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FRAMING ICT4D RESEARCH USING ACTIVITY THEORY: A MATCH BETWEEN THE ICT4D FIELD AND THEORY?

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Abstract: While there is mounting evidence on the positive national level economic benefits of Information Communication Technologies (ICT) in developing countries, one area where knowledge could be improved is how ICT and information has led to a re-orientation and transformation of human activity. That is, changes in activities in terms of how they are conducted, the actors, actions and laws/norms and the labour that contributes to the activity and how ICT introduced in one activity impacts on other activities and the creation of new activities. This paper serves as an introduction to the use of activity theory in the context of Information Communication Technologies for Development (ICT4D) as a theory based framework to answer questions concerning how ICT have enabled changes at the "activity" level in developing countries. Four activity theoretic contributions are identified for framing the study of ICT4D. Despite the relatively unexplored use of activity theory in ICT4D research, it is argued that there are several appealing ways in which the field of ICT4D is compatible with its underlying critical and emancipatory commitments and that its use in ICT4D research may lead to richer insights.

Keywords: activity theory, theory, ICT and development

1 INTRODUCTION

Over the last two decades the use of information and communication technology (ICT) in developing countries[1] has been increasing. This trend has been enabled by a mixture of factors, which are not necessarily unique to the developing world, such as advances in mobile and wireless technology (e.g. 3G/4G, wireless broadband); decreasing costs of mobile phones, the internet and computing equipment (ITU, 2011); new social norms surrounding communication and access to/sharing of information; a range of long-term national programmes linking ICT investment to development (Ma et al., 2005; Ramasamy et al., 2004); and, initiatives driven by development agencies aimed at providing access and capacity to use ICT (ADB, 2010).

The ICT and Development (ICT4D) field encompasses a complex body of literature covering economics, information systems (IS), information science and development. Early studies of ICT4D focused heavily on the provision of ICT, typically through shared access points (Harris, 2005), in order to ameliorate the asymmetry in access to ICT that existed spatially and socially and to build subsequent capacity to use ICT. Along with greater dispersion and use of ICT there has been a wider sphere of research covering the factors contributing to digital asymmetry (Fuchs, 2009; van Dijk, 2006), various application areas where the use of ICT has enhanced activity such as environmental monitoring (Karanasios, 2011; Ospina & Heeks, 2010), health (Puri et al., 2009), business operation/entrepreneurship (Karanasios & Burgess, 2006; Rovere & Melo, 2012), community approaches to development (Stillman et al., 2012) and increasingly on the nature of

[1] In this paper the term "developing countries" is used as a general term to refer to least developing, developing and emerging economies (including low and middle income countries), which while recognised as a heterogeneous group share common challenges in human development (cf. Klugman, 2011; World Bank., 2012 for country classifications and definitions)

theory in the field (Avgerou, 2008; Njihia & Merali, 2013). The number of special edition journals focusing on various aspects such as design, theory development, regional perspectives and specific domains illustrate the growth in interest, diversity and advancement of the field.

Another stream of research, which continues to grow, and largely undertaken by global institutions, has focused on building evidence on the relationship between access to/number of ICT and positive economic change. For instance, a World Bank study showed that a 10 per cent increase in broadband adoption led to an increase in economic growth of 1.38 per cent (Qiang et al., 2009). Equally, studies of mobile phone penetration show a relationship between high mobile penetration and economic growth (Kumar, 2009). Indeed, the ITU Broadband Commission (2011 p.1) suggested that *"The benefits of broadband are profound – in opening up young minds to new horizons through educational technologies; in empowering women to expand their opportunities through genuine choices; in improving awareness of hygiene and healthcare; and in helping family breadwinners find work, a better salary or return on their goods. Through broadband, the provision of public services is transformed".* Despite this, accurate measurement and understanding of the impacts remain challenging, especially in the sphere of social impacts, unintended impacts and influence of and transformational potential of ICT on human activity (UNCTAD, 2011).

While there is mounting evidence on the positive national level economic benefits, one area where knowledge could be improved is how ICT and information has led to a re-orientation and transformation (or not) of human activity. That is, changes in activities in terms of how they are conducted, the actors, actions and laws/norms and the labour that contributes to the activity and how ICT introduced in one activity impacts on other activities and the creation of new activities. Therefore, a theoretical and practical challenge is what are the changes enabled by ICT[2] at the activity level? And, what are the approaches that can be used to frame ICT4D studies and augment understanding of the changes?

This paper argues that an activity theoretic perspective can help provide answers to these questions. It serves as an introduction to activity theory, demonstrating its basic concepts and identifies the potential contributions between activity theory and ICT4D field. In the next section, the paper suggests that an activity theoretic perspective is useful for understanding changes in activity/behaviour and providing insights into the ways that ICT has changed and improved (or not) activity and may engender new activities. Four principle contributions are described. Following this, the paper charts areas where the subject of ICT4D is both appealing, and is able to provide more comprehensive use of activity theory, in line with its philosophical underpinnings, in particular in areas where its application is currently lacking in other fields. It also outlines some challenges for the use of activity theory in ICT4D research and areas of future inquiry concerning the extension of activity theory in ICT4D research. The paper concludes by summarizing the main points and suggesting that the use of activity theory in ICT4D research is compatible with its underlying critical and emancipatory commitments and may yield interesting results and insights for practice and theory.

