

Research on Information Systems in Developing Countries: Current Landscape and Future Prospects

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ABSTRACT

The current landscape of the information systems research literature concerned with developing countries is surveyed by examining a range of research articles published from 2000 onward. These are discussed in terms of the key challenges addressed, including the role of technology, and the methodological and theoretical approaches used. Prospects for future research are discussed, based on a conceptual view as to how to study information and communication technologies (ICTs) in developing countries, to classify existing work, identify gaps, and suggest future opportunities. The authors contribute to the important debate on how ICTs in general, and information systems research in particular, can make a positive difference in the developing countries. © 2006 Wiley Periodicals, Inc.

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1. INTRODUCTION

There had been some debate as to whether information and communication technologies (ICTs) were relevant to developing countries, but this debate has been resolved with a clear yes answer. The question has become not whether, but how ICTs can be beneficial. Information and communication technologies have high potential value across all sectors, in both public and private enterprises, and at multiple levels, from software businesses in urban areas, for example, to health delivery in rural villages. However, the application of ICTs has not always been successful to date, and indeed there are many examples of failure or partial failure (see, for example, Avgerou & Walsham, 2000), but the challenge remains to tackle these difficulties and to resolve them. A further challenge with respect to ICTs is to address issues of the “digital divide” between those people with access to the technologies and the ability to use them effectively, and those without.

The increasing visibility and importance of ICTs in developing countries is mirrored to some extent by a growth in the information systems (IS) research literature addressing the

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area. There are some specialist journals devoted to the area, and articles also appear in the mainstream information systems (IS) journals on occasion. While it is true that very few currently appear in premier journals such as *MIS Quarterly (MISQ)* and *Information Systems Research*, evidence of increased interest is a recent announcement of a special issue of *MISQ* devoted to the area. The journal *Information Society* published a special issue on ICTs in developing countries in 2002 (Vol. 18, No. 2). The International Federation of Information Processing, IFIP working group 9.4 (IS in developing countries) held a joint conference in Athens in 2003 (Korpela, Montealegre, & Poulymenakou, 2003) with the long-established working group 8.2 of IFIP (IS in organizations) under the title, "Organizational Information Systems in the Context of Globalization." This provides a further indication of a coming together of IS researchers with interests spanning the world.

Our purpose in this article is first to survey the "landscape" of current research on IS in developing countries. We seek to identify what is currently being reported on in the literature, how researchers have carried out their studies, and what their results suggest about particular topics. In addition to this survey of work to date, we also wish to address the future by identifying positive trends which need further development, and by suggesting what we perceive to be important topics, issues or theories which are omitted in the current literature, or where work is very sparse. We hope that this will encourage future research aimed at filling gaps, expanding the coverage of important but relatively neglected topics, and stimulating further debate on topics and research approaches of relevance.

The method we adopted was as follows. For the survey aspect, we first read, independently of each other, 10 recent articles sampled from different journals and generated some initial classifications. We then came together and developed a combined classification approach that is mirrored in the format of our article below, namely, key challenges for the use of ICTs identified in each paper; the role of technology; and theory and methodology, including new models and concepts developed if any. We then carried out a more widespread investigation of the literature, using the same classification scheme. Further details of the journals and other sources we examined are provided in the Appendix. We restricted our research to publications from 2000 onward to reflect current or recent work. For the section entitled "Looking Ahead," we developed our approach through careful examination of what the survey revealed, from a conceptual view of how to study ICTs in developing countries, and from ideas derived from our own field experience.

2. KEY CHALLENGES

Our analysis of the papers showed a variety of challenges which were being addressed by the researchers and, in many cases, these reflected challenges faced by the practitioners in the field situations themselves. In this section, we have divided these challenges into four categories, moving from broad issues of globalization and economic development at the national level, through organizations engaged in cross-cultural working and attempts at local adaptation, to efforts to help particular groups.

2.1 How Can Information and Communication Technologies Promote "Development"?

Articles in this category dealt with broad issues of the contribution of ICTs to development, sometimes in the context of a specific country. In some cases, the meaning of the term

development was itself discussed. For example, in this latter category, Madon (2000) examined the use of the Internet in sectors such as health and education, and in domains such as economic productivity and sustainable development. She drew from the development studies literature to define these latter concepts. She derived some conclusions for government intervention, including the important role of intermediary institutions in linking the local to the global.

Avgerou (2003) also problematized the notion of development, and in particular questioned the rhetoric that ICTs are an instrument for economic and social gains only within the context of a market regime. She drew from a discourse analysis of literature generated by development aid organizations, and argued for the crucial role, in her view, of the institutional setting of ICT use. A more detailed exposition of her institutional approach is provided in Avgerou (2002).

