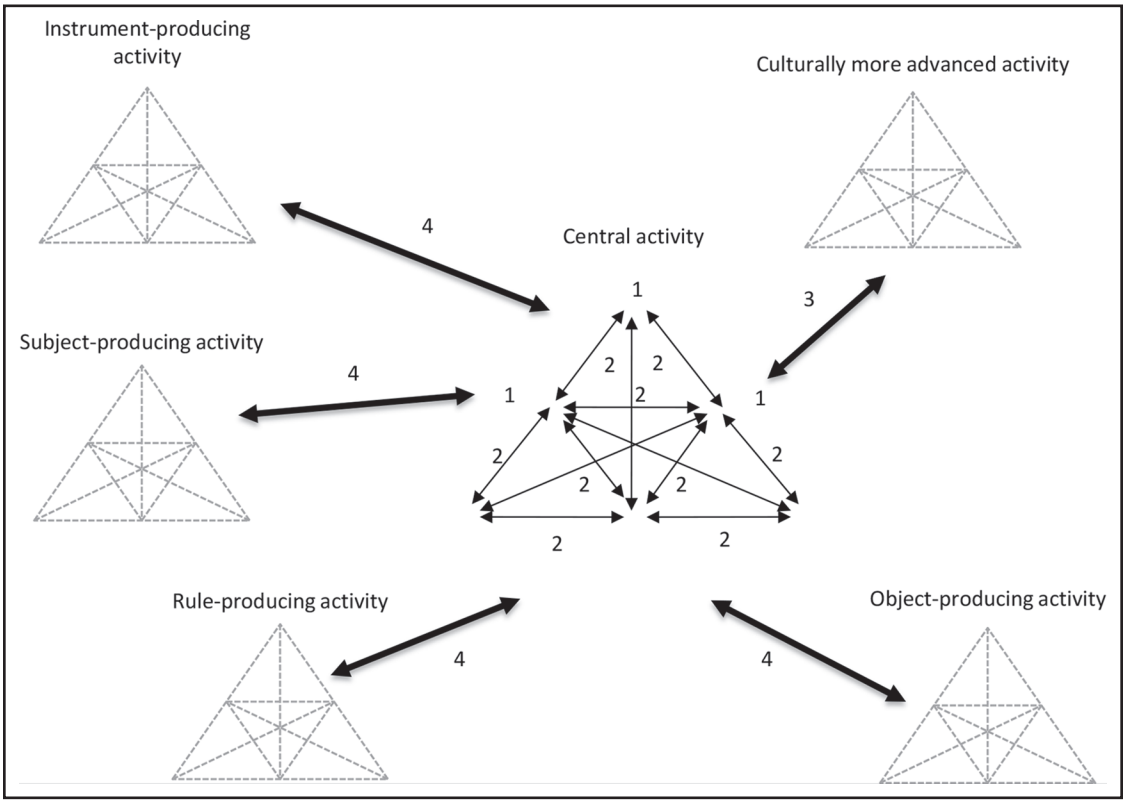

Figure 2. Four levels of contradictions, adapted from Engeström (1987, p. 103).

As contradictions are aggravated within an activity, some individuals begin to deviate from the activity's established norms, which in some cases may lead to a deliberate and/or collective change effort and constantly evolving and transforming activities (Engeström, 2001), in which "equilibrium is an exception and tensions, disturbances and local innovations are the rule and the engine of change" (Cole & Engeström, 1993 p. 8).

Therefore, a contribution here to ICT4D research is that the resolution of contradictions can be viewed as an indicator of the process of development.

Furthermore, complex activities, such as those related to development, have increasing numbers of contradictions (and therefore feedback loops), causing contradictions to be the cause of more contradictions, that can generate snowballs and arbitrary and unpredictable change and maladaptive changes, just as adaptations to contradictions in one activity can engender new contradictions in other activities. This is important as in the development context ICT can contribute to benefits, such as equality, and disbenefits such as inequality (Howkins & Valantin, 1997).

An example of a common contradiction that spans the *secondary* and *tertiary* levels might occur between the community and the subject, who may have contradictory motives toward the object (Wiredu, 2007). To use the tourism example once more, a remote tourism operator introducing the Internet to its business operations to market directly to customers (thereby removing or limiting the need for intermediaries—the community) may cause a renegotiation of labor, power, and norms within the activity and may generate contradictions as intermediaries act to protect their market interests as this directly impacts their related activities (of matching customers with suppliers; Karanasios & Burgess, 2006). Such contradictions give rise to transformation in the industry whereby some intermediaries, who saw revenues and control reduced by the Internet, later reinvent themselves as online firms (the process of re-intermediation). Wider contradictions may emerge in the local environment as the use of the Internet to attract customers may disturb the local agriculture, economy, and social norms in positive and negative ways. At the same time, contradictions are not always straightforward and often emerge and are observed in hindsight as individuals depart from the status quo.

