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Creating a Better World with Information and Communication Technologies: Health Equity

Sajda Qureshi[*]

Editor-in-Chief

Introduction

When news broke on 23rd July 2014, that a case of the deadly virus Ebola had been confirmed in Lagos, home to about 21 million people and a major transportation hub, the World held its breath. If not contained, this virus could spread quickly killing a multitude of people around the World. By 15th October, cases of Ebola had been recorded around the World: Liberia reported 4249 cases with 2458 deaths, Sierra Leone reported 3252 cases with 1183 deaths, Guinea 1472 cases with 843 deaths, Nigeria reported 20 cases with 8 deaths, the USA reported 3 cases and 1 death, Spain and Senegal reported 1 case with no deaths (Qureshi et al, 2015).

Nigeria was able to contain Ebola through concerted efforts in identifying, isolating and interviewing victims while using mobile signals to track potential threats. Using the latest Global Positioning System (GPS) technology, the Nigerians, with the help from the World Health Organization (WHO), were able to quickly trace contacts and map links between identified chains of transmission. Eventually, every single one of the country's 20 confirmed cases was linked back to direct or indirect contact with the air traveler who brought Ebola to Lagos from Liberia on 20th July (Paddock, 2014; WHO, 2014).

By 20th October, the WHO declared Nigeria "free of Ebola virus transmission." The chains of transmission had been broken, because it has been exactly 42 days – double the maximum incubation period for Ebola virus disease – since the last infectious contact with a confirmed or probable case occurred (WHO, 2014). Some of most critical factors in Nigeria's successful response were leadership, engagement by the Minister of Health and state government's rapid response in establishing emergency coordination offices, identifying isolation centers in readiness for potential outbreaks, sensitizing their populations and working with federal authorities. There was coordination with private sector organizations like the Dangote Foundation that donated about a US$1 million towards the Emergency Operation Center in Lagos to cover its operational costs (Ikhuoria, 2015; Paddock, 2014; WHO, 2014).

The use of Information and Communication Technologies (ICTs) in combatting the spread of this deadly virus was prevalent with the neighboring countries with infected populations collecting data, sharing, analyzing and putting it to use in identifying and treating victims. The national coordinator for the Ebola response used the information that the data management team was generating to provide accurate status updates on the outbreak. This information was also used to develop policies to prevent further outbreaks such as tighter border controls (Qureshi et al, 2015), which was one of the ways the notorious Ebola virus was prevented from becoming a major epidemic. In addition to data analysis and cell phone records to track suspected cases, social media, SMS platforms and radio played a key role in the sensitization of the public. This enabled messages on transportation, treatment testing and training of

health workers to take place quickly and providing support for isolated patients or suspected cases while promoting an anti-stigmatization campaign to protect Ebola-free victims (Garcia, 2015; Ikhuoria, 2015; Paddock, 2014).

While combatting global epidemics with state-of-the-art GPS technology has become more common with the help of International organizations, such as the WHO, the provision of basic healthcare is often seen as a luxury in many parts of the developed and developing world. Given the increasing disparities within countries, people at the bottom of the pyramid are left out and are unable to afford healthcare. People with limited resources are forced to live with preventable diseases due to lack of education, information and access to healthcare workers. Lack of health means that their ability to work is reduced and as a result they are not able to earn a living to be able to lead better lives or even to survive. Such negative spirals inevitably lead to large numbers of deaths in segments of a population that are unable to access or pay for healthcare. It appears that in the majority of countries in the world, the burden of paying for healthcare falls on the patients and/or their families (SDSN 2014). This means that as the costs of healthcare rise, so do the costs of staying healthy and leading productive lives. With the rising costs of healthcare, there is an economic cost to communities and countries from such negative health spirals (Bloom et al., 2011; SDSN 2014).

Lack of healthcare and poverty are connected. The WHO reports that while inequalities in healthcare exist between countries, the widest inequalities take place within countries. Despite its success in fighting epidemics, Nigeria has the largest inequality on the composite coverage index, with only 10% of the poorest and almost 80% of the rich having access to healthcare (WHO, 2015). The USA is also known for its wide gap in healthcare coverage. As of 2014 there were 46.7 million people living in poverty in the USA (US Census Bureau, 2015). Blumenthal and Squires (2014) suggest that escalating healthcare costs have contributed to the rising economic gap between America's rich and the rest of the population. The USA has been transitioning towards greater healthcare coverage through the Patient Protection and Affordable Care Act of 2010. This Act requires the creation of measures and reporting of the *meaningful use of the electronic health record* (EHR) and *quality of care furnished to an individual* in an effort to increase outcomes (Blumenthal & Tavenner, 2010).