Silva and Figueroa (2002) dealt with a specific country, Chile, and discussed how to promote the improved use of ICTs in this particular institutional context, drawing from institutional theory, including particular adaptations of the theory to the IS field (King et al., 1994). The authors also drew on the radical development theorist Escobar (1995) to discuss the meaning of the term development. In terms of technology, they emphasized the importance of a standards and telecommunications infrastructure in supporting ICT applications. The study provides an interesting theoretical basis although, in line with most published studies in this broad category, the data used were largely secondary in nature rather than being derived from the authors' own empirical research. This is not necessarily a bad thing, but contrasts with the more micro-level studies, drawing on primary data, which form the basis in the majority of the papers studied.

Sayed and Westrup (2003) also wrote about a particular country, Egypt, but they looked at the role of enterprise resource planning (ERP) systems in bringing together networks in a globalized world. These included, in their case study, global organizations, local companies, government, and aid organizations. They showed how heterogeneous networks of human and nonhuman elements are brought together in a specific global–local combination, linked for example, to particular national plans for development. Although they did not state this explicitly in the article, the analysis is clearly related theoretically to actor-network theory.

2.1.1 Promoting cross-cultural working. In contrast to the rather diverse literature whose exemplars were discussed above, a second category of articles dealt with a rather specific issue, albeit complex, namely that of cross-cultural working. For example, Aman and Nicholson (2003) discussed the growing phenomenon of offshore development, and the problems of working together, with data drawn from Malaysia. They emphasized the specific difficulty in non face-to-face communication when working across cultures. To offset this, they generated a model for sensitizing collaborators in cross-cultural offshore development projects to issues and problems which may need to be handled. Walsham (2002) also dealt with cross-cultural issues in software production and use, drawing on secondary data from two case studies, including that of a joint Jamaican and Indian software team. The output in this case is a model of the processes involved, drawing mainly from structuration theory.

Adam and Myers (2003) took a critical stance on one aspect of cross-cultural working, namely that a software package may “impose its own logic” when transferred between different cultural contexts. They addressed the challenge of how to avoid the culturally inappropriate imposition of IS, using a case study of the Maldives Customs Service. They related their findings to theories of neo- and post-colonialism. Shoib and Nandhakumar (2003), in something of a contrast, used two case studies to argue that multiple forms

of rationality exist in any context and that national culture is only one aspect of actors' sense-making activities. Thus, we need to unpack the notion of culture rather than seeing it as a fixed entity.

Liu and Westrup (2003) also opposed the view of culture as static, drawing from anthropology to support their arguments. They examined a case study of coordination and control between the UK and China in a multinational corporation. Although technologies such as e-mail and fax enable time-distance stretching, there is no "death of distance" in that locality reasserts itself in opposition to any attempt at tight control from distance. They argued that ICT-enabled coordination is only effective when linked with other approaches such as the use of expatriates and face-to-face contacts. Braa, Monteiro, and Sahay (2004) also discussed cross-cultural issues but, unlike most reported studies, they dealt with South-South rather than North-South contexts. In particular, they examined issues of the transfer of a district health information system, and related procedures such as training material, from its origin in South Africa to Mozambique.

2.1.2 Local adaptation and cultivation. Although two groups may not be present as clearly as in cross-cultural issues, bringing a technology to a new local context also involves some implicit elements of cultural transfer and mutual learning. Local adaptation and cultivation in the new context are themes addressed by another group of papers. For example, Bada (2002) described a longitudinal case study of BPR-style change involving the computerization and networking of branches in the banking sector in Nigeria. He critiqued globalization theorists who argue that cultural homogeneity is becoming the norm, and instead emphasized the need to understand, and indeed value, locally meaningful ways of doing things.

Macome (2003) made somewhat similar arguments to those above, drawing from a case study of the implementation of an invoice information system in the Mozambique Electricity Company. She concluded that the local context was crucial in the implementation process, and that it was essential to involve local stakeholders in the entire process. Puri and Sahay (2003) also dealt with participation in terms of the need to bring local participatory practices into geographical information systems' (GIS) design, drawing from their research in India. Geographical information systems can be regarded as addressing spatial issues in a particular top-down manner, whereas local stakeholders also have relevant knowledge, for example of where water streams are located, which is not captured in the GIS. The authors argued the need to draw from both approaches to inform appropriate land management practice.

D'Mello (2003) was also concerned with local adaptation related to new ICTs, but in her case she addressed the adaptation of people in contexts such as global software outsourcing. She argued that this has produced a new breed of knowledge workers in the software industry in countries such as India from where she drew her field data. These workers straddle both global and local experience of events, and this creates tensions of identity, for example between family orientation and individualism. She summarized her perspective through the title of "thinking local, acting global" in an ironic counter to the normal cliché.

2.1.3 Focusing on particular groups. While software professionals in India may struggle to come to terms with the new globalized but still local world, they are anything but marginalized with respect to contemporary society. In contrast, as noted in the introduction to our article, many people and groups are operating outside the margins of the "digital divide." Some authors have started to focus on these groups.

