

Theoretical Framing of ICT4D Research

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Abstract. Research on information and communication technologies for development (ICT4D) requires the combination of multiple theoretical strands. Central among them are the foundational theories on technology, on context, and on socio-economic development. In addition, ICT4D research draws from middle range theories, which shed light on specific topics of ICT related phenomena in the context of a developing world. In this paper, I explain what each of the three foundational theories is about and indicate the need for middle range theories. I suggest that the challenge for ICT4D research is to draw creatively from existing theoretical debates and to construct analytical routes and theoretical propositions suitable for the complex phenomena of ICT and development.

Keywords: ICT4D · Theory of technology · Contextual research · Socio-economic development · Middle range theory

1 Introduction

Research on ICT in developing countries emerged in the 1980s, with studies of computer diffusion in various countries and studies of government policy about the use of computers in various sectors [1–3]. At that time, governments in developing countries with pressing socio-economic needs used to tax computers as luxuries. Since in the then global economy the competitive advantage of many developing countries was cheap labour, government economists did not see computerization as a prudent policy. They feared that automating factories and offices would deprive their economies of much needed jobs in industrial and service sectors. However, early researchers of what came to be known as ‘ICT for development’ (ICT4D) shared the belief that computers can solve many of the severe problems confronting developing economies and societies, such as grossly inefficient government administration, inadequate provision of health care and education and inability to compete in a global economy. If only poor countries could acquire computers and engineering know-how to put them in effective use!

In the 1990s, concern about the slow diffusion of computers was compounded with concern about limited telecommunications infrastructures, which severely restricted access to the internet. It was about that time that international development organizations (the World Bank, various UN agencies, ITU, national development aid organizations such as Canada’s IDRC) and multiple NGOs started promoting ICT and access to the web. The discourse on the digital divide/digital inclusion has been anchored on the argument that ICT is necessary for development. Numerous publications of international development agencies produced tables correlating country development and internet

accessibility indexes [4–8], projecting a cause and effect relationship of ICT and development. At the top of the tables are countries that achieved high ICT diffusion with dynamic privatized telecommunication service providers; they are rich and have well educated and healthy population and democratic regimes. At the bottom of the tables are countries with pitifully little computing and telecommunication capacity; they are the poorest of the poor with low human development indicators and failed states. The causality between ICT diffusion and economic growth is supported with basic arguments about ICT and economic performance from neo-classical and institutional economic theories [9]. Moreover, as good government, fundamental democratic principles of freedom, equality, liberal education and health assume central importance in the debates of international development [4, 10], it is suggested that ICT is indispensable means for achieving such developmental objectives too.

Anecdotal evidence of transformative effects of ICT helped to popularise the causal claims about ICT and development. Women of a remote village on the Andes were selling handicrafts over the internet to American customers without ever having to leave their village or change their traditional lifestyle. Fishermen in Kerala started getting better prices for their catch as they received information on their mobiles about fish prices in the markets of different towns while they were still at sea. Indian villagers also made online requests and received government certificates in information telecentres without having to travel to towns and queue for hours in government offices. More than that, e-government software empowered them to keep government officials accountable by allowing them to file electronically grievances if they were not satisfied with government services.

Research on the implementation and use of computers and the internet in various types of organizations and in communities of developing countries, showed a more complex relationship of ICT and development. At close examination, the anecdotal stories of transformational ICT uses were shown to be more complex than initially reported. The e-commerce activities of the women on the Andes village depended on the facilitatory business skills of a Dutch visitor to the village, who set up their web page for orders, sales and payments. Other women's cooperatives that set up an online presence for their handicrafts could not that easily succeed in selling to international markets [11]. Keralite fishermen's optimal pricing on their catch had various other important conditions at play in addition to the use of mobiles [12]. And telecentres in Indian villages did not quite transform the relationship of Indian villagers with the Indian government [13]. Many of them struggled to be sustained and with time disappeared [14].