Implementing this dual focus on outcomes and access to care to ensure that the poor are not left behind is not a simple endeavor. The legislation mandates the use of Information Technology (IT), in particular, EHRs have become a central component of healthcare provision in the USA. On the other hand, while access to healthcare is getting easier in the USA, in China tens of millions live below the poverty line and access to healthcare for some is getting harder. Its transition from planned to a market-driven economy has meant that China has seen widening gaps in economic and social development between different regions. This trend appears to coincide with the increasing privatization of its healthcare services (Gao, Qian, Tang, Eriksson, & Blas, 2002).

Development requires equitable healthcare provision. Equity in healthcare is an ethical concept which ensures that people are not prevented from becoming healthy because of their socioeconomic circumstances. Inequities can prevent large segments of a population from being engaged in pursuing better livelihoods. While healthcare is central to the wellbeing of an individual, community and even a nation, it is also a resource that needs to be allocated in a manner that enables the most people to benefit from it. In particular, there is a sense that the health of individuals permeates the lives of those around them and affects those who may be healthy. When the health of individuals affects that of the community and nation, then the adequate provision of healthcare services becomes a public responsibility. In this, ICT infrastructures can enable more equitable distribution of healthcare resources to be made available.

Improvements in people's healthcare has to be seen in the context of the individual, community and nation, where the government takes responsibility for ensuring the wellbeing of the

individual not just for the sake of that individual but also for the benefit of the community and society. In response to Walsham's call for creating a better world with ICTs and the challenges of doing so, this editorial offers a specific view into a well-known but often misunderstood topic, the effects of ICTs in the provision of healthcare (Walsham, 2012). Concepts of health equity, healthcare access and outcomes, and mHealth are explored as a means of understanding the challenges and opportunities for creating a better world with ICTs. In particular, the concept of *health equity* is defined and explored to help understand the duality between healthcare access and outcomes. The growing use of mHealth applications are offered as an opportunity to address some of the individual, community and public health challenges that current ICTs do not address and often complicate the quest for better healthcare provision.

Following a discussion of the challenges faced in the use of ICTs for healthcare provision and the opportunities for ICTs in healthcare provision, this editorial offers ways in which researchers and practitioners can add to what is known. This issue offers nine papers that add to what we know about ICTs in healthcare provision and the role of governments in enabling such efforts to lead to improvements in people's lives. The view from the practice section features two papers that move the discussion forward as to how current research may (and may not) be making a better world with ICTs. The concepts developed in this editorial relate to the papers in this issue in that (1) they provide a lens for the contributions that the papers make in ICTs for healthcare, (2) they enable an understanding of the role of government as it implements technology infrastructures to support access to healthcare while securing equitable outcomes, (3) they help us use the research reported in these papers to use ICTs to make a better world through equitable healthcare access and outcomes, and (4) they offer ways in which these papers can inform new contributions in this area.

Health equity

There is a sense that the equitable provision of healthcare is central to achieving development in any society. The need for health equity arises from inequalities in health status, healthcare utilization and healthcare financing (SDSN 2014; Sen, 2002; WHO, 2015). The concept of heath equity arose from the belief that differences in social and economic backgrounds of people lead to differences in their ability to access healthcare. In other words, groups of people who are already socially disadvantaged due to their poverty, gender, racial, ethnic or religious backgrounds are further disadvantaged with respect to their health. Braveman and Gruskin (2003) offer a conceptual definition that they operationalize as follows:

> equity in health is the absence of systematic disparities in health (or in the major social determinants of health) between groups with different levels of underlying social advantage/disadvantage – that is, wealth, power, or prestige . . . . health is essential to wellbeing and to overcoming other effects of social disadvantage. (Braveman & Gruskin, 2003, p. 254)

In understanding the concept of health equity it is important to note that *health* represents both physical and mental wellbeing in which key social determinants include household living conditions, conditions in communities and workplaces and access to healthcare according to Braveman and Gruskin (2003). They add that health *equity* is not the same as health *equality*:

> health equity focuses attention on the distribution of resources and other processes that drive a particular kind of health inequality – that is, a systematic inequality in health (or in its social determinants) between more and less advantaged social groups, in other words, a health inequality that is unjust or unfair. Not all health disparities are unfair . . . For example, we expect young adults to be healthier than the elderly population. (Braveman & Gruskin, 2003, p. 255)

This means that having equal opportunities to be healthy is central to the concept of health equity. In essence, health equity is an ethical concept that entails the equal opportunity to be

healthy regardless of economic or social standing (Braveman & Gruskin, 2003). This ethical concept is followed in countries that offer universal healthcare to all their people where the mental and physical wellbeing of the population as a whole is a social responsibility.