For example, Mosse and Sahay (2003) described attempts to improve health provision to poor districts in Mozambique, itself one of the poorest countries in the world, through computer-based health information systems. They argued the need to create counter-networks, using a term drawn from Castells (1996, 2000), to the existing dominant networks of human and nonhuman actors operating within deep-rooted sociocultural structures. Metcalfe and Joham (2003) described their research on oral cultures, drawing from their work with some Aboriginal groups in Australia. They argued that modern technology, such as UHF citizen band radio, can be highly effective in supporting knowledge exchange between groups with strong oral traditions.

A rather different focus group is that chosen by Okunoye and Karsten (2003) who were concerned with the challenge of providing good access to knowledge sources, such as the Internet, for researchers working in regions such as sub-Saharan Africa. They provided a detailed discussion of the specific use of technologies such as e-mail, databases, and telecommunications in six African countries. The authors used a simple knowledge management framework, involving knowledge creation, application, and storage, to generate some implications for future practice. Shoib and Jones (2003) were also concerned with researchers, but rather more specifically with those trying to do IS research in Egypt. Their work was based on a literature review, and some methodological and theoretical implications were found of use to the target group.

3. THE ROLE OF TECHNOLOGY

While information and communication technologies were involved in all the case studies and other empirical work discussed above, the details of the technology and how this affected the context and outcomes were often not articulated in great detail. The purpose of this section is to pick out some studies that addressed the technology as a central issue.

3.1 Standardization Versus Localization

The current era has seen the development of global systems and approaches which aim to transfer best practices and procedures between different contexts and countries. However, there is a tension in developing such systems between wishing to standardize for efficiency and comparability purposes, and the difficulty of imposing the same standards on different local contexts. Braa and Hedberg (2002) described some interesting work on this issue, involving the development of software and the setting of standards in an action research project concerned with improving health data and thereby health care in developing country contexts. The work started in South Africa, but the approach has since been used in a number of other developing countries including India and Mozambique. Braa and Hedberg addressed the problem of standardization versus localization through a hierarchy of standards at different levels in the health system, and provision in the software for local tailoring to specific needs.

A related piece of work was described by Thompson (2002) who went back even further with respect to the health information systems in a specific location, namely health clinics in the Western Cape province in South Africa. He looked at the way in which the raw data were generated, mostly through manual forms, and noted the way in which this often created problems due to a mismatch between the needs of the system and the local knowledge of the nurses and others who created the data. He argued the need for locally relevant data

collection methods, such as simple counters and forms designed in a bottom-up way, to engage “the whole person” at the grass roots level in the process of data creation and interpretation.

3.2 Alignment of Actors in Networks

A relatively popular theory in the IS literature in recent years, not only in developing countries, has been actor-network theory (ANT). A reason for this is that, unlike some other sociological theories, ANT offers an explicit way of conceptualizing technology as one of the “actors” in the actor-networks. A number of the papers in the previous section drew on ANT explicitly or implicitly (Mosse & Sahay, 2003; Sayed & Westrup, 2003). Braa and Hedberg (2002) discussed above also referenced the theory as a way of conceptualizing actor-networks involving heterogeneous elements such as people, organizations, software, and standards.

Rolland and Monteiro (2002) described a case study of the implementation of a complex information infrastructure in a global maritime shipping organization with offices in more than 100 countries, including many developing countries. The use of the term *information infrastructure*, rather than information system, reflects the authors’ view that such highly complex networks of actors, including technologies, need different methods of development and management. They also addressed the standardization versus localization debate, where they argued that universal solutions are unlikely to be successful in multiple locations spanning different social, political, institutional, and strategic contexts. There is a need for a pragmatic balance between global standards and local needs.

3.3 Particular Technologies

Particular technologies have been discussed in some of the articles described herein so far, including the ubiquitous Internet and ERP systems (Madon 2000; Sayed & Westrup 2003), although rarely in great detail. A currently fashionable technological debate revolves around the use of open source and free software, and indeed it is clear that some developing countries, such as Brazil, are taking strategic initiatives to encourage the open source route. No discussion of this was to be found in the papers that we examined, although Braa and Hedberg (2002) state that their South African-origin health information systems program (HISP) software is open source. However, little detail was provided on this topic.

Two other groups discussed issues around software, the first being Pries-Heje, Baskerville, and Hansen (2003) on bringing new software practices into Russia. While Russia may not qualify for the term developing country, the authors’ analysis is relevant to other countries wishing to introduce what they term *high-speed software development*. They use Kline’s model of innovation and diffusion linked to a model of organizational growth. Mursu, Lyytinen, Soriyan, and Korpela (2003) investigated perceived software project risks in the context of Nigeria. They used a Delphi approach to elicit the views of relevant stakeholders.