In a study of the implementation of a town-wide wireless infrastructure (called a Town Information Network, or TIN), contradictions in the pre-implementation environment between the commercial operators and the profit motive explained the emergence of a social enterprise as the operator of a newly donor-funded telecommunications infrastructure (the lack of revenue potential and high investment costs in this remote and sparsely populated town were the initial reasons for the poor existing telecommunications infrastructure). The same study showed how contradictions were emerging between the community and the object (the wireless infrastructure) as it was being developed and implemented. As the TIN became a reality, individual actors started to reconceptualize how it could be used, which was inconsistent with initial motivations (Karanasios & Allen, 2013).

The examination of contradictions can be undertaken by the researcher, or in the case of action research and participatory research, can include the individuals involved in the activity. Where the individuals are involved in the process, it can lead to learning and the construction and implementation of a new activity object and wider transformation, known as expansive learning (Engeström, 1987).

3.4. Contribution 4: Networks of Activity Systems

In addition to examining the activity as a unit of analysis, the activity theoretic perspective allows researchers to connect the activity with the multivariate nature of human activity by examining connected activities (in terms of activities related to the central activity and new forms of the activity). This is a way to determine how activities develop and change over time, and it follows that activities are woven, combining, merging, interpenetrating, dividing, and becoming more complex over time (Spinuzzi, 2008). Korpela, Soriyan, and Olufokunbi (2000, p. 196) use the example of a network of activity systems to show how each element of an activity (e.g., rules/norms, tools) is connected by separate but interconnected activities. Karanasios and Allen (2013) used the notion of connected activities to observe the connections and contradictions among activities and generate insights into how tools developed in one activity were absorbed into other activities, enabling new opportunities for change. This is illustrated in Figure 3, which shows how the tool developed in the central activity (the implementation of a TIN) was later absorbed as a tool in local activities, offering an alternative conceptualization of how an ICT4D activity can be embedded into the local context. The object of the central activity was absorbed as a tool in local e-government, education, and business activities. Using this theoretical lens, one examines how ICT interventions enable activities and how activities interpenetrate over time. It also allows researchers to map out activities and the tensions and contradictions that exist among them in the process of change and development.

The notion of connected activities also allows researchers to connect independent activities that share the same objective. For example, in an environmental disaster (flood, earthquake, etc.) the fire, police, medical services, international donors, and volunteer organizations converge on the scene and work largely independently toward a shared object(ive) of managing the disaster (similar to the notion of knotworking [Engeström, Engeström, & Vähäaho, 1999]). In the Figure 4 example, different organizations (e.g., international aid agency, volunteer organization, police force, and paramedics) have the same shared object (respond to incident) but are governed by independent rules/norms, which could lead to conflict in working toward the shared object, and often does (Allen, Karanasios & Norman, 2013). This conceptualization is useful as it allows exploration of the tensions and contradictions that exist among the tools, rules and norms, division of labor, and community across the interconnected activities as the subjects work toward a shared object (see Engeström, 2008b for other examples).

