Digital Innovation: A Research Agenda for Information Systems Research in Developing Countries

Petter Nielsen

Digital Innovation: A Research Agenda for Information Systems Research in Developing Countries

Petter Nielsen

University of Oslo
pnielsen@ifi.uio.no

Abstract. This paper is based on a survey of the current landscape of information systems research concerned with developing countries and development. Significant gaps are identified representing a lack of focus on digital technologies and the impact and significance of digital innovation for developing countries and development. We need to expand our focus from primarily addressing the challenges of access to and the ability to use ICTs, to also include how developing countries can participate in and take relevant roles in digital innovation. We are witnessing a wide-spread digitization of organizations and societies at large, and these significant changes warrant a new research agenda for information systems in developing countries. This paper proposes three new directions for research to support this shift; empirical research on digital innovation by developing countries; theorizing digital innovation by developing countries; and participation in digital innovation as freedom.

Keywords: Digital innovation, information systems, development, research agenda

1 Introduction

There is significant interest in and a growing body of literature on digital innovation in information systems research [see e.g. 1]. Digital innovation is about the breaking up of vertical industry silos and the creation of networks where different actors come together and innovate by combining and recombining their digital technology components. With technologies such as platforms, new venues for innovation are opened up and participation in innovation potentially attracts a broader audience. Digital innovation is by many argued as a deep change in ways in which innovation is organized, influencing industrial structures and competitive landscapes. Digital innovation is also self-referential in the sense that it requires the use of digital technologies [1]. The widespread diffusion of digital innovations has created a virtuous circle that furthers the development and accessibility of digital devices, networks, services and contents [2, 3]. While there is a significant debate in research on the impacts of digital technologies and digital innovation, these discussions have still to reach the information systems literature engaged with developing countries and development. Instead of exploring the potential and impacts of digital innovation, research seems to be stuck in a perspective on developing countries as passive, and often reluctant, receivers of inno-

adfa, p. 1, 2011.

vations and new ICTs. The aim of this paper is to support a shift in this respect and bring digital innovation on the agenda of information systems research in developing countries.

While the potential of ICTs for developing countries and development is well established, the question of *how* to make ICTs relevant is still under scrutiny. Research has approached this how question from different angles. For example, by exemplifying a range of different ICT failures, Avgerou and Walsham [4] focus on the importance of taking into account the *contexts* in which ICTs are implemented and used. These context discussions include a broad array of influential factors such as for example information infrastructures [5], institutions [6] and local practices [7]. Other researchers have focused more particularly on understanding the *processes* of introducing, implementing and maintaining relevant ICTs in developing countries, related to integration [8], scaling [9] and sustainability [10]. These discussions are based on the 'classical' North-South digital divide [11, 12] where the prime challenge to be addressed is bridging the design-actuality gaps between the developed countries where the ICTs are designed and the actuality of the periphery where they are used (developing countries).

Reviewing the literature on ICTs in developing countries, Walsham and Sahay [13] identified four broad categories of information systems topics addressed. These include cross-cultural working, local adaptation of global technologies, particular marginalized groups, and the meaning of development in itself. These topics are still relevant, and of particular interest here, the definition and nature of development and how it relates to innovation has remained as an important concern. For example, Qureshi [14] discusses how innovations in the use of ICTs can transform development by enabling people to use ICTs in ways that benefits them and help them to establish the power to determine their own life. Along the same line of argument, Foster and Heeks [15] argue for *inclusive innovation* as a means to make innovation relevant for low income groups, defined as addressing problems relevant for the poor; involving the poor in the development; enabling the poor to adopt the innovations; and focus on innovations improving the livelihoods of the poor. But innovation is not limited to the relevance of, the access to and the ability to use ICTs effectively as discussed by for example Walsham and Sahay [13]. In this paper I argue that innovation is also about how individuals and organizations in developing countries are involved in and ultimately take a lead in innovation as a process.