The technology of GIS has already been mentioned in the context of participative design approaches (Puri & Sahay, 2003). Barrett, Sahay, and Walsham (2001) described some related work on GIS for forestry management in India. They argued that foresters in India normally rely on different spatial awareness methods than the use of maps, and therefore that the spatial features embedded in GIS software often conflict with local ways of perceiving

and knowing. They linked the case material to Giddens' analysis of globalization processes involving different trust systems and shifts in identity.

4. THEORY AND METHODOLOGY

It is clear from our literature review so far that a wide range of theories are being drawn on by researchers of IS in developing countries. We will attempt to put a little order in this diversity in the first subsection below, although any attempt at classifying theories will always be controversial. Next in this section we will discuss new models and concepts which are visible from the literature we have surveyed. Finally, we discuss the methodologies which are being used in the current landscape.

4.1 Popular Theorists and Theories

When addressing broad and complex phenomena such as globalization, typical theorists such as Castells (Mosse & Sahay, 2003) and Giddens (Liu & Westrup, 2003) have been drawn on, with occasional mentions of other authors such as Albrow (Madon & Sahay, 2001). Development is another broad and diffuse topic with a range of theorists being used including Escobar (Silva & Figueroa, 2002) and Sen (Madon, 2003). Other general theories of society, if we can call them this, include theories of neo-colonialism and post-colonialism (Adam & Myers, 2003). Anthropological theories of culture are also drawn on by IS researchers (Metcalfe & Joham, 2003).

General sociological theories, which can be thought of as connecting multiple levels from society down to the individual include Giddens' structuration theory (Walsham, 2002), and actor-network theory as discussed in the role of technology section above. Institutional theory is another approach to connecting multiple levels within a historical context (Avgerou, 2002). Power operates at multiple levels of course, and various theorists have been drawn on here, including for example, Clegg's circuits of power (Silva & Backhouse, 2003).

Theories which derive directly from the IS field itself are less common in the literature surveyed, although the theory around information infrastructure is one example (Rolland & Monteiro, 2002). Improvisation theories, while not derived from IS itself, have nevertheless been widely drawn on and developed in IS, and are cited in a few articles that we examined (Silva, 2002). Other theories drawn on in our surveyed papers include theories of innovation and diffusion (Pries-Heje et al., 2003) and knowledge management frameworks (Okunoye & Karsten, 2003).

4.2 New Theory and Concepts

There has been debate for many years in the IS field (Orlikowski & Barley, 2001) as to whether IS needs to develop its own theory, or whether it can adapt theory from other disciplines. We will not attempt to take sides in this debate here, but we would like to make a few observations with respect to IS in developing countries. First, if researchers wish to address topics such as globalization, culture, power, or the meaning of development itself, there are vast literatures to draw on, and it would surely be foolish to ignore them. Such theories should, however, not be drawn on uncritically, and it is incumbent on the IS

researcher to select what is relevant to his or her study, and in some cases to develop the ideas within the specific IS domain.

We have already given examples of a number of studies which have drawn on existing theories in other domains, but then applied and adapted them to IS. We would argue that this is, in principle, wholly desirable, although the merit of any particular study depends of course on whether the authors can convince reviewers and other readers of this. All the literature in our selection clearly achieved this to some extent, for we included only refereed articles.

In addition to drawing from theory and concepts in other domains, some authors in our survey have developed existing IS theory, with information infrastructure theory being one example. Some have developed new models, such as the design-reality gap model for IS implementation described by Heeks (2002). Others have used or coined new concepts to describe their findings, such as actually existing globalization (Bada, 2002), local universalities (Braa & Hedberg, 2002), and intermediary institutions (Madon & Sahay, 2002).

4.3 Methodology

An interesting methodological finding from the surveyed literature is that there is widespread recognition of the need to investigate the interconnection of levels of analysis. In a survey article written about 10 years ago, which provides an interesting comparative basis for our survey of recent work, Sahay and Walsham (1995) argued the need for multi-level analysis, "The process of IT use in developing countries is a complex phenomenon and it typically involves actors at various levels. It is important to study the interaction of these different actors on the process of IT implementation and use" (p. 118).

Few papers were doing that 10 years ago, but now they are quite common, and often with more sophisticated views of what constitutes an "actor" than in the quote above. For example Sayed and Westrup's (2003) article on ERP systems in Egypt, discussed earlier, looked at actor-networks involving global organizations, local companies, governments and aid organizations.

With respect to labeling their methodological approach, the majority of the studies, if they address this explicitly, claim to be interpretive. Very few studies in our survey adopted a positivist approach with stated hypotheses, instruments for data collection, statistical inference etc. It is beyond the scope of this paper to analyze the precise reasons for this, but it is certainly true that many of the research questions and challenges tackled by IS researchers in our survey would not have lent themselves naturally to a positivist methodology.