[2] For simplicity, in this paper the frame of reference of ICT is limited to "new" ICT, including the internet and communication devices (mobile phones) following a close approximation with other ICT4D authors (Grace et al., 2004; Kleine & Unwin, 2009).

2 THEORISING ICT, DEVELOPMENT, CHANGE AND HUMAN ACTIVITY

It has been argued that the theoretical contribution of research in the ICT4D field has been weak (Avgerou, 2010). It is also however challenged by the complexity of the field which encompasses social, cognitive, economic, political, development/humanitarian and technological issues. The complexity and multi-dimensionality of the field explains the difficulty in adopting relevant theoretical approaches to frame studies. Actor-Network Theory (ANT) is one theoretical approach that has remained popular (Brigham & Hayes, 2012; McBride, 2003). McBride (2003) used ANT to provide insights into how mobile technology is adopted within different countries and illuminated on the geographical factors, government policy, infrastructure, culture and economic models that pattern its spread. In McBride's study ANT provided a framework for describing the process of technology adoption and developing stories which explained the take-up. Like ANT, structuration theory, is commonly employed. Donner (2007) used an adaptation of structuration theory to explore the use of mobile phones and meanings behind certain uses. While Njihia and Merali (2013) demonstrated the value of Archer's morphogenetic approach in understanding and explaining the complexity of the broader context within which many developing country ICT projects are implemented. Sen's Capability Approach has also been applied in multiple ICT4D studies (and more generalist development studies) as a conceptual framework to illuminate upon the relationship between ICT and empowerment, capabilities and sustainable development (Bass et al., 2011; Grunfeld et al., 2011).

Several approaches with pragmatic origins, which have emerged from development studies, have also been used to frame ICT4D studies. The sustainable livelihoods approach in particular has proven useful for understanding the impact of ICT intervention, particularly at the programme level, by illuminating upon transformation in the vulnerability context, policies, institutions, processes and livelihoods assets. While largely employed to inform high-level policy decisions it has also been employed to frame theoretically driven studies of ICT and development (Alam et al., 2011; Duncombe, 2006).

In the next section activity theory is presented as a theory based framework for studying ICT4D. It also points to several theoretical contributions that can help overcome some of the theoretical limitations identified in the ICT4D literature (cf., Avgerou, 2010; Best, 2010). The discussion section (Section 3) returns to this point by emphasizing that activity theory has the potential to act as an emancipatory framework, addressing the essence of ICT4D research.

2.1 An activity theoretic perspective

Activity theory (or cultural-historical activity theory) is based on the concepts of the cultural-historical school of Russian psychology, which drew largely upon the works of Vygotksy (1978) between 1920 and 1930 (and others including Luria, Il'enkov and Leont'ev) centering on the unity of consciousness and activity taking into account cultural and historical influences on human actions. For a detailed introduction to activity theory see Engeström (1987), Leont'ev (1978) and Korpela et al., (2002).

In order to demonstrate how activity theory is useful, this section draws upon literature from several disciplines that have a tradition of using activity theory and are considered relevant fields to ICT4D. These include information science (Hassan Ibrahim & Allen, 2012; Wilson, 2008), IS (Korpela, et al., 2002; Wiredu & Sørensen, 2006), organisational science (Engeström, 2000), computer science and human computer interaction (HCI) (Nardi, 1996) and social psychology (Blunden, 2010). 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) which has contributed to the activity theory in the context of information and ICT, are heavily drawn on.

As observed in Karanasios and Allen (2013), in reviewing the extant use of activity theory, a gap is noted in its application in the field of international development and in particular ICT4D research. This is notable given its use in related fields (such as IS, information science and HCI). A small body of researchers have employed activity theory as a lens to problematise ICT4D through the use of contradictions and tensions in order to identify the need for transformation (Hooker, 2008) and guide systems development (Freitas & Byrne, 2006). Korpela, Soryan and colleagues developed and applied an IS development (ISD) methodology based on activity theory focusing on Nigerian software companies and the healthcare sector. Using activity theory they developed a detailed and practicable procedure for studying ISD as a work activity in context (Korpela, et al., 2002; Korpela et al., 2000; Soriyan et al., 2001). Their work remains the most comprehensive in this field. More recently, Karanasios and Allen (2013) used activity theory, in particular activity systems, to frame the study of the implementation of a broadband network and identify contradictions and tensions in the process of development, implementation and expansion.

In the following sections four multilevel contributions of activity theory are identified and expanded upon.

2.1.1 Contribution one: The activity system as a unit of analysis

The first contribution identified is the notion of an activity system. An activity system follows that activities are object-orientated, meaning that a *subject* (a person or collective) 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, collective or thing) in order to produce an outcome. Building on this simple expression of human activity, Engeström (1987) added the *community*, the *division of labour* 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 executed by a division of labour, which takes place between the subject and community.