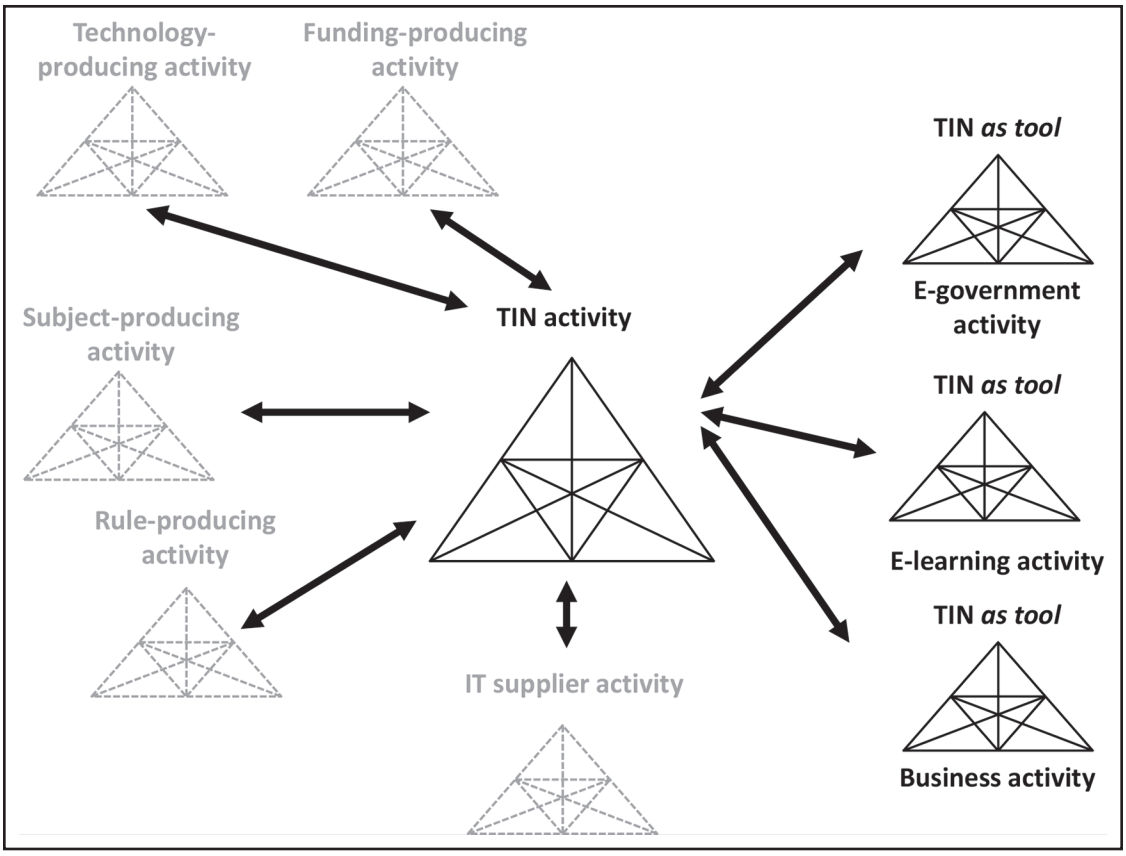

Figure 3. Mapping activities, adapted from Karanasios and Allen (2013, p. 300).

3.5. Contribution 5: Emancipation

The ICT4D field is ultimately concerned with positive change, participation, and emancipation/empowerment enabled through improved access to information (Unwin, 2009; Wheeler, 2007). Sen discusses the ways that mobile technology can emancipate some, while restricting others (Sen, 2010) and has highlighted to need to address women's agency and participation in political, economic, and social activities as "development as freedom" (Sen, 1999, p. 203). While Sen's capability approach has been advanced by Kleine (2013) and others and focuses on the dimension of freedoms and empowerment in ICT4D, emancipation is largely a notion, which, while it is a pertinent concern in the ICT4D field, is typically neglected or pushed to the background in ICT4D research and not theoretically driven.

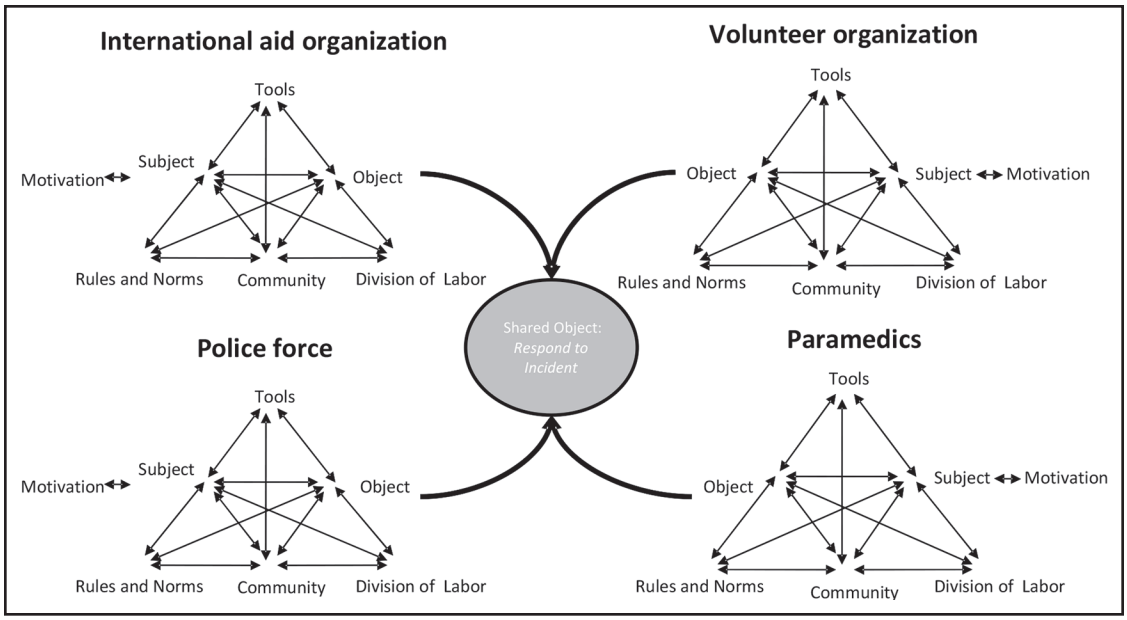

Figure 4. Connected activities with shared object, adapted from Allen, Karanasios, and Norman (2013).