Many of the studies come across as quite solid in methodological terms, with in-depth case studies being common, for example, the two studies described in Walsham (2002). This contrasts strongly with the generally "thinner" studies discussed in Sahay and Walsham (1995) a decade earlier. Perhaps surprisingly, bearing in mind the importance of action in addressing issues of development, action research studies are somewhat rare, although the over 10-year research program in South Africa and elsewhere summarized by Braa and Hedberg (2002) is a notable exception. Overall, reading the survey paper of Sahay and Walsham (1995), and comparing it to our in-depth analysis of materials from 2000 onward, suggests to us that progress has been achieved over the last decade in research on IS in developing countries. However, we now turn to a forward look to try to see where and how research could be progressed further.

5. LOOKING AHEAD

To address the question of what type of research is needed in the future, we need a conceptual view of the role of ICTs in developing country contexts and how to study it to classify existing work, identify gaps, and suggest future opportunities. We develop such a view in the first subsection below. The remaining subsections expand this conceptualization, and use it to link back to the existing literature surveyed here, and then forward to future research prospects.

5.1 A Conceptual Approach to the Study of Information and Communication Technologies in Developing Countries

The first part of this article can be regarded as having developed a type of grounded theory approach (Glaser & Strauss, 1967) on studying ICTs in developing countries based on the existing literature. This produced categories of key challenges, the role of technology, and theory–methodology. However, as described in Orlikowski (1993), such grounded categories can be usefully complemented by existing formal theory, and in our case we suggest that theories of development in the contemporary world are of obvious theoretical relevance. Putting these two sources together, together with our own subjective knowledge of the field, we suggest the following conceptual framework of four questions which all research studies on ICTs in developing countries should address:

- What is the “development” to which ICTs aim to contribute?
- What are the key issues being studied related to ICTs?
- What is the theoretical and methodological stance?
- What level and focus of analysis is being adopted?

Although we believe that all studies should address all of these questions, authors will no doubt wish to place their emphasis on different parts of this framework where they feel that their contribution is highest. In the rest of this section, therefore, we will examine each of these questions in turn, looking both at existing studies which are particularly strong on addressing the specific question, but also at gaps and opportunities for future work related to the question. A summary of some key points in the rest of this section is given in Table 1.

5.1.1 What is the “development” to which ICTs aim to contribute? We identified some papers in our review, summarized in Table 1, which dealt explicitly with the question of how ICTs aim to contribute to development, and what the authors meant by the latter term. However, in many other papers in the existing literature, the precise notion of what development means, and how ICTs can promote it, is implicit or underemphasized. There are clearly opportunities here for future work.

For example, picking a specific topic, the evaluation of information systems in developing country contexts could be broadened by wider definitions of development such as those proposed by Sen (1999), looking at how freedoms of opportunity and choice can be extended. Similarly, for institutional theory, we would argue that it is only being touched on in some of the existing literature to address issues of development, for example by Avgerou (2002). However, there is great potential for its further use in developing country contexts, for example in research on public sector organizations where institutional arrangements are often crucial.

TABLE 1. Some Existing Literature and Future Opportunities for IS Research in Developing Countries

Topic	Examples in existing literature	Future opportunities
Development to which ICTs contribute	Use of Internet for sustainable development (Madon, 2000) ICT not instrument for development only within market regime (Avgerou, 2003) Institutional theory to analyze ICTs for development in Chile (Silva & Figueroa, 2002)	<ul style="list-style-type: none"> • Draw on wider definitions of development, e.g., Sen (1999) • Further work with promising theories, e.g., institutional theory, development economics • Make contributions to related disciplines, e.g., development studies, anthropology
Key issues being studied	Local adaptation and cultivation of ICTs (Bada, 2002; Macome, 2003; D'Mello, 2003) Standardization versus localization of technology (Braa & Hedberg, 2002; Thompson, 2002) In-depth studies of GIS technology (Puri & Sahay, 2003; Barrett et al., 2001)	<ul style="list-style-type: none"> • Important but neglected topics, e.g., scalability/sustainability • In-depth studies of other technologies: e-government, open-source software • Large-scale infrastructure, e.g., telecommunications • Society-based critical issues, e.g., information related to HIV/AIDS
Theoretical and methodological stance	Wide range of theories drawn on e.g., globalization, post-colonialism, theories of power (Liu & Westrup, 2003; Adam & Myers, 2003; Silva & Backhouse, 2003) Methodology of interconnected levels and in-depth studies more common than decade earlier (Sayed & Westrup, 2003; Walsham, 2002)	<ul style="list-style-type: none"> • More explicitly critical studies • Need for methodological precision about the nature of interpretive studies • More action research and longitudinal studies • Cross-cultural research teams
Level and focus of analysis	Individual/group/organization (D'Mello, 2003; Okunoye & Karsten, 2003; Bada 2002) Sectoral/national (Mursu et al., 2003; Silva & Figueroa, 2003) Cross-cultural working (Aman & Nicholson, 2003; Adam & Myers, 2003) Public/private sector (Madon, 2003; Rolland & Monteiro, 2002)	<ul style="list-style-type: none"> • More individual-level studies, e.g., on identity issues • A focus on community in addition to public/private sector • Increased geographical coverage, e.g., China • More locally based research from developing countries