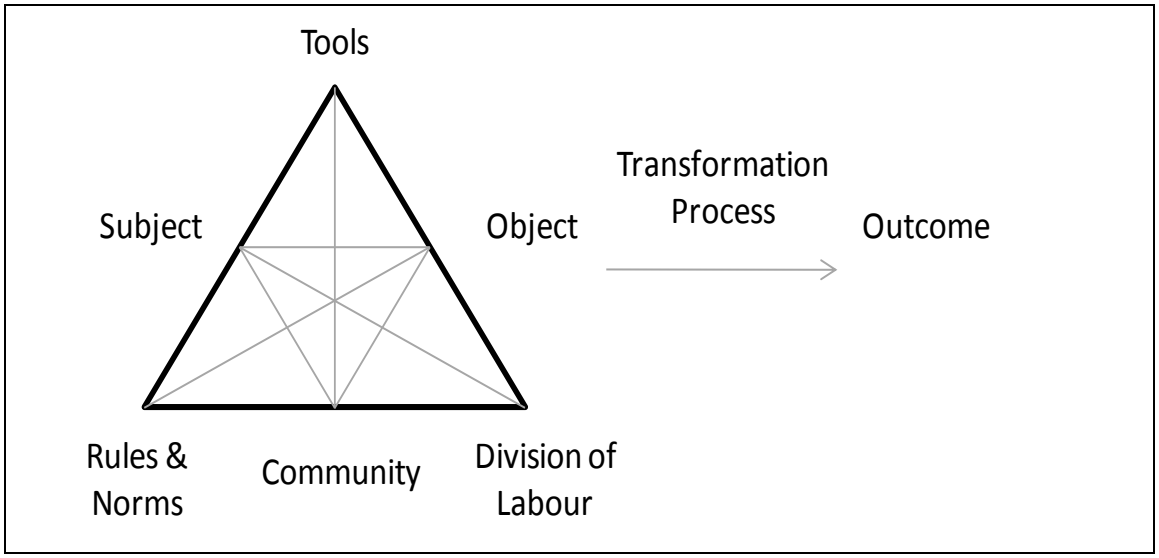

Figure 1: Engeström's (1987 p. 78) activity system

Tools act as a focal point in the activity theoretic perspective. Herein lie's one 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 (activity theory is also concerned with non-physical tools such as language, but for the purpose of this paper the

discussion is limited to physical tools i.e. ICT). Therefore, it is interested in the technology for its ability to enable improved vehicles of information and communication in an activity, rather than the artefact per se. Tools are not simply objects which are used, they are the result of a social process and previous activities, embody cultural characteristics (status, mobility, freedom or a "panopticon") and may later act as a norm and a means of labour in subsequent activities (Blunden, 2010). Further, the use of tools is both governed by rules and norms 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 (i.e. M-PESA), whereby transactions are performed using mobile technology, setting new norms surrounding trust, money and financial institutions (Morawczynski & Miscione, 2008). Likewise tools are likely to introduce new ways of working and transform the division of labour, creating new efficiencies, new types of labour or making some labour redundant. For instance, Jensen (2007) found that mobile phones allowed fisherman to negotiate prices and deals whilst at sea, changing the norms surrounding the activity and reducing the need for some labour. Here we can see that the introduction of ICT can transform the division of labour. The division of labour within an activity is a powerful notion in the context of ICT4D where researchers are interested in ways that ICT can improve conditions, create efficiencies and break down divides.

An activity does not take place in isolation of 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 operation of the business) the community includes potential customers, competitors and intermediaries (Karanasios & Burgess, 2008), all with their own norms and behaviours (and tools for mediating the interactions between one another), which are likely to influence the activity. Therefore, the activity system provides the site for analysing interaction between actors and collective structures and the use of tools (Allen et al., 2011).

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 towards which the subject directs his/herself in order to achieve a desired outcome
Object	Why is the activity taking place?	The problem situation or focus of the activity
Motivation	The stimulus for the activity	The reason(s) for the activity taking place. Activities can be poly-motivational*
Subject	Who is involved in carrying out the activity?	The individual or group who is undertaking the activity (and who's 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
Division of labour	Who is responsible for what when carrying out the activity and how are the roles organised?	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 subject interacts
Outcome	What is the (desired) outcome from the activity?	The outcome of the activity

Adapted from: Mwanza (2001), Engeström et al., (1999), Allen et al., (2011), Engeström and Miettinen (1999)

* Debates around the "object" vs. the "motivation" representing the true motive are not discussed here (cf. 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. Whereas, in activity theory, they are inseparable and form a single unit of analysis, the activity system (Allen et al., 2013). That is, agency/structure can be considered to be "co-constructed", implicitly or explicitly. The analytical lens offered by the activity system also captures the relevant context, in a holistic way, a critical challenge in ICT4D research (Hayes & Westrup, 2012a). At the same time, the author acknowledges that any simplified representation of context suffers from limitations (cf. Asdal & Moser, 2012; Hayes & Westrup, 2012a for more detailed discussion on context in social sciences and ICT4D).