The method adopted in this paper was as follows. I first made a literature review on digital technologies in developing countries, focusing on the main information systems journals and conferences concerned with ICT4D. It quickly became apparent that while 'electronic', 'online' and 'digital technologies' are popular terms, discussions related to how digital technologies and digital innovation represents something new and different for developing countries are more or less absent. Based on this, the review strategy was changed to also include more general ICT related innovation for development. This review was contextualized in the broader information systems discourse on digital innovation. Finally, this was used as a basis to develop new research directions to bring digital innovation to the research agenda for information systems in developing countries.

Digital innovation remains as more or less a void in information systems research on ICTs in developing countries. My aim and hope is that pointing out this gap and suggesting research directions will encourage future studies addressing this topic and stimulate research on how to approach digital innovation in developing countries and if possible how to make it relevant for development.

In the next section, digital innovation is introduced. In the following section a review is done of existing research on ICTs and digital innovation in developing countries. This is followed by a section outlining a research agenda for information systems in developing countries including digital innovation. The concluding section five summarizes the paper and discusses future research.

2 Digital Innovation

Digital innovation is on the agenda in information systems research [see e.g. 16, 17, 18]. In their research commentary, Yoo et al. [1] put forward that digital technologies and their modular architectures will have profound implications on how firms organize innovation. They describe digital technologies as different from analogue technologies on three levels: they are reprogrammable, enabling them to perform a variety of different tasks; data is homogenized enabling the same digital device the ability to store, transmit, process and display a variety of different digital contents and content becomes separated from the media; and finally digital innovation requires digital technologies creating a drive towards further digital innovation. These changes in technology are drivers towards radical changes in the way innovation unfolds [17]. The rapid drop in the cost of digital technologies including PC's and smartphones combined with the explosive diffusion of Internet have radically lowered the barriers of access to the digital tools for digital innovation: "Digital technology, therefore, has democratized innovation and almost anyone can now participate." [1].

Digital innovations are based on layered architectures comprised of core components, complementary components and interfaces between these components. With digital innovation, there is a separation between devices and services and networks and contents. While the core components are stable and with low variability, the complementary products are rapidly changing [19]. This layered and modular architecture enables innovation distributed among different and different kinds of actors. Yoo et al. [1] characterizes these architectures as doubly distributed, in terms of how they offer opportunities in combining a variety of resources on different levels as well as the control over and the knowledge about the different components being distributed among actors. Digital innovation activities require the ability to mobilize other actors to release the potential of platforms, to combine and recombine components, rapidly respond to changes in constellations of components and attribute new meanings and usages to existing technologies [20]. Technical attributes of platforms play key roles in concert with human relationships in shaping the socio-technical generativity of digital technologies [21]. Examples of digital innovations range from open source software projects, Google's shared platform and new mobile services.

Digital innovation is about the breaking up of silo systems and creation of networks where different actors comes together and interlink complementary digital components. While user involvement in innovation is not something new [22], the pervasiveness and accessibility of digital technologies are. Even if the user is offered a more significant role and have the potential to make their own modifications of technologies, user driven innovation is based on a user – innovator relationship. Digital innovation is a deeper change in the ways in which firms organize innovation, influencing industrial structures and competitive landscapes. Old vertically integrated industries and models are broken down and new complex technical, organizational and social networks are emerging based on heterogeneous actors with control over and knowledge about different components. Instead of being based on a user – innovator relationship, digital innovation offers multiple venues for multiple different actors to participate in innovation. It opens up for different actors to take new roles, but participation will also require new knowledge, competencies and social relationships. The opportunities digital innovation offers and what it takes for individuals and organizations from developing countries to participate is by large unknown and yet to be explored.