A further theoretical area where we see little work being carried out on IS in developing countries is on development economics. This does not apply to higher levels of policy, in government for example, where some commentators (see, for example, Escobar, 1995) have argued forcefully that economists are over-represented. Rather, we would argue that many micro-level projects and approaches involving ICTs have important economic elements that are often ignored in the current literature. For example, many studies of cross-cultural software outsourcing to developing countries rightly argue that cultural issues are important, but the economics of outsourcing are also vital. These issues have been made especially pertinent through the debates on Business Process Outsourcing and the larger economic

implications it has upon unemployment levels and foreign exchange reserves (Innovation India, 2004). It would be good to see more studies that combined both economic and cultural perspectives. Similarly, the study of telecenters and information kiosks in developing countries surely requires that the economics of these operations be considered carefully, not least in tackling issues of financial sustainability referred to earlier.

The above suggestions for future work have all been concerned with IS researchers drawing from other literatures, such as development studies and economics, to try to make a contribution to the literature on IS in developing countries. However, future contributions could also be the other way, with IS researchers aiming to contribute to disciplines such as development studies, organizational studies, sociology, and anthropology. Applied fields such as medicine could also be a domain for contribution, as our frequent references to ICTs in health in this article indicate. However, to achieve a contribution to any of these disciplines, authors need to acquaint themselves with the norms of a particular field, and its publishing approaches, and to be fully aware of the relevant literature from that field. This is not easy to achieve, but we propose it here as a worthwhile challenge for researchers on IS in developing countries.

5.1.2 What are key issues being studied related to ICTs? As we discussed in the landscape sections of this article, there is good literature on a number of key issues and topics concerning IS in developing countries. These issues include local adaptation and cultivation of ICTs, standardization versus localization, and detailed studies of particular technologies. A summary of examples is given in Table 1. However, when working in developing countries, we have encountered a range of other issues, considered by many to be very important, but which have currently received rather less attention in the literature.

5.1.2.1 Important but neglected topics. For example, while a considerable amount of research has been carried out on the use of ICTs in developing countries in areas such as health, public administration, and education, a key problem remains the issue of scalability. This relates to how small-scale pilot projects, which are quite common, can be rolled out across much wider reaches of whole districts, provinces or countries. Scalability also relates to trying to increase the complexity of services offered over time. India provides a good, if rather extreme, example of this problem, with a population of over 1 billion people. It is noticeable that the literature contains very little discussion of how to tackle this important problem.

A topic which is often related to scalability is that of sustainability, or in other words, how can ICT-based projects be sustained over long periods with appropriate resources, including money and people. Telecenters and other community-based facilities such as information kiosks are often good examples of the sustainability issue. It is one thing to set up a telecenter with subsidies from government or various NGOs; it is quite another to create a self-sustaining long-term facility. Again, little has been written to date on this topic. (However, for some useful material, see the special issue of the *Electronic Journal of Information Systems in Developing Countries*, edited by Gurstein & Harris, 2001.)

5.1.2.2 In-depth studies of other technologies. A second set of key issues relates to in-depth studies of particular technologies, and the detailed way in which their hardware, software, and system configurations interact with the social, economic, and cultural context. While there is some existing literature on particular technologies such as GIS, as noted earlier, it is perhaps surprising that a number of other areas have so far received limited

attention. An example is the area of e-government, where the precise way in which the particular software, hardware, and related networks are set up for a specific application is often crucial in determining whether the application is successful.

A second technological area where more research is needed, and where more precision in the technology is important, is that of open source and free software. The distinctions between the two, and subdivisions of these, are important issues in influencing whether and how a particular developing country can use a specific piece of software. Licensing agreements are variable and free software, for example, may give free use but no access to the source code. Open source software may require that any future product based on the software be made available to others, or in some cases not. These technological details of licensing agreements are not minor issues in assessing the potential of open source and free software to provide developing countries with cheaper and better ICTs; IS research needs to reflect this.