2.1.2 Contribution two: the hierarchy of activity-actions-operations

Beneath the level of activity are *actions* and *operations*. This follows that an activity is made up of human *actions,* which are goal orientated, and contribute to the achievement of the object. That is, actions are accomplished because they realise a specific activity (Roth, 2007) and can be described as subordinate to an activity. *Operations* are distinguished from actions as being undertaken without conscious deliberation. This model is according to Bannon (1995) 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 (cf. Allen, et al., 2011 for 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 their relationship between the three levels. Table 2 illustrates the inter-relationship between 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/motives (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 (non-conscious) (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 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 for the activity) such as when to grow, what to grow, how to trade, interactions with extension workers and so on (ADB, 2010). For instance, iCOW (http://icow.co.ke/), a mobile application that runs on mobile phones prompts dairy farmers using voice/SMS on vital days of the gestation period, helps farmers find the closest vet, collects/stores produce and 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.

2.1.3 Contribution three: 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. They manifest to the researcher as problems, ruptures, breakdowns and clashes within the activity (Kuutti, 1999).

Contradictions exist at several levels: *primary* contradictions are found within a component of the activity (i.e. in the rules/norms, object etc.); *secondary* contradictions occur between constituents of the activity (i.e. between the community and the tool); *tertiary* contradictions occur between the current activity and its previous form (i.e. before change); and, *quaternary* contradictions occur between the activity and related activities (Engeström, 1987). Kutti (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*". 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/collective change effort, leading to 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).

An example of a common contradiction that spans the *secondary* and *tertiary* levels is between the community and the subject who may have contradictory motives towards 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 labour, power and norms within the activity, and generate contradictions as intermediaries act to protect their market interests, as this directly impacts their related activities (of matching customers with suppliers) (Gartner, 2004). At the same time, contradictions are not always straightforward and often emerge and are observed in hindsight as individuals depart from the status-quo. For example, the success of M-PESA emphasized the underlying existing problems around trust and financial institutions (Morawczynski & Miscione, 2008), and therefore mobile banking could be seen as a resolution of this contradiction.

2.1.4 Contribution four: 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 of determining how activities develop and change over time and follows that activities are woven, combining, merging, interpenetrating, dividing and become more complex over time (Spinuzzi, 2008). Korpela (2000 p.196) uses 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 inter-connected activities. Karanasios and Allen (2013) used the notion of connected

activities to observe the connections and contradictions between activities and generate insights into how tools developed in one activity were absorbed into other activities, enabling new opportunities for change.

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 and volunteer organisations converge on the scene and work largely independently towards a shared object(ive) of managing the disaster. The notion of connected activity systems offers a lens to understand how the individual agencies act individually and collectively in order to achieve the shared object(ive). An investigation of contradictions and tensions between the individual activities is likely to reveal several pertinent opportunities and directions for change.

3 DISCUSSION

It has been suggested that the ICT4D research community needs to identify research approaches of maximum benefit to theory and practice (Walsham & Sahay, 2006). The foregoing discussion brought together the theoretical perspective of activity theory and the field of study of ICT4D. It argued that there are several ways activity theory can contribute to research, knowledge and generate more meaningful insights on the role of ICT and information in human activity in the development context. It has not been the purpose of this paper to suggest that an activity theoretic approach is superior to other approaches (see Allen et al., (2013) see for comparison with critical realism; Miettinnen (1999) and Spinuzzi (2008) for comparison with ANT). Rather, this paper presents it as an appealing approach, which has been largely neglected in ICT4D research, and yet has many complimentary concepts with ICT4D research. Four principle multilevel 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; and, (4) the notion of networked activities and the shared object.

Underpinning these contributions is the often stated power of activity theory to "emancipate" subjects, prompting change and development; a form of emancipatory science, which is "*an approach to science whose effect is to emancipate its subjects, rather than predict or control them*" (Blunden, 2010 p. 5). However, the emancipatory agenda is largely lacking in extant social science studies 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, in order to unleash the emancipatory power of activity theory that collaborative, participatory and action research methods should be used. Likewise, Engeström (2008 p. 258) noted that "*If 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"*. This is an area where the ICT4D field can contribute to activity theory, by providing more nuanced analysis of change, use of tools (ICT), activity and the context of capitalism, particularly given that the remit of ICT4D is using ICT to improve socio-economic development, human rights and livelihoods. Therefore, an activity theoretic perspective provides the tools to examine ways in which activities can be improved (for instance, transforming the division of labour, identifying contradictions and changing rules and norms) and subjects emancipated.

Linked to this, is the issue of contradictions and the depth of the investigation of contradictions. The primary contradiction of activities within capitalism is that between the "use and exchange value" of commodities and this contradiction pervades all elements of an activity system

(Engeström, 2001). Engeström et al., (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 amongst scholars is rather insipid, and one where the ICT4D field can both provide significant insights and will find challenging to address in light of the issues and debates surrounding development, capitalism and poverty.