3 A review of research on ICTs and Innovation in Developing Countries

3.1 Innovation *for* developing countries

There is a common concern that the context of developing countries poses certain challenges to ICTs and requires different technologies and implementation approaches. For example, resource constraints in terms of weak ICT infrastructure and electricity outages will inevitably result in expensive and fluctuation Internet connections. This mandates solutions using as little bandwidth as possible and providing offline capabilities [e.g. 23]. Discussing the design of hospital systems for resource constrained context, Sahay & Walsham [24] describe technical innovation as intrinsically related to social and institutional innovation, and argue that ICT based innovation in developing countries requires these different types of innovation to happen at the same time. They introduce the concept of *frugal innovation* to ICT4D research by arguing that innovation in resource constrained context must achieve doing more with less. In their concrete case, frugal innovation included amongst other factors saving money based on using open source software, reaching out to rural populations and reducing external dependencies. The focus on the particularities of the context in developing countries also includes research on the broader social context. For example, Khalid et al. [25] discuss and suggest a particular design of a partograph for real-time clinical decisions in India based on addressing key cultural barriers. These barriers include; the human capacity to absorb the complexities of a graphical format; the capacity of the health providers to give training to their staff; insufficient resources to assure accountability and usage in decision making; and linking the solution to the wider health system.

There is also a body of research on ICTs in developing countries that does not focus on the design of technology for a particular context, but the processes in which innovations are introduced and used. This is for example related to discussions on digital divides between the developed and developing countries and how marginalized groups and regions can achieve access to the 'network society' [26]. While research on digital divides have focused on who have access to technology (first order effects), there are also arguments for focusing on second order effects in terms of the ability for those who have access to use the technology in a meaningful way [27]. Dijk and Hacker [12] argue that while the lack of access to hardware that existed in the 1980s and 1990s in developing countries is less a challenge today, the lack of access to skills required for meaningful use is different and likely to increase. In a similar fashion, Kibere [28] in her study of the use and appropriation of mobile phones in the Kiberia slum in Kenya problematizes how social, cultural and political structures influences the processes of technology adoption, diffusion and use. More broadly, Diga and May [29] in their introduction to a special issue on ICT Ecosystems in the Information Technology for Development Journal, discuss how ICT usage is always framed in a context where for example socio-economic and political forces are at play. In sum, this body of literature focuses on different facets of the context in developing countries, and contributes by suggesting how technologies and implementation processes can be designed accordingly.

The digital divide is recognized as not only the lack of access to ICTs but also the social and institutional context shaping access and the capacity of people to use ICTs [30]. There is a stream of research on innovation and ICT4D, motivated by the challenges emerging when ICTs designed and developed for and by the developed countries are implemented in developing countries. Addressing technology production in general, Suchman [31] pointed out the different social worlds of users and developers, and the challenges emerging when technologies are crossing these boundaries. To address these challenges, she calls for developers to cross over to where technology is used. Heeks [7] have made a similar argument particularly for ICT4D research with his discussion of design-actuality gaps. Heeks describe these gaps, between the designers' approach to design and the local actuality of the users, along dimensions of; information; technology; processes; objectives and values; staffing and skills; management systems and structures; and other resources. Heeks argues for designing applications that comes with fewer assumptions related to these different dimensions. Instead, they should be enabling and put as little as possible constraints on local improvisations. There is, at the same time, the need to balance between the room for improvisation and what the design requires of local implementation capacity on the ground.

3.2 Innovation *by* Developing Countries

Bridging design-actuality gaps and drawing the balance between initial design and room for improvisation assumes a situation where developed countries are producers of innovations and developing countries form the implementation and use context. This perspective is reflected in for example the work of Nicholson and Sahay [32],

discussing how political and cultural issues challenges the management of software development projects across developed and developing countries. While Nicholson and Sahay focus on outsourcing as motivated by manpower shortages and needs to cut costs by companies in developed countries, outsourcing can also have a development aim. Discussing impact sourcing, Nicholson et al. [33] describe how outsourcing can target the poorest people with a particular aim of poverty alleviation. The role of developing countries in impact sourcing is at the same time limited to data entry and digitization of documents.