5.1.2.3 Large-scale technological infrastructure. A further broad category of future work centered on the technology would concern itself with large-scale technological infrastructure investments. A good example here is telecommunications. Despite a general improvement in telecommunications coverage in the developing countries over the last decade, connectivity and quality in poorer areas and countries often remain inadequate. Why is this and what can be done about it? The Internet provides a second technological example where more detailed research is needed. Writers in the richer countries sometimes speak of the networked society where everyone is connected online. This is certainly not the case in the developing countries, and even within poorer groups in the rich countries of the world. In addition, the digital divide as applied to the Internet is not only a question of access, but also a question of educating people to be able to use the resources of the Internet effectively, a much harder task in many ways. Some “digital inclusion” projects are taking place, and are occasionally reported on the literature (see Macadar & Reinhard, 2002, for an example). But this is a worthwhile and under-researched area for future work.

A less obvious, but no less important example of an area for future research concerns a more holistic approach to the provision of ICTs in conjunction with other major technological infrastructure such as roads and electricity. It is not uncommon in the poorer countries of the world to find expensive computing equipment lying idle due to an inadequate power supply, or the unavailability of spare parts or technicians due to impassable roads. Mosse and Sahay (2003) described how the large physical distances and lack of adequate transportation impede the flow of health information in Mozambique. Solutions to technological problems thus need to be seen in conjunction with other physical constraints, and of course with human resources, so as to develop approaches that gain benefit from the potential that ICTs offer, but are also sensitive to broader constraints.

5.1.2.4 Society-based critical issues. Finally, in this section on key issues for future research work, we would argue that there are some society-based critical issues which demand attention; HIV/AIDS is a good example. Of course, medical and pharmaceutical knowledge are crucial in addressing this problem, but the role of information and related technologies is also important. For example, in trying to target antiretroviral drug treatments, good patient data and records are needed, something which is often lacking in the poorer countries where the disease has its worst effects. Research is needed to address how best to tackle the informational aspects of HIV/AIDS, and link these systems with policy processes regarding drug roll-out and education campaigns (Chilundo, Sahay, & Sundby, in press).

The importance of the role of information applies to the treatment of many diseases, and health care in general, in developing countries.

5.1.3 What is the theoretical and methodological stance? We noted in the landscape sections that a wide range of theories have been drawn on in the existing literature on IS in developing countries, including theories of globalization and post-colonialism, and explicit theories of power. Methodologically, the existing literature is stronger than a decade earlier, with in-depth studies and those dealing with interconnected levels of analysis being more common.

With respect to theory in future studies, we would suggest that there is a need for more studies to be explicitly critical in the academic sense of that term (Orlikowski & Baroudi, 1991). Topics and issues in developing countries are normally deeply intertwined with issues of power, politics, donor dependencies, institutional arrangements, and inequities of all sorts. These are precisely the type of issues where critical work can open up the “black box” as an aid to deeper understanding, and a stimulus to appropriate action. Some studies surveyed in the landscape sections could undoubtedly be classified as critical studies, but often this was not made explicit (for example, Braa & Hedberg, 2002). Making a critical stance explicit, and using appropriate critical theories, helps authors and readers alike to see how particular interpretations were arrived when assessing a topic such as the use of ICTs for marginalized groups.

With respect to methodology, much of the current research surveyed for the landscape sections used case studies, and largely qualitative research methods. A significant proportion of the research studies stated that they adopted an interpretive approach. It is important in future studies to distinguish some of these labels carefully. Not all qualitative research is interpretive, in the sense that an interpretive study specifically aims to access the interpretations of stakeholders and other research participants, and to bring out the authors’ own interpretations. The aim is then to write up the research in ways which facilitate the readers’ interpretations, undoubtedly different in subtle ways at least to those of the authors. Also, interpretive research does not necessarily use qualitative data only. Quantitative data are quite acceptable as a part of an interpretive study. For example, in the context of a study of users’ reactions to a specific information system, quantitative data could include numbers of users, frequency of use of the system, and even perceived satisfaction levels.

We would also like to see more action research studies. There were surprisingly few among the papers surveyed. Action research would appear to be particularly relevant in contexts where resources are scarce, when it can be argued that outside researchers should not only go away with data for their own papers and academic careers, but also aim to make a specific contribution in the research setting itself. This is not an argument that action research is the only way of influencing the world in a positive way. Ideas are crucial in changing attitudes, and a relatively esoteric piece of writing may have large consequences, as shown by the writings of the better theoretical sociologists for example. Nevertheless, for IS in developing countries, it would be good to see a better balance of action research and more traditional research studies.

Action research is normally oriented towards processes of change, and more generally process-oriented research is something to be encouraged in our view. Developing country contexts are complex and change processes are often slow, taking place over a number of years. The instability of political contexts can impede or delay the maturing of projects. Longitudinal studies, with visits and possibly interventions in field sites taking place on several occasions spaced out over time, are obviously relevant here. Some

of the papers in the landscape survey involved longitudinal studies, and frequently had a process orientation. This shows some maturing of research approaches when compared to the earlier work surveyed by Sahay and Walsham (1995), and we hope that this trend will continue.