Activity theory is not a "theory" in the sense that it provides scientific theory (i.e. how something works); rather it is a "theory based" conceptual framework for inquiry of human activity consisting of a set of basic principles (Karanasios & Allen 2013) which can help explain certain phenomenon. It therefore falls within the category of a theory for "analysis", and "study design" and "explaining" (as a theory for describing/understanding how and why things happened) rather than a theory of "prediction" (cf. Gregor, 2006 for distinctions). The analytical and explanatory findings that emerge from the use of activity theory allow for "naturalistic or qualitative generalisation" (Stake, 1995), rather that statistical/quantitative inferences. 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 deeper explanation (Allen, et al., 2013) and 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 deeper/more generalist explanation (Nardi & O'Day, 1999). For instance, studies have combined structuration theory (Canary & McPhee, 2009) and institutional theory (Ogawa et al., 2008) with activity theory.

The growing use of activity theory by scholars in the IS/information fields can be described as pragmatic rather than following a doctrinaire approach (Allen, et al., 2013; Hassan Ibrahim & Allen, 2012). This suits the multiple and often practical objectives of ICT4D research and epistemological approaches. While qualitative and quantitative methods are accommodated, pluralistic methods which draw on approaches suited to ICT4D research such as participatory approaches (cf. Byrne & Sahay, 2006; Korpela et al., 1998) and action research, case study research, interviews, surveys and ethnography (Choudrie & Harindranath, 2011) would strengthen findings.

The manner in which the activity theoretic perspective is presented in this paper is suggestive of its potential for providing a better understanding of the changes to human activity as a result of ICT and improved vehicles of communication and information access. In order to effectively sketch out how activity theory can contribute to the ICT4D field some aspects have been omitted and others presented as relatively straightforward. For instance, there are several contested concepts, words of caution and unresolved debates which are not expanded upon in this paper (cf. Avis, 2009; Bakhurst, 2009; Blunden, 2010; Peim, 2009). One particular aspect is the messiness around the poly-motivational nature of the object of an activity (Kaptelinin, 2005), which are 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 recognises that activities have multiple motivations and underscores the complexity of the range of social, cultural and political and other factors which influence activities (Allen, et al., 2013) and the field of study that is ICT4D (Karanasios & Allen 2013).

The activity theoretic approach however is not without limitations. One limitation is that whilst it provides a framework for structured activity, it suffers from scalability to large-scale phenomenon. That is, it seems best suited to the study of micro/bounded-level activity rather than national level inquiry. Along these lines, the contributions outlined in this paper may not all be possible in one study. In fact, studies tend to rely on specific aspects such as contradictions (Helle, 2000; Hooker, 2008), or the activity level (Allen, et al., 2013; 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 which are not commonly used in IS and ICT4D research. In this way the activity theoretic approach is modular and can be adapted to particular study needs.

The contributions specified in this paper provide an approach for understanding the changes enabled by ICT in human activity, and goes beyond measuring short-term impacts, which encourages narrow understanding of ICT4D (Hayes & Westrup, 2012b), and rather illuminates on the deeper social-cultural changes at the activity level. The contributions would also be useful for illuminating upon failed examples of ICT intervention to support specific types of activity. A limitation of previous studies using activity theory is that they are largely temporal. Longitudinal studies which can examine and observe how activities transform, interpenetrate and how contradictions emerge and are resolved would provide valuable insights. Future work may also examine whether the use of the concepts identified in this paper are useful for development practitioners.

4 CONCLUDING REMARKS

In terms of further research and future agenda, this paper started by suggesting that there is a need for greater insights and research concerning the changes enabled by ICT at the activity level in the development context. Activity theory was introduced as a theory based framework to frame ICT4D studies in order to illuminate upon these changes. Four principle 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; and, (4) the notion of networked activities and the shared object. It also suggested that the use of activity theory in ICT4D research is compatible with its underlying critical and emancipatory commitments and may therefore yield interesting and unexpected results and insights for practice and theory. By doing so, it also identified several areas of critique related to the current use of activity theory in social science research and a space where the ICT4D can contribute. This paper has had relatively little prior work on to review and build on in the context of activity theory in ICT4D research, as such, there are many opportunities for further work.

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References

ADB. (2010). Information and Communication Technology for Development: ADB Experiences. Manila: Asian Development Bank.

Alam, M. J., Alam, N., & Alam, M. N. (2011). *An impact assessment of information and communication technology (ICT) for agriculture through livelihood framework in Bangladesh.* Paper presented at the IFIP WG 9.4: Social Implications of Computers in Developing Countries. 11th International Conference: Partners for Development - ICT Actors and Actions, Kathmandu, 22-25 May, 144-149.

Allen, D., Karanasios, S., & Slavova, M. (2011). Working with activity theory: Context, technology, and information behavior. *Journal of the American Society for Information Science and Technology, 62*(4), 776-788. doi: 10.1002/asi.21441

Allen, D. K., Brown, A., Karanasios, S., & Norman, A. (2013). How should technology-mediated organizational change be explained? A comparison of the contributions of critical realism and activity theory. *MIS Quarterly, 37*.

Asdal, K., & Moser, I. (2012). Experiments in Context and Contexting. *Science, Technology, & Human Values, 37*(4), 291-306.

Avgerou, C. (2008). Information systems in developing countries: a critical research. *Journal of Information Technology, 23*(3), 133-146.