This is not to conclude that ICT diffusion has not been contributing developmental effects. In many developing countries, socio-economic conditions have been improving the last three decades; as millions of families have been lifted out of extreme poverty, ICT has been increasingly used in all sectors and all countries. Although not as ordinarily present as in the global North, computers, internet connectivity and mobile phones are found almost everywhere and are visible in the practices of all development policies. It is reasonable to assume that ICT plays an enabling role in socio-economic improvements. But a simple cause and effect relationship between ICT diffusion and development outcomes is misleading because it hides other conditions at play, and the

challenge for ICT4D research is to understand and explain the complex processes of ICT-mediated socio-economic change.

For this, a lot can be learnt from the general theoretical debates on the relationship of ICT and organizational change in the Information Systems (IS) field. We need to add theoretical capacity to address two salient aspects of ICT4D research: the developing countries context and socio-economic development [15–17]. In this paper, I discuss the theoretical framing of ICT4D research as a combination of foundational theories on technology, context and development, with middle range theories, that is, theories of a less abstract nature, which are relevant for the specific research questions under investigation.

2 Theories of Technology

IS research has produced valuable insights on the theoretical relationship of ICT and organizational change by focusing on the interaction of individuals with ICT artefacts in the performance of organizational tasks. Seminal contributions to that end include Markus's [18] explanation of resistance to change, Markus and Robey's [19] essay on the causal structure of IT and organizational change, and Orlikowski and Iacono's [20] theorization of the ICT artefact. These contributions set foundations about the causal relationship between ICT artefacts and social change, which avoid technology deterministic and social deterministic theses. The former locates causal agency solely at the properties of technology and forms propositions of universal impact of specific technologies, irrespective of social context, while the latter locates causal agency at the social alone, positing that the material properties of technology do not matter as far as human societies are concerned [21]. Rejecting both technology and social determinism as inadequate to explain IS phenomena, IS research developed perspectives that locate causality at the interaction of people with technology and consider IS phenomena as being formed by the engagement of individual actors with IT artefacts in their social context.

Several research streams have elaborated on the IT/human actor relationship as the fundamental causal explanation of IS phenomena. They include the sociotechnical systems approach [22, 23] and various approaches taken from the interdisciplinary field of Science and Technology Studies (STS) [24–26] that articulate propositions about the way IS innovation happens. Particularly influential from among the STS theories has been actor network theory (ANT), which overcomes the lurking risk of social determinism by recognising technology itself as 'actor' and by seeing reality as formed by the actions of hybrid sociotechnical entities [27–30]. More recently, the theorization of the relationship between IT and human action has focused on the notion of 'socio-materiality' [31–37]. A major stream of arguments in this debate reaffirms the idea that IS phenomena result from the dynamic relation of the material properties of ICT with the socially derived ability of their human participants to act. It elaborates on the way ICT artefacts and people interact to bring about IS phenomena, using concepts such as 'affordances' [32, 35, 38], 'imbrications' [39], or 'functions' [40]. According to these views, both the ICT artefact and the human actor possess causal capacity in the formation of IS phenomena. They are ontologically independent (i.e. one may disappear

and the other may still exist) and epistemologically separable (i.e. each of them can be studied and understood without studying the other).

An alternative perspective takes its departure from an assumption of ontological primacy of actions rather than entities – whether artefacts of human beings. It considers IS phenomena as mutually re-configuring ‘ensembles’ of human and technology entities that are constantly producing/reproducing or changing each other [33, 36, 41]. This view implies that IS phenomena are constituted by a dynamic human and technology entanglement (intra-actions). Neither technologies nor people have an independent, self-contained existence and they are epistemologically inseparable – that is, impossible to understand by studying them as independent entities.

Both versions of sociomateriality theory focus on micro-settings of situated practice where intra-actions and interactions of ICT artefacts and human beings occur. They both allude to broader contexts of IS phenomena [36, 38, 42], but neither elaborates on the way contexts beyond situated practice are implicated in IS phenomena. Context remains elusive in the IS theories of sociomateriality and this limits their explanatory capacity in ICT4D research.