A further area where we would wish to encourage methodological innovation involves the composition of research teams. With respect to the former, we see considerable merit, not just for cross-cultural work, in having cross-cultural research teams. While indigenous researchers have obvious merits in terms of their deep immersion in the local context, researchers from outside can often bring new perspectives and approaches to a local field situation. We would like to see more cross-cultural research teams in action, and this may also be a stepping stone towards improved theorizing of cross-cultural interaction.

5.1.4 What level and focus of analysis is being adopted? Different levels of analysis can be identified when researching the use of ICTs in developing countries, namely individual, group, organization, sector or national, and international (Walsham, 2001). For example, in the latter category, we discussed research on cross-cultural working in some detail in the landscape portion of this article. All of these levels are represented to some extent in the existing literature, as illustrated by the examples in Table 1. With respect to the focus of analysis, both public and private sectors are also well-represented.

In terms of future studies, a relatively neglected level of analysis is the individual level. Groups, organizations, and societies receive significant attention, but the individual is normally subsumed within these groupings. Yet, issues of shifting identity for example, as noted for Indian software engineers in D'Mello (2003), are often vital to improved understanding of a particular phenomenon in the field. More work on individuals, and issues such as identity, would be a valuable direction for future IS research.

As noted above, both the public and private sectors are very visible in the existing literature. It would, of course, be good to see work continue in these areas, for example on large-scale government systems and on the role of ICTs in multinational corporations. However, communities would also be a valuable focus of research studies. Community-based facilities are one way of trying to provide support and access to marginalized groups within the developing countries. For example, Byrne and Sahay (2003) describe a study on including indicators of vulnerability of children in the community into the formal district health information system in South Africa. However, the extent of current research focus does not match the size of the problem. Poor or marginalized groups exist in rich countries as well; part of what Castells (1996) calls the "Fourth World." There is very little research work at all on the role of ICTs in such groups (although Kvasny, 2002 provides one example).

A final comment on future research focus relates to the geographical coverage of the current research landscape. While the range of countries in which research has been carried out is reasonably broad, it does tend to be the English-speaking world talking to itself. For example, the world's most populous country, China, is severely underrepresented in terms of reported research in the international literature. In addition to geographical narrowness, the current research landscape is even narrower if the authors' countries of residence are taken into account. Many of the authors writing about Latin America, Africa, and Asia are located in North America and Western Europe. It would be good to see some indigenous and locally based research being reported on more widely in the future.

6. CONCLUSIONS

Our goal in this article was to provide a critical appraisal of the landscape of current research on IS in developing countries, and to present a forward-looking assessment of where we feel valuable future research could be directed. This latter material is aimed to stimulate debate in the field, and we believe that our views expressed here could be used as a basis for discussions in forums such as PhD workshops and working conferences. Indeed, more generally, we would argue that meetings and conferences on IS in developing countries should include material of this nature, namely surveys of where we are and where we are going, in addition to more conventional papers on specific research topics. Research in the area is still relatively new, and deals with highly complex issues in a multitude of contexts. Critical reflection by the research community is needed to try to identify research topics and approaches of maximum benefit to both theory and practice.

We believe that the evidence presented here supports the view that the research area of IS in developing countries has matured in recent years in a number of respects: methodologically, theoretically, and in substantive analyses and results. However, we would like to see more emphasis in future work on the meaning of development, and how ICTs link to this. We would like to see more research on issues such as scalability and sustainability, on in-depth studies of specific technologies, and on society-based critical issues such as HIV/AIDS. We have made a case for more studies which are explicitly critical in their theoretical orientation. We suggest the need for an increase in the number of action research studies. We would like to see increased geographical coverage and more locally based research from developing countries themselves. Research on IS in developing countries has high potential in the future to make contributions to vital problem areas, for example, in helping in the fight to reduce poverty, inequity, and marginalization. We hope that we have made a small contribution to the debate on how to use ICTs to make a better world.

APPENDIX

List of Journals and Conference Proceedings Surveyed

We examined the abstracts of all articles published in the following journals from January 2000 to May 2004, selecting those papers that related to IS in developing countries. We then read and classified all the selected papers. For the two conference proceedings listed below, we read and classified all the papers in the first conference, and those papers in the second conference that related to IS in developing countries.

List of journals examined include:

Communications of the ACM
Electronic Journal of Information Systems in Developing Countries
European Journal of Information Systems
Information and Organization
Information Systems Journal
Information Systems Research
Information Technology and People
Information Technology for Development
Journal of the AIS
Journal of Strategic Information Systems

MIS Quarterly
Scandinavian Journal of Information Systems
The Information Society

Conference proceedings examined include:

“Proceedings of the International Federation of Information Processing, IFIP 9.4 Conference” held in Cape Town, South Africa, 2000

“Proceedings of the International Federation of Information Processing, Joint IFIP 9.4 and 8.2 Conference” held in Athens, Greece, 2003.

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