Avgerou, C. (2010). Discourses on ICT and Development. *Information Technologies & International Development, 6*(3), 1-18.

Avis, J. (2009). Transformation of transformism: Engeström's version of activity theory. *Education Review, 61*(2), 151-165.

Bakhurst, D. (2009). Reflections on Activity Theory. *Education Review, 61*(2), 197-210.

Bass, J. M., Nicholson, B., & Subrahmanian, E. (2011). *Institutional analysis, the capability appraoch and ICT for development.* Paper presented at the IFIP WG 9.4: Social Implications of Computers in Developing Countries. 11th International Conference: Partners for Development - ICT Actors and Actions, Kathmandu, 22-25 May, 209-224.

Bertelsen, O. W., & Bødker, S. (2003). Activity Theory. In J. M. Caroll (Ed.), *HCI Models, Theories, and Frameworks: Towards an Interdisciplinary Science* (pp. 291-324).

Best, M. L. (2010). Understanding Our Knowledge Gaps: Or, Do We Have an ICT4D Field? And Do We Want One? *Information Technologies & International Development, 6*, 49-52.

Blunden, A. (2010). *An Interdisciplinary Theory of Activity*. Leiden: Brill.

Brigham, M., & Hayes, N. (2012). Hybridity, consulting and e-development in the making: inscribing new practices of impact assessment and value management. *Information Technology for Development*, 1-21. doi: 10.1080/02681102.2012.690171

Broadband Commission. (2011). The Broadband Challenge. Geneva: Broadband Commission.

Byrne, E., & Sahay, S. (2006). Participatory design for social development: A South African case study on Community-Based Health Information Systems. *Information Technology for Development, 13*(1), 71-94.

Canary, H. E., & McPhee, R. D. (2009). The Mediation of Policy Knowledge: An Interpretive Analysis of Intersecting Activity Systems. *Management Communication Quarterly, 23*(2), 147-187.

Choudrie, J., & Harindranath, G. (2011). *Institutional analysis, the capability appraoch and ICT for development.* Paper presented at the IFIP WG 9.4: Social Implications of Computers in Developing Countries. 11th International Conference: Partners for Development - ICT Actors and Actions, Kathmandu, 22-25 May, 627-653.

Cole, M., & Engeström, Y. (1993). A cultural-historical approach to distributed cognition. In G.Salomon (Ed.), *Distributed cognitions, psychological and educational considerations* (pp. 1-46). Cambridge: Cambridge University Press.

Donner, J. (2007). The Rules of Beeping: Exchanging Messages Via Intentional "Missed Calls" on Mobile Phones *Journal of Computer-Mediated Communication, 13*(1), article 1.

Duncombe, R. (2006). Using the Livelihoods Framework to Analyze ICT Applications for Poverty Reduction through Microenterprise. *Information Technologies and International Development, 3*(3), 81-100.

Engeström, Y. (1987). *Learning by Expanding: An Activity-Theoretical Approach to Developmental Research*. Helsinki: Orienta-Konsultit.

Engeström, Y. (2000). Activity Theory and the Social Construction of Knowledge: A Story of Four Umpires. *Organization, 7*(2), 301-310.

Engeström, Y. (2001). Expansive Learning at Work: Toward an Activity Theoretical Reonceptualization. *Journal of Education and Work, 14*(1), 133-156.

Engeström, Y. (2008). Enriching activity theory without shortcuts. *Interacting with Computers, 20*(2), 256-259.

Engeström, Y., & Miettinen, R. (1999). Introduction. In Y. Engeström, R. Miettinen & R.-L. Punamäki-Gitai (Eds.), *Perspectives on activity theory. Learning in doing : social, cognitive and computational perspectives* (pp. 1-16). Cambridge: Cambridge University Press.

Engeström, Y., Miettinen, R., & Punamäki, R.-L. (1999). *Perspectives on activity theory*. Cambridge: Cambridge University Press.

Er, M., & Lawrence, E. (2011). *Using Activity Theory to Examine Information Systems for Supporting Mobile Work.* Paper presented at the 24th Bled eConference, Bled, 12-15 June, 517-529.

Freitas, M. R. d., & Byrne, E. (2006). *Activity theory as an analytical tool: a case study of IS development for an anti-retroviral treatment clinic in South Africa.* Paper presented at the Annual Research Conference of the South African Institute of Computer Scientists and Information Technologists on IT Research in Developing Countries, Somerset West, South Africa 90-99.

Fuchs, C. (2009). The Role of Income Inequality in a Multivariate Cross-National Analysis of the Digital Divide. *Social Science Computer Review, 27*(1), 41-58.

Gartner, W. C. (2004). Factors affecting small firms in tourism: a Ghanaian perspective. In R. Thomas (Ed.), *Small firms in tourism : international perspectives* (pp. 35-52). Oxford: Elsevier Ltd.

Grace, J., Kenny, C., Qiant, C. Z.-W., Liu, J., & Reynolds, T. (2004). Information and Communication Technologies and Broad-Based Development: A Partial Review of the Evidence *World Bank Working Paper No.12*. Washingtom: World Bank.