There are attempts to explore and discuss developing countries as having a more active role in innovation. George et al. [34] define inclusive innovation as "innovation that benefits the disenfranchised" (p. 661). Inclusive innovation entails making the poor not only customers and employees, but also owners, suppliers and community members in innovation. Heeks [35] also seeks to expand existing innovation models by distinguishing between pro-poor, para-poor and per-poor innovation. Where pro-poor is innovation for the poor by the non-poor and para-poor is innovation by the non-poor alongside the poor, per-poor innovation is by poor communities themselves. This promising body of literature on per-poor innovation in developing countries is at the same time limited and not particularly addressing digital technologies.

To summarize this literature review, we can see that the research on ICTs and innovation in developing countries primarily focuses on the challenges emerging when innovation is driven by developed countries. There are a few initiatives to explore how developing countries can take a more active role in these innovation processes, but these are limited and not addressing digital technologies in particular.

4 A Digital Innovation Research Agenda for Information Systems in Developing Countries

In 2008, Thompson [36] introduced Web 2.0 to information systems research in developing countries and discussed its implications for development in terms of openness, collaborative logic and how it supports networked social behavior. He described Web 2.0 as reflecting a different social life, comprised of diversity, collaboration and multiple truths, enabled by technology. When Walsham and Sahay [13] suggested an agenda for research on information systems in developing countries, they also emphasized the role of technology and the need of detailed studies of particular technologies. These calls to study particular technologies in the developing country contexts; a global call to study digital innovation through theorizing and empirical research [1]; and the identified gap in research on digital innovation in this paper have shaped the first two research directions suggested below in this section. Linked to the two first, the third research direction suggested concerns how digital innovation can improve the livelihoods and the quality of life for individuals in developing countries. Inspired by Amartya Sen in the way he define development as human capabilities and the freedoms of individuals to participate in the activities they want [37], the third direction is based on appreciating the opportunity for individuals to participate in digital innovation as a freedom.

4.1 Empirical Research on Digital Innovation by Developing Countries

The implications of and what roles organizations and individuals from developing countries will take in digital innovation are unknowns. The scant, but growing body of empirical research on digital innovation involving developing countries have included studies of open source software projects and the participation of developing countries in software generification processes [38] and crowdsourcing platforms emerging from developing countries [39]. While unveiling new opportunities for developing countries, these studies also reveal the persistence of old and the emergence of new barriers and divides.

The very nature of digital technologies leaves a potential for developing countries participating in digital innovation. We should also appreciate participation in innovation as a potential venue to bridge design-actuality gaps. At the same time, while ICTs now are available and affordable for large populations in developing countries, the argument that digital technology: "… has democratized innovation and almost anyone can now participate …" [1] paints a too simple and rather naïve picture of the context in developing countries. Such an argument can only be based on the assumption that digital innovation is open for all and incentives, knowledge and human capacity are equally distributed on a global scale.

There is a need for more empirical research in this area. Will digital innovation be a democratization of innovation where innovation will be *by* developing countries, will developing countries only be users of digital platforms, or will digital innovation become the source of yet another digital divide? These questions could be approached by for example case studies in various domains on how platforms for digital innovation is shaped, influenced and developed by developing countries, how developing countries is taking part in innovation on top of platforms or more broadly on the role of developing countries in networks and ecosystems generating digital innovations. While these studies should focus and appreciate how organizations and individuals from developing countries can take active roles in digital innovation and how this can promote development, they should also critically scrutinize the real impact of digital innovation in this context.

4.2 Theorizing Digital Innovation by Developing Countries

Digital divides can be explained by economic, socio-cultural and infrastructural factors [40]. Infrastructural factors includes ICT penetration, Internet penetration and digital wireless penetration [27]. But access to ICTs does not equate effective use and participation in digital innovation. Further, digital technologies should be taken seriously and properly theorized as any other technology [41]. Research should find inspiration from existing theorizations not particularly focusing on the developing country context. For example, Ghazawneh and Henfridsson [42] argue that digital technologies are not only about platforms, their owners, applications and developers, and conceptualize boundary resources as a necessity to keep these different dimensions together. These resources, including for example software tools and regulations, are also tools that afford certain actors control over others. Another example is Dittrich

[43] and her discussion of platforms as "half products", and how they *have to* be configured, customized and extended to fit a specific context. Other examples include the discussion of Diga and May [29] on how ecosystems can both facilitate and hinder the participation of certain communities in digital innovation, the discussion of different types of digital innovation networks by Lyytinen et al. [17] and the conceptualization of socio-technical generativity and role of human capacities in digital innovation in developing countries by Msiska and Nielsen [21].