Yet, universal access to healthcare does not necessarily mean that it is equitable. At the same time, the rich are able to live healthier lives because they can afford to pay for basic and often advanced healthcare. Sen (2002) argues that:

> the violation of health equity cannot be judged merely by looking at inequality in health. Indeed, it can be argued that some of the most important policy issues in the promotion of health care are deeply dependent on the overall allocation of resources to health, rather than only on distributive arrangements within health care. (p. 661)

With the ethical dimension, equitable healthcare provision does not necessarily mean that everyone should have the same access to healthcare, but that people should be able to live the lives that they value. Braveman (2006) notes that since 2003, the WHO has removed ethical considerations when calculating health equity and replaced it with a new measurement which focuses on disparities across groupings. Sen (2002) argues that, since health is central to our wellbeing, it is just as important that the equally basic recognition that the freedoms and capabilities that we are able to exercise are dependent on our health achievements. By this he means that people are not able to do much if they are disabled or continually troubled by illness, and they can do very little if they are not alive. In this sense, Sen's freedoms include the ability to:

> do what one sees as one's agency responsibilities and commitments . . . . where health and survival are central to the understanding not only of the quality of one's life, but also for one's ability to do what one has reason to want to do. The relevance of health equity for social justice in general is hard to overstress . . . in the making of health policy, there is a need to distinguish between equality in health achievements (or corresponding capabilities and freedoms) and equality in the distribution of what can be generally called health resources. While the latter has relevance, I have argued, through process considerations, it is the former that occupies a central territory of equity in general and health equity in particular. (Sen, 2002, p. 663)

There is a sense that the concept of health equity is more than just ensuring that as many people as possible in a society are able to access care. While there are differences in gender, education, financial resources and race/ethnic inequalities that prevent people from being able to access care, the supply of quality care may also be limited. This means that if a government with limited healthcare resources were to distribute these over a very large population of people who require healthcare, there would be people who would not be able to have access to care. They would not be able to become healthy for the very reason that the healthcare resources are unavailable to them. It appears from the disparities in their socioeconomic conditions that poor or disadvantaged people need more and better healthcare, and possibly earlier access to healthcare to receive comparable outcomes with those with wealth or easy access. In this sense, equity in health may entail preventive healthcare programs that offer early access that targets people in communities in need. Another dilemma faced when attempting to offer equitable healthcare is: how does society ensure that healthcare outcomes improve the health of individuals, groups and communities? The following section discusses the dilemma of offering access to healthcare to as many people as possible while ensuring quality of care outcomes.

Healthcare access and outcomes: role of government in the use of ICTs for healthcare provision

Governments tend to have limited resources to ensure equitable distribution of healthcare. At the same time, individuals, organizations and communities will make choices that fit their views of what would best support their healthcare goals. They will look to see where they can find the best

healthcare outcomes. When it comes to understanding disparities in access and outcomes, there is a measurement challenge. Braveman (2006) explains this challenge well:

> Comparing the health of a disadvantaged group with average levels of health may not be very informative about social inequalities in health. For example, in a setting in which a large proportion of a population is disadvantaged, the health of the most disadvantaged may be markedly different from that of the best-off social group but not very different from the average. (p. 178)

In order to understand differences between groups, the WHO uses infant mortality as a health indicator to measure inequalities. It also measures differences between the richest and poorest in a country. While the WHO measurement methods show the disparities between the healthiest and sickest in a society, it does not take into account the differences between the poorest and richest or between those in historically disenfranchised and in the dominant racial/ethnic groups. In the USA, socioeconomic disparities in populations have generally been categorized according to income or educational attainment, comparing all other groups with the highest income/education group and racial/ethnic backgrounds when assessing health disparities (Braveman, 2006).

These differences in measurement techniques make it difficult to measure inequities in healthcare. The problem with such indicators is that they do not provide the full picture of the nature of healthcare required. For example, the UK, a developed country, has a healthcare system that provides universal access to all its people. In its efforts to ensure equality of healthcare, the government takes responsibility for distributing its healthcare resources to every segment of its population. Recently, the British Broadcasting Corporation (BBC) reported that:

> "Parts of London, in the United Kingdom (UK) have higher Tuberculosis rates than Rwanda, Iraq or Guatemala." The article noted that healthcare provision was "Prevention poor" and that, "The borough with the highest rate per 100,000 people was Newham, with 107 cases . . . . Figures for 2013 from the World Health Organisation showed in Rwanda the figure was 69, while in Iraq it was 45. The average rate per 100,000 in the UK was 13." (BBC, 2015, p. 1)

It turns out that London was infected by a particularly drug-resistant strain of Tuberculosis. The question arises: why does London, perhaps one of the richest cities in the world, have the worst healthcare outcomes in the country? The reasons given for such low healthcare outcomes are socioeconomic:

> Poor housing, chronic ill health and poor nutrition trigger latent Tuberculosis (TB