Gregor, S. (2006). The nature of theory in information systems. *MIS Quarterly, 30*(3), 611-642.

Grunfeld, H., Guddireddigari, S., Marian, B., Peter, J., & Kumar, V. (2011). Analysing an ICT4D project in India using the capability approach and a virtuous spiral framework. In E. Adomi (Ed.), *Handbook of research on information communication technology: trends, issues and advancements* (pp. 50–75). Hershey: IGI Global.

Harris, R. W. (2005). Explaining the success of rural Asian telecentres. In R. M. Davison (Ed.), *Information systems in developing countries : theory and practice* (pp. 83-100). Hong Kong: City University of Hong Kong Press.

Hassan Ibrahim, N., & Allen, D. (2012). Information sharing and trust during major incidents: Findings from the oil industry. *Journal of the American Society for Information Science and Technology, 63*(10), 1916–1928. doi: 10.1002/asi.22676

Hayes, N., & Westrup, C. (2012a). Context and the processes of ICT for development. *Information and Organization, 22*(1), 23-36.

Hayes, N., & Westrup, C. (2012b). Power/knowledge and impact assessment: creating new spaces for expertise in international development. *New Technology, Work and Employment, 27*(1), 9-22.

Helle, M. (2000). Disturbances and contradictions as tools for understanding work in the newsroom. *Scandinavian Journal of Information Systems, 12*(1), 81-113.

Hooker, M. (2008). 1:1 Technologies/Computing in the Developing World: Challenging the Digital Divide. Dublin: GeSCI.

ITU. (2011). ICT services getting more affordable worldwide Retrieved 15 Oct, 2012, from http://www.itu.int/net/pressoffice/press_releases/2011/15.aspx

Jensen, R. (2007). The digital provide: Information (technology), market performance, and welfare in the South Indian fisheries sector. *The Quarterly Journal of Economics, 122*(3), 879-924.

Kaptelinin, V. (1996). Activity Theory: Implications for Human-Computer Interaction. In B. Nardi (Ed.), *Context and Consciousness: Activity Theory and Human-Computer Interaction*. Cambridge, MA: MIT Press.

Kaptelinin, V. (2005). The Object of Activity: Making Sense of the Sense-Maker. *Mind, Culture, and Activity, 12*(1), 4-18.

Karanasios, S. (2011). New and Emergent ICTs and Climate Change in Developing Countries. In R. Heeks & A. Ospina (Eds.). Manchester: Centre for Development Informatics, University of Manchester.

Karanasios, S., & Allen , D. K. (2013). ICT and Development in the Context of Chernobyl Nuclear Power Plant Closure. *Information Systems Journal, 23*(2). doi: 10.1111/isj.12011

Karanasios, S., & Burgess, S. (2006). Exploring the Internet use of small tourism enterprises: evidence from a developing country. *Electronic Journal of Information Systems in Developing Countries, 27*(3), 1-21.

Karanasios, S., & Burgess, S. (2008). Tourism and Internet adoption: a developing world perspective. *International Journal of Tourism Research, 10*(2), 169-182.

Kleine, D., & Unwin, T. (2009). Technological Revolution, Evolution and New Dependencies: what's new about ict4d? *Third World Quarterly, 30*(5), 1045-1067. doi: 10.1080/01436590902959339

Klugman, J. (2011). Human Development Report 2011 Sustainability and Equity: A Better Future for All. New York: United Nations Development Programme (UNDP).

Korpela, M., Mursu, A., Soriyan, A., Eerola, A., Häkkinen, H., & Toivanen, M. (2004). Information systems research and development by activity analysis and development: Dead Horse or the Next Wave? *IFIP International Federation for Information Processing* (Vol. 143, pp. 453-471): Springer.

Korpela, M., Mursu, A., & Soriyan, H. A. (2002). Information Systems Development as an Activity. *Computer Supported Cooperative Work, 11*, 111–128.

Korpela, M., Soriyan, H. A., & Olufokunbi, K. C. (2000). Activity analysis as a method for information systems development: General experiments from Nigeria and Finland. *Scandinavian Journal of Information Systems, 12*(1), 191-210.

Korpela, M., Soriyan, H. A., Olufokunbi, K. C., Onayade, A. A., Davies-Adetugbo, A., & Adesanmi, D. (1998). Community Participation in Health Informatics in Africa: An Experiment in Tripartite Partnership in Ile-Ife, Nigeria. *Computer Supported Cooperative Work, 7*, Computer Supported Cooperative Work.

Kumar, R. (2009). A policy overview *India: The Impact of Mobile Phones. The Policy Paper Series* (pp. 1-4): Vodafone.

Kuutti, K. (1999). Activity theory, transformation of work, and information systems design. In Y. Engeström, R. Miettinen & R.-L. Punamäki-Gitai (Eds.), *Perspectives on activity theory. Learning in doing : social, cognitive and computational perspectives* (pp. 360-376). Cambridge: Cambridge University Press.

Leont'ev, A. N. (1978). *Activity, Consciousness, and Personality*: Prentice-Hall.

Ma, L., Chung, J., & Thorson, S. (2005). E-government in China: Bringing economic development through administrative reform. *Government Information Quarterly, 22*(1), 20-37.