To understand who stands to gain from digital innovation related to the developing country context, we need to further theorize digital technologies and the processes of digital innovation in the developing country context, including dimensions such as; boundary resources in terms of e.g. intermediaries; platform technologies and human capacity needs for implementation and use; and inclusion/exclusion and the openness of ecosystems.

4.3 Participation in Digital Innovation as Freedom

The question "… will the digital revolution revolutionize development?" [11] is not entirely new, but it remains by large unanswered. What should be a concern is that so little current research is engaged in answering this question. If we continue along this path, we will remain with only a weak understanding of what digital innovation is, the opportunities it may bring, the challenges it may pose and the actual and potential impacts on developing countries and development. I find it striking that the contribution from developing countries in digital innovation still is discussed as a simple source of 'insights' to developed countries engaged in digital innovation [44]. This is about the impact of digital innovation on development, but also about the impact of human development on digital innovation. It is also about bridging the often disconnected discussions on understanding ICTs *for* development and studies focusing on understanding ICTs *in* developing countries [45].

Sahay and Walsham discuss whether ICT-based innovation contributes to human development, using the capability approach of Sen by describing ICT as having the potential to offer increased freedoms [24]. Their discussion is focused on how access to innovation and particular kinds of innovation can enable a growing range of freedoms including political rights and economic choices and protection in developing countries. But at the same time, the focus of their research agenda is on how to best introduce and use innovations in developing countries which are developed elsewhere (the developed world). There is a need to push information systems research further by also include research on how developing countries can be enabled to participate and take relevant roles in digital innovation. To do this, we need to understand what relevant roles can be; how participation in digital innovation by individuals and organizations from developing countries can contribute to development; what are the additional barriers for participation; and what extra support is needed in developing country contexts. This is partly about exploring digital innovation and how it can open up for the engagement of a wider audience from developing countries. It is also about exploring the relevance of digital innovation for the development agenda and understanding how participation in digital innovation relates to the freedoms of indi-

viduals. Building a deeper understanding of digital innovation as development should inspire and influence information systems research on digital innovation as well as ICT4D research in general.

5 Conclusion

My goal in this paper is to support a shift in research on information systems in developing countries by bringing digital innovation on the agenda. Based on reviewing the existing literature and identifying a gap in research on digital innovation and developing countries, I have suggested and discussed three new directions for research; empirical research on digital innovation by developing countries; theorizing digital innovation by developing countries; and participation in digital innovation as freedom. My hope is that this discussion and the directions can act as an inspiration and guidance for further research. While research on information systems in developing countries has matured both methodologically and theoretically, there is still a need to focus on the relationship between ICTs and development [13]. This paper argues for a stronger focus on digital technologies and the particular relationship between digital innovation and development. With this agenda, I believe that information systems research can make an important contribution by exploring the opportunities and challenges of digital innovation in developing countries and avoid digital innovation becoming the source of yet another digital divide.