3 Contextualizing the Study of ICT

A distinguishing feature of ICT4D research is that it includes national, regional or community conditions and processes in the explanation of IS phenomena. But such contextual research is confronted with the question of what, out of the infinite number of conditions and processes amidst which IS phenomena are formed, need to be accounted for [17, 43]. In other words, what is relevant context for ICT4D phenomena?

I define context as the processes and conditions, other than the constituent causal sociomaterial interactions (or intra-actions) of IS phenomena, that affect their formation and are effected by them. In other words, context refers to conditions and processes in the environment of an observed IS phenomenon. For example, an information system of a doctor’s surgery consultation involves the interaction of a knowledgeable actor (the doctor) and a complex set of software/hardware/telecommunications artefacts. A description of the doctor’s interaction with the system’s functionality provides a rudimentary explanation of the ICT-mediated medical consultation, diagnosis and treatment decision. But we need to consider much more than the clinician/IT interaction to find answers to questions of interest in ICT4D research. For example, to understand whether and how a computerised clinician consultation system may help doctors to treat more effectively the population of a village, a city, or a country and improve population health outcomes or to explain why such systems may result in variation of health service delivery we may need to examine the organizational structures and processes of the wider health care system and the life conditions and health vulnerabilities of the population [44]. The theoretical challenge for contextual research is to identify what else, beyond the constituent parts of an information system (i.e. the functionality of the technology, the behavioural characteristics of the doctor, and their interaction), needs to be taken into account to construct convincing explanation of IS phenomena and to assess their developmental impact.

Contextualization is the research design concerned with the identification of relevant context. It involves two decisions: (a) the choice of conditions and processes of the environment of a focal IS phenomenon to be studied by the research and (b) the choice of domains to be researched as the phenomenon's environment.

3.1 Identifying Relevant Contextual Conditions and Processes

ICT4D research has studied a large variety of contextual aspects related with culture, power structures, history, etc. Increasingly, these are not ad hoc findings of empirical studies but derived from middle range theories adopted to address specific research questions. For example, in our research of entrepreneurial opportunities created by the internet in developing countries [45], my co-author and I first agreed that, in order to understand why the diffusion of the internet is having widespread entrepreneurial effects in some regions in the world and almost no such effects in others, we should consider entrepreneurial activity as a socially embedded process. There are other ways to explain entrepreneurial activity, for example by studying the behavioural characteristics of the individual entrepreneur, but our interest was in understanding why individuals come to start doing business online in some regions and not others. From preliminary research in China we understood that 'net-preneurs' in that country were clustered in some villages and towns and they all relied at the time of our research on the services of the giant IT services company Taobao. Existing knowledge couldn't explain why starting business on the internet was clustered in communities. We thought it a paradox that, while the internet overcomes information asymmetries, shrinks physical distance, and enables business collaboration and economic exchange from any place, entrepreneurship was not occurring randomly but was clustered.

We read a lot about clustering and entrepreneurship, ICT innovation, competition and collaboration and e-commerce. We found that there had been research that paid attention to the social embeddedness of internet-based activities in IS research and organizational studies, mostly drawing from the importance of networked social relations [46–49]. Relational embeddedness was therefore a promising theory to explain our puzzling observation of entrepreneurial clustering. But we thought that there were also other conditions enabling the formation of the Chinese clusters, which were not considered in the theories of relational embeddedness. We needed, for example, a conceptual language to address the role of the ICT services provider, on whom the net-preneurs so heavily relied. We thought that the institutional structure of the Chinese economy had also something to do with the emergence of small-scale online new business ventures by large numbers of people without prior business experience. This led us to complement the relational embeddedness approach for the study of the conduct of online business with a version of institutional embeddedness proposed by the economic historian Karl Polanyi and his followers [50]. These middle range theories of social embeddedness led us to construct an explanation of the emergence of entrepreneurial clusters in Chinese communities in terms of some specific institutional conditions of the Chinese political economy, the ICT services sector and aspects of culture in contemporary China.