McBride, N. (2003). Actor-Network Theory and the Adoption of Mobile Communications. *Geography, 88*(4), 266-276.

Miettinen, R. (1999). The riddle of things: Activity Theory and Actor-Network Theory as approaches to studying innovations. *Mind, Culture & Activity, 6*(3), 170-195.

Morawczynski, O., & Miscione, G. (2008). Examining trust in mobile banking transactions: The case of M-PESA in Kenya. In C. Avgerou, M. Smith & P. van der Besselaar (Eds.), *Social Dimensions Of Information And Communication Technology Policy* (Vol. 282, pp. 287-298): Springer Boston.

Mwanza, D. (2001). *Where Theory meets Practice: A Case for an Activity Theory based Methodology to guide Computer System Design.* Paper presented at the INTERACT' 2001: Eighth IFIP TC 13 Conference on Human-Computer Interaction, Tokyo, July 9-13,

Nardi, B., & O'Day, V. (1999). *Information ecologies, using technology with heart*. Cambridge Mass: MIT Press.

Nardi, B. A. (1996). Activity theory and human computer interaction In B. A. Nardi (Ed.), *Context and Consciousness: Activity Theory and Human-Computer Interaction* (pp. 1-8). Cambridge, Massachusetts: The MIT Press.

Njihia, J. M., & Merali, Y. (2013). The Broader Context for ICT4D Projects: A Morphogenetic Analysis. *MIS Quarterly, forthcoming*.

Ogawa, R. T., Crain, R., Loomis, M., & Ball, T. (2008). CHAT-IT: Toward Conceptualizing Learning in the Context of Formal Organizations. *Educational Researcher, 37*(2), 83-95.

Ospina, A. V., & Heeks, R. (2010). Unveiling the Links between ICTs & Climate Change in Developing Countries: A Scoping Study. Manchester: Centre for Development Informatics, Institute for development Policy and Planning (IDPM), University of Manchester.

Peim, N. (2009). Activity theory and ontology. *Education Review, 61*(2), 167-180.

Puri, S. K., Sahay, S., & Lewis, J. (2009). Building participatory HIS networks: A case study from Kerala, India. *Information and Organization, 19*(2), 63-83.

Qiang, C. Z.-W., Rossotto, C. M., & Kimura, K. (2009). Economic Impacts of Broadband *Information and Communications for Development 2009* (pp. 35-50). Washington, DC: The World Bank.

Ramasamy, B., Chakrabarty, A., & Cheah, M. (2004). Malaysia's leap into the future: an evaluation of the multimedia super corridor. *Technovation, 24*(11), 871-883.

Roth, W.-M. (2007). Emotion at Work: A Contribution to Third-Generation Cultural-Historical Activity Theory. *Mind, Culture, and Activity, 14*(1), 40 - 63.

Rovere, R. L. L., & Melo, L. d. J. (2012). *A profile of ICT Entrepreneurs in Brazil.* Paper presented at the CONF-IRM, Vienna, 21-23 May, Paper 43.

Soriyan, H. A., Mursu, A. S., Akinde, A. D., & Korpela, M. J. (2001). Information systems development in Nigerian software companies: Research methodology and assemssment from the healthcare sector's perspective. *Electronic Journal of Information Systems in Developing Countries, 5*(4), 1-18.

Spinuzzi, C. (2008). *Network: Theorizing Knowledge Work in Telecommunications*. Cambridge: Cambridge University Press.

Stake, R. E. (1995). *The art of case study research*. Thousand Oaks, Calif.: Sage Publications.

Stillman, L., Herselman, M., Marais, M., Boshomane, M. P., Plantinga, P., & Walton, S. (2012). Digital doorway: Social-technical innovation for high-end communities. *Electronic Journal of Information Systems in Developing Countries, 50*(2), 1-18.

UNCTAD. (2011). Measuring the Impacts of Information and Communication Technology for Development *Current Studies on Science, Technology and Innovation No.3*. Switzerland: United Nations Conference on Trade and Development (UNCTAD).

van Dijk, J. A. G. M. (2006). Digital divide research, achievements and shortcomings. *Poetics: The digital divide in the twenty-first century, 34*(4-5), 221-235.

Vygotsky, L. (1978). *Mind in society: the development of higher psychological processes*. Cambridge, Mass: Harvard University Press.

Walsham, G., & Sahay, S. (2006). Research on Information Systems in Developing Countries: Current Landscape and Future. *Information Technology for Development, 12*(1), 7-24.

Wilson, T. D. (2008). Activity theory and information seeking. *Annual Review of Information Science and Technology, 42*, 119-161.

Wiredu, G. O. (2007). User appropriation of mobile technologies: Motives, conditions and design properties. *Information and Organization, 17*(2), 110-129.

Wiredu, G. O., & Sørensen, C. (2006). The dynamics of control and mobile computing in distributed activities. *European Journal of Information Systems, 15*, 307-319.

World Bank. (2012). How we classify countries Retrieved 9 October, 2012, from http://data.worldbank.org/about/country-classifications/country-and-lending-groups