References

1. Yoo, Y., O. Henfridsson, and K. Lyytinen, *The New Organizing Logic of Digital Innovation: An Agenda for Information Systems Research.* Information Systems Research, 2010. **21**(4): p. 724-735.
2. Hanseth, O. and K. Lyytinen, *Design theory for dynamic complexity in information infrastructures: the case of building Internet.* Journal of Information Technology, 2010. **25**: p. 1-19.
3. Benkler, Y., *The Wealth of Networks: How Social Production Transforms Markets and Freedom*. 2006: Yale University Press.
4. Avgerou, C. and G. Walsham, eds. *Information Technology in Context: Implementing Systems in the Developing World*. 2000, Ashgate Publishing: Brookfield, VT, USA.
5. Aanestad, M., E. Monteiro, and P. Nielsen, *Information Infrastructures and Public Goods: Analytical and Practical Implications for SDI.* Information Technology for Development, 2007. **13**(1): p. 7-25.
6. Aanestad, M., E. Monteiro, and P. Nielsen, *Information Infrastructures and Public Goods: Analytical and Practical Implications for SDI.* Information Technology for Development, 2007. **13**(1): p. 7-25.
7. Heeks, R., *Information Systems and Developing Countries: Failure, Success, and Local Improvisations.* The Information Society, 2002. **18**(2): p. 101-112.
8. Sahay, S., E. Monteiro, and M. Aanestad, *Configurable Politics and Asymmetric Integration: Health e-Infrastructures in India*. Journal of the Association for Information Systems, 2009. **10**(5): p. 399-414.

9. Sahay, S. and G. Walsham, *Scaling of Health Information Systems in India: Challenges and Approaches.* Information Technology for Development, 2006. **12**(3): p. 185-200.
10. Braa, J., E. Monteiro, and S. Sahay, Networks of Action: Sustainable Health Information Systems across Developing Countries. MIS Quarterly, 2004. **28**(3): p. 337-362.
11. Boas, T., T. Dunning, and J. Bussell, *Will the Digital Revolution Revolutionize Development? Drawing Together the Debate.* Studies in Comparative International Development, 2005. **40**(2): p. 95-110.
12. Dijk, J.V. and K. Hacker, *The Digital Divide as a Complex and Dynamic Phenomenon.* The Information Society, 2003. **19**(4): p. 315-326.
13. Walsham, G. and S. Sahay, *Research on Information Systems in Developing Countries: Current Landscape and Future Prospects.* Information Technology for Development, 2006. **12**(1): p. 7-24.
14. Qureshi, S., *Networks of change, shifting power from institutions to people: how are innovations in the use of information and communication technology transforming development?* Information Technology for Development, 2013. **19**(2): p. 97-99.
15. Foster, C. and R. Heeks, *Conceptualising Inclusive Innovation: Modifying Systems of Innovation Frameworks to Understand Diffusion of New Technology to Low-Income Consumers.* European Journal of Development Research, 2013. **25**(3): p. 333-355.
16. Yoo, Y., et al., *Organizing for Innovation in the Digitized World.* Organization Science, 2016. **23**(5): p. 1398-1408.
17. Lyytinen, K., Y. Yoo, and R. Boland, *Digital production innovation within four classes of innovation networks.* Information Systems journal, 2016. **26**: p. 47-75.
18. Nambisan, S., et al., *Digital Innovation Management: Reinventing Innovation Management Research in a Digital World.* MIS Quarterly, 2016. **Forthcoming**.
19. Baldwin, C.Y. and C.J. Woodard, *The Architecture of Platforms: A Unified View.* Harvard Business School Finance Working Paper No. 09-034 2008.
20. Lane, D.A., *Complexity and Innovation Dynamics*, in *Handbook on the Economic Complexity of Technological Change*, C. Antonelli, Editor. 2011, Edward Elgar Publishing Limited: UK.
21. Msiska, B. and P. Nielsen, *Innovation in the Fringes of Software Ecosystems: The role of Socio-Technical Generativity.* in review, 2016.
22. Hippel, E.V., *Lead Users: A Source of Novel Product Concepts.* Management Science, 1986. **32**(7): p. 791-805.
23. Braa, K. and P. Nielsen. *Leveraging the Potential of Mobiles in Developing Country Health Initiatives: From ICT4D to Information Infrastructures 4D.* in *Proceedings of the 12th International Conference on Social Implications of Computers in Developing Countries*. 2013. Ocho Rios, Jamaica: Faculty of Social Sciences, University of West Indies, Mona, Jamaica.
24. Sahay, S. and G. Walsham, *Information Technology, Innovation and Human Development: Hospital Information Systems in an Indian State.* Journal for Human Development and Capabilities, 2016. **In Press**.
25. Khalid, M., et al. *Designing a Mobile Partograph for Real-Time Decision Support for Safer Deliveries in India*. in *Proceedings of the 13th International Conference on Social Implications of Computers in Developing Countries*. 2015. Negombo, Sri Lanka: University of Oslo, Norway.
26. Mosse, E.L. and S. Sahay, *The role of communication practices in the strengthening of counter networks: Case experiences from the health care sector of Mozambique.* Information Technology for Development, 2005. **11**(3): p. 207-225.
27. Riggins, F.J. and S. Dewan, *The Digital Divide: Current and Future Research Directions.* Journal of the Association for Information Systems, 2005. **6**(12).