Unlike the very abstract theories about the fundamental nature of social phenomena, such as the theories of technology I outlined in the previous section, middle range theories are relevant for specific topics [51]. The grounding of contextual explanation in middle range theory guides attention to contextual factors that may contribute to bringing about an observed phenomenon and the mechanisms through which they do so. It strengthens the ICT4D field by allowing us to trace the variation of research findings produced in different empirical studies [52]. But the choice of middle range theory limits research attention to the constructs of the theories we use. In ICT4D research we tend to use theories from social science fields, most frequently organizational theory, behavioural or social psychology, sociology and economics. This has resulted in studies that consider only social aspects of context, as in the example of our research of Chinese net-preneurship. Notable for their rarity are explanations that account for material/technological aspects of the environment of ICT4D phenomena, including temporal and spatial characteristics and material life conditions. It is odd that most IS research adopts a sociomaterial perspective of IS phenomena but a purely social perspective of their context. This is a weakness that I hope future ICT4D research will overcome by developing sociomaterial theoretical perspectives of the broader setting of IS phenomena.

3.2 Identifying Relevant Domains of Context

While in most IS research the assumed context of IS phenomena has been the organization in which ICT systems are implemented and used, ICT4D research tends to extend the research to domains of enquiry such as communities, countries, or global institutions. As I noted above, our research tends to consider context as a social domain, and we usually seek to unravel influences on the shaping of IS phenomena from social collectives that are assumed to be layered, typically organizations, regions, countries and the world at large. Our research design often involves cross-level or multi-level research strategies [53–55]. The layered view of social collectives is underpinned by a systems theory perspective, according to which social collectives emerge from the interaction of their sub-systems and, subsequently, they influence the interactions among their constituent subsystems. A good example of this is research that adopted Pettigrew’s ‘contextualist’ ideas [56] and studied IS development and impact as a process of change that unfolds through time under organizational and national influences [57, 58]. Walsham’s [58] case studies of IS development explained key decisions and actions of IS development with reference to the changing culture and politics of the organization, both linked to national socio-economic and political changes. Similarly, Madon’s [57] case study of the introduction of computer based information systems in local administration offices in India explained their limited impact by showing how officers made sense of and used that innovation in the context of the layered Indian administration as well as the broader culture and social stratification of India.

The layered contextualization approach is compatible with and can be supported by middle range theories in established social sciences, such as political economy and sociology. But it has been criticised for reifying conventional notions of social

structures. An alternative approach is achieved by tracing relations of the constituent parts of an IS phenomenon with other artefacts, individuals, and social groups contributing to its formation [59, 60]. In such relational approaches the study of IS phenomena may include influences from generally recognizable categories of social collectives, such as organizations and national states, but not necessarily in a layered order. Without levels of analysis that associate a phenomenon with assumed enduring social structures, this relational contextualization approach is open ended and the identification of contextual entities that create conditions of possibility of a phenomenon is a matter of empirical investigation in specific cases. The tracing of relevant context by examining relations of the constituent entities and processes of a focal phenomenon with a more extended range of entities or processes is a research design with the potential to develop powerful new explanatory theory.

4 Drawing from Theories of Socio-Economic Development

Socio-economic development is a multidisciplinary academic field in its own right. What do we seek to gain from its theories and how can we find our way in this complex area of academic research and policy practice? So far, ICT4D research has derived from development theories mostly definitions of desirable ends that ICT innovation should aspire to serve and to a lesser extent an understanding of the processes for achieving them.

Two means/ends relationships between ICT and development are discernible in ICT4D research. The first adopts the notion of development as economic growth [61] underpinned by the assumption of neo-classical economics that technology increases productivity in organizations and, in an aggregate form, the economy at large. It thus gives rise to cause and effects projections of ICT impact in developing countries that I mentioned in the introduction. In its crudest - yet widespread - form, the economic growth approach to development associates measures of the diffusion of computers, internet connections or mobile phones with increases of Gross Domestic Product (GDP) and employment. For example, the 2015 Human Development Report, quotes a study which estimates that ‘if Internet access in developing countries were the same as in developed countries, an estimated \$2.2 trillion in GDP and more than 140 million new jobs – 44 million of them in Africa and 65 million in India – could be generated’ [62, p 89]. Similarly, Chavoula [63] derives the following estimate from an econometric analysis: ‘on average, a 1% increase in mobile telephony users for every 100 people would increase per capita GDP by 0.39%, 0.26% and 0.15% for the upper-middle-, low-middle- and low-income countries, respectively’.