Underpinning the four previous contributions is the often-stated power of activity theory to "emancipate" subjects, prompting change and development; offering conceptual tools and an agenda that is omitted from many other contemporary social theories (the capability approach is the most notable exception). Blunden (2010, p. 5) describes activity theory as a form of emancipatory science, which is "an approach to science whose effect is to emancipate its subjects, rather than predict or control them." Engeström (2008b) refers to "runaway objects," (objects with strong emancipatory potential) which open up new possibilities, development, and well-being and which are typically poorly controlled, for example, the Linux operating system.

Despite this, the emancipatory agenda is largely lacking in extant studies across all disciplines employing activity theory. Korpela et al. (2004, p. 453), whose worked spanned IS/ICT4D, noted

> that the currently dominant methods in Information Systems are not satisfactory for emancipatory research and development whose starting point is work. Activity theory was proposed as such an emancipatory research-cum development approach in IS a decade ago. However, the potential identified in the theory has not fully materialized.

They argued that in order to unleash the emancipatory power of activity theory, collaborative, participatory, and action research methods should be used. Likewise, Engeström (2008a, p. 258) noted that "[i]f activity theory is stripped of its historical analysis of contradictions of capitalism, the theory becomes either another management toolkit or another psychological approach without potential for radical transformations." However, for most research, the emancipatory agenda is problematic to address, particularly in commercial organizational settings.

This is an area where the ICT4D field can contribute to activity theory. In other words, ICT4D provides the setting (one concerned with change and emancipation), enabling the full emancipatory capabilities of activity theory to be applied holistically. Activity theory provides the tools for offering a more nuanced analysis of change, tool use, division of labor within activities, and underlying norms.

Linked to this is the issue of contradictions and the depth of the investigation into contradictions. The primary contradiction of activities within capitalism is that between the "use and exchange value" of commodities and this contradiction penetrates all elements of an activity system (Engeström, 2001). Engeström, Miettinen, and Punamäki, (1999, p. 5) noted that this "dialectical concept is critical for any serious analysis of

the contradictory nature of human activities and human psyche in a capitalistic society." This is another area where the extant use of activity theory among scholars is rather insipid, and one where the ICT4D field can provide significant insights and can be challenging to address in light of the issues and debates surrounding development, capitalism, and poverty.

4. Discussion: Advancing Activity Theory in ICT4D Research

This article commenced by arguing that theoretical understanding and knowledge contribution within the ICT4D field are weak, especially concerning how ICT and information have led to a reorientation and transformation (or not) of human activity and learning of activity in the development context. The article then critiqued current approaches to studying ICT4D and noted the calls for moving away from theoretical homophily (Anderson & Hatakka, 2013) and toward identification of approaches of maximum benefit to theory and practice (Walsham & Sahay, 2006). Following the calls of other ICT4D scholars, this article also argued for stronger use of theory in ICT4D research. It followed this logic and critique in order to reason that there are several ways activity theory can contribute to ICT4D research and generate meaningful insights on the role of ICT and information in human activity in the development context. The current use of activity theory in social science research was also critiqued, and it was suggested that in fact ICT4D can contribute to a more holistic use of activity theory. The discussion of the contributions explored how activity theory acts as a conceptual framework for inquiry of human activity consisting of a set of basic principles to generate insights in ICT4D research. Several examples were articulated.

The findings that have emerged from the use of activity theory allow for "naturalistic or qualitative generalization" (Stake, 1995), rather than statistical/quantitative inferences; however, this does not preclude activity theory from quantitative or mixed methods studies. While it can be used in the interpretation and explanation of data (Er & Lawrence, 2011), it is useful, and often necessary, to turn to other theories for further explanation (Allen et al., 2013). Therefore, a benefit is that it is not overly prescriptive, but rather can be integrated within or, with other theoretical approaches and other more explicit theories, can be drawn upon to provide a deeper and more generalist explanation (Nardi & O'Day, 1999). For instance, studies have combined structuration theory (Canary & McPhee, 2009) and institutional theory (Ogawa, Crain, Loomis & Ball, 2008) with activity theory.