28. Kibere, F.N., *The Paradox of Mobility in the Kenyan ICT Ecosystem: An Ethnographic Case of How the Youth in Kibera Slum Use and Appropriate the Mobile Phone and the Mobile Internet.* Information Technology for Development, 2016: p. 47-67.
29. Diga, K. and J. May, *The ICT Ecosystem: The Application, Usefulness, and Future of an Evolving Concept.* Information Technology for Development, 2016. **22**(Supplement 1): p. 1-6.
30. Madon, S., et al., *Digital Inclusion Projects in Developing Countries: Processes of Institutionalization.* Information Technology for Development, 2009. **15**(2): p. 95-107.
31. Suchman, L., *Located accountabilities in technology production.* Scandinavian Journal of Information Systems, 2002. **14**(2): p. 91-105.
32. Nicholson, B. and S. Sahay, *Some political and cultural issues in the globalisation of software development: case experience from Britain and India*. Information and Organization, 2001. **11**: p. 25-43.
33. Nicholson, B., et al. *Evaluating Impact Sourcing: A Capabilities Perspective From a Case Study in Pakistan*. in *Proceedings of the 13th International Conference on Social Implications of Computers in Developing Countries*. 2015. Negombo, Sri Lanka: University of Oslo, Norway.
34. George, G., A.M. McGahan, and J. Prabhu, *Innovation for Inclusive Growth: Towards a Theoretical Framework and a Research Agenda.* Journal of Management Studies, 2012. **49**(4): p. 661-683.
35. Heeks, R., *ICT4D 2.0: The Next Phase of Applying ICT for International Development.* Computer, 2008. **41**(6): p. 26-33.
36. Thompson, M., *ICT and development studies: towards development 2.0*. Journal of International Development, 2008. **20**(6): p. 821-835.
37. Sen, A., *Development as freedom.* 1999, Oxford, UK: Oxford University Press.
38. Gizaw, A.A., B. Bygstad, and P. Nielsen, *Open Generification.* Information Systems Journal, 2016.
39. Marsden, J., *Stigmergic self-organization and the improvisation of Ushahidi.* Cognitive Systems Research, 2013. **21**: p. 52-64.
40. Skaletsky, M., O. Soremekun, and R.D. Galliers, *The Changing - and Unchanging - Face of the Digital Divide: an Application of Kohonen Self-Organizing Maps.* Information Technology for Development, 2014. **20**(3): p. 218-250.
41. Orlikowski, W.J. and C.S. Iacono, *Research Commentary: Desperately Seeking the "IT" in IT Research - A Call to Theorizing the IT Artifact* Information Systems Journal, 2001. **12**(2): p. 121-134.
42. Ghazawneh, A. and O. Henfridsson, *Balancing platform control and external contribution in third-party development: the boundary resources model.* Information Systems Journal, 2013. **23**(2): p. 173-192.
43. Dittrich, Y., *Software Engineering Beyond the Project – Sustaining Software Ecosystems.* Information and Software Technology, 2014(56): p. 1436-1456.
44. Barrett, M., et al., *Service Innovation in the Digital Age: Key Contributions and Future Directions.* MIS Quarterly, 2015. **39**(1): p. 135-154.
45. Brown, A.E. and G.G. Grant, *Highlighting the Duality of the ICT and Development Research Agenda.* Information Technology for Development, 2010. **16**(2): p. 96-111.