IS research has elaborated nuanced variants of ICT and economic performance, according to which productivity and economic growth are not just accrued from investment in ICTs but require management and policy interventions for organizational and institutional change [64, 65]. Socio-economic analyses of ICT and economic growth have also drawn from alternative economic approaches, which shift attention to other indicators of economic change, such as transaction costs [66] and competitiveness [6], and emphasise the importance of social institutions [67, Chap. 17]. In promoting ICT diffusion, international development agencies too explain that the way ICT

innovation contributes to economic performance of organizations, sectors and countries is multifaceted and marred with uncertainty [5]. In short, economic developmental outcomes do not result from the diffusion of ICT alone, and policy makers have to muddle through models that associate economic growth benefits of ICT with government interventions for regulation, structural reforms, education and social welfare [68]. This is clearly an area where ICT4D research can make important contributions. We should endeavour to answer the question: what does it take for ICT innovation to contribute to economic effects such as business creation, employment, elimination of poverty, government revenue generation to fund social services programmes?

The second perspective of development that has been influential in ICT4D research, centres on the notion of 'human development', which underpins the UNDP's Human Development reports, and the UN's initiatives known as Millennium Development Goals and Agenda for Sustainable Development (Millennium Project 2006; United Nations Development Programme (UNDP) 2016). The notion of human development draws from Amartya Sen's ideas of development as people's freedom to 'lead lives that they value', known also as the 'capabilities approach' [69]. Key concepts in Sen's theory are wellbeing, which refers to a person's 'functionings' (what he/she can do or be) and agency, defined in this theory as the pursuance of what a person values or regards as important. Policies aiming to enhance human development adopt indicators for health, education, work, and political freedom. Income indicators are also included but they are understood as means for enlarging people's choices rather than as an end condition of development.

Sen's contribution to the critique of development as economic growth created awareness that development goals involve a moral choice. His capabilities theory has become the espoused theory of development for many ICT4D researchers. It serves as a normative intellectual device, from which ICT4D research derives objectives of ICT innovation. For example, from the perspective of the capabilities theory, conventional topics of IS research, such as entrepreneurial ICT activities or e-government, are examined for their potential and actual empowering effects for disadvantaged citizen groups (Jimenez and Zheng 2016; Madon 2005). More importantly, by invoking the capabilities approach, ICT for development researchers have broadened the research agenda of the field to study questions that rarely feature in IS research, but are crucial for human development, such as addressing gender inequalities [70] and education gaps [71].

In addition to defining development goals, ICT4D research can draw from the debates on socio-economic development valuable lessons about the nature of the processes of action for the realization of development goals. For example, the operationalization of development theory in policy action involves conflicts of interests and strategies for domination at the local and global level. A thought provoking study that considers multiple aspects of the political economy of ICT-driven development is Carmody's [72] critical study of the developmental role of mobile phones in Africa.

It is important to engage that ICT4D research engages with the debate on the definition of the general notion of 'development' and the processes it entails. But I would argue that the theoretical challenge of ICT4D regarding development is not the choice between economic growth or human development approaches, but the grounding of our research on theories that problematise desirable socio-economic objectives with adequate specificity for the domains of ICT-enabled activities we study.

For example, recently in my research I needed theoretical bearings to assess the contribution of ICT to the conduct of elections in Brazil and India, the formation of entrepreneurial activity in Chinese communities, or government administration reform in various countries. I deduced relevant developmental goals from theories that elaborated on desirable change, relevant contestations, and required enablers and impediments that are likely to frustrate the developmental contribution of ICT innovation specifically for each of these research areas.

I therefore suggest that the engagement of ICT4D research with socio-economic development discourse is not confined to the debates on the general definitions and approaches to ‘development’. It is dispersed in a much broader theoretical literature that addresses transformative options in a range of domains of human activity. Again, such theoretical choice comprises middle range theories that conceptually describe problem situations and puzzling conditions of human institutions and offer models and analyses that help us identify the potential transformative role of ICTs.