The growing use of activity theory by scholars in the IS and related information fields can be described as pragmatic rather than following a doctrinaire line of thinking. This suits the multiple and often practical objectives of ICT4D research and epistemological approaches. The value of the activity system in particular is that it can capture ethnographic, anthropological, and cultural aspects related to the introduction of technology and can be used to conceptualize the transformation dynamics. While qualitative and quantitative methods are accommodated, pluralistic methods which draw on methods suited to ICT4D research such as participatory (Korpela et al., 1998) and action research, case study research, interviews, surveys, and ethnography (Choudrie & Harindranath, 2011) would strengthen findings.

To effectively sketch out how activity theory can contribute to the ICT4D field, some aspects have been omitted and others presented as relatively straightforward. The process of internalization and externalization (Engeström & Miettinen, 1999), expansive learning and visibilization (Engeström, 1999b; Engeström, 2001), and congruencies (Allen et al., 2013a) have not been expanded on. These provide further fruitful concepts to be explored in the ICT4D research context.

Several contested concepts, words of caution, and unresolved debates have not been expanded upon in this article (Bakhurst, 2009; Blunden, 2010). One particular aspect is the messiness around the polymotivational nature of the object of an activity (Kaptelinin, 2005), which is often reconstructed during an activity (Karanasios & Allen, 2013), providing a challenge for research undertaken in a temporal frame. At the same time, however, this is a benefit, as it recognizes that activities have multiple motivations and underscores the complexity of the range of social, cultural, political, and other factors which influence activities (Allen et al., 2013a) and the field of study that is ICT4D (Karanasios & Allen, 2013). Furthermore, while activity theory provides a lens to understand object-oriented activity, it suffers from scalability to large-scale phenomenon. That is, it seems best suited to the study of micro and bounded activity rather than national-level inquiry. However,

Engeström (2008b) alludes to the potential to tackle larger-scale activities such as climate change, social innovations (organic farming movements, crowdsourcing, etc.) and "runaway objects" (objects not under anybody's control that have far-reaching and unintended impacts) that generate opposition and controversy, which can "also be powerfully emancipatory objects that open up radically new possibilities of development and well-being" (Engeström, 2008b, p. 3). This provides an area of development and exploration for future ICT4D research.

Josephs (1996) argued that the concept of activity is nebulous and the concepts proposed by activity theory cannot be tested. A further limitation is that the contributions outlined in this article may not all be possible in one study. In fact, studies tend to rely on specific aspects such as contradictions or the activity level (Karanasios & Allen, 2013), rather than the actions and operations level, which require greater investment of time, and in the case of operations, data collection techniques not commonly used in ICT4D research. In this way, activity theory is modular and can be adapted to particular study needs.

The contributions outlined in this article provide an approach for understanding the changes enabled by ICT in human activity (going beyond measuring short-term impacts, which encourages a narrow understanding of ICT4D [Hayes & Westrup, 2012]) and illuminates the deeper social-cultural changes at the activity level. The contributions would also be useful for illuminating failed examples of ICT intervention to support specific types of activity. A limitation of previous studies using activity theory is that they are largely time bound. Longitudinal studies which examine and observe how activities transform and how contradictions emerge and are resolved, as well as following how the object is reconstructed over time (Karanasios & Allen, 2013), would provide valuable insights. The lens of connected activities would be particularly useful for monitoring ICT4D initiatives over time to observe how activities connect, interpenetrate, disengage, and are consumed over time.

It has not been the purpose of this article to suggest that activity theory is superior to other theoretical lenses. Nor that the theoretical and knowledge challenges facing the ICT4D field can be ameliorated by more widespread use of one particular theory. Alongside the introduction of relevant theoretical approaches, greater discourse is needed about the nature of insights needed, learning and underlying research questions to help guide research, and the type of theory that may best contribute to the field.

5. Conclusion

This article introduced the use of activity theory in the context of ICT4D research as a theory-based framework to answer questions concerning how ICT has enabled changes at the "activity" level in developing countries. Five principal contributions were identified: (1) the activity system as a unit of analysis; (2) the hierarchy of activity-actions-operations; (3) the notion of contradictions and tensions as a source of change, where it was noted that the resolution of contradictions can be viewed as a direct indicator of the development process; (4) the notion of networked activities and the shared object; and (5) emancipation as a critical and neglected emphasis for ICT4D research. This article has had relatively little prior research on it to review and build upon in the context of activity theory in ICT4D research and, as such, there are many opportunities for further work. ■

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