5 Putting Together Multiple Theories in the Framing of Empirical ICT4D Research

The crafting of ICT4D research involves the framing of each of our studies by combining multiple theories. In this essay, I suggested three foundational theoretical perspectives that underpin all ICT4D research: ways of thinking about ICT and organizational or socio-economic change, ways of identifying relevant context, ways of thinking about transformations that make a positive difference in people’s life conditions. These are present in all ICT4D research, but they are not always made explicit or argued about. In addition, ICT4D research involves conceptual vocabularies and assumptions of mechanisms of change that are specific to a topic under study – that is, middle range theories.

A comparison of two PhD studies in my university can exemplify choices in the theoretical framing I suggest for ICT4D research. Both studies concern the implementation of consecutive ICT systems for international trade management: one in Mexico, by Carla Bonina¹, the other in Ghana, by Atta Addo². They both adopted a sociotechnical perspective of ICT, assuming a recursive dynamic relationship between ICT and organizational change, according to which IT is implemented to bring about organizational arrangements deemed desirable by some stakeholders, but is likely to be contested by others. Neither Bonina’s nor Addo’s research takes an explicit position regarding the definition of development – economic growth or human development. Instead, they both engage with specific questions about desirable transformation of public administration in relation to the development discourses in the countries they study and international influences.

In Bonina’s study, the focal potential transformation is the mix of ‘public values’ at the core of public administration. She examines whether ICT implementation amidst

¹ http://etheses.lse.ac.uk/584/1/Bonina_public_values_information_2012.pdf.

² Forthcoming.

organizational reforms triggered by policies of economic liberalization altered core values of public bureaucracies, such as fair service by following the rule of law. She complements the theoretical analysis of public values with a theory on discourse (critical discourse analysis) to trace ideological influences that shaped the orientation of ICT implementation towards supporting specific public value combinations. In Addo's study, the focal transformation is the 'modernization' of public sector services, that is, the reduction of red tape that has historically been formed in Ghana's patrimonial tradition of government administration. He develops an analytical basis by combining a typology of government administration historically formed in developing countries with the institutional logics theory of organizational sociology [73]. Bonina's contextualization approach spans two layers of context. Her analysis associates ICT implementation and its effects on the values underpinning practice in international trade administration with Mexico's political economy – specifically the policies of successive governments for opening up the economy and pursuing economic development through strengthening the competitiveness of Mexican firms. Addo's contextual analysis associates the situated practice of civil servants with organizational reform interventions of the public sector. It is thus contained at the level of the inter-organizational domain of Ghana's public administration.

I hope the two examples show the kind of combinations of foundational and middle range theories required in ICT4D research. Both these studies address questions about the developmental effects of the same techno/organizational innovation – ICT platforms for the administration of international trade - and contribute insights on the way ICTs come to make a difference in the public sector of developing countries. They adopt the same foundational theory of technology, but they contextualise their research differently. Importantly, they both draw also from middle range theories - on public values, institutional logics, critical discourse analysis, ideal types of administration. A clear theoretical framing is necessary for the articulation of research questions in conceptual terms, for the construction of an analytical route for an empirical study, and for delineating the theoretical contribution of the research as propositions that extend or refute existing knowledge on ICT4D phenomena.

6 Conclusions

My argument in this paper is that ICT4D research requires the combination of two types of theories: foundational and middle range. Foundational theories are very general and highly abstract – they tend to elaborate on the nature of social phenomena and the processes through which they are formed. Invariably, ICT4D research requires theories about technology, about context, and about development. Middle range theories are more limited in their abstraction and relevance and their aim is to explain specific kinds of phenomena.

Students often ask me what theory they should use for the research of so-and-so a topic. This is an impossible question to answer: it is not one theory that is needed in ICT4D research, but many; and nobody can prescribe the theories for the study of a topic. Research framing is the informed choice of theories in relation to which

questions for investigation are expressed and contributions to knowledge are made. I believe it is the most challenging part of academic ICT4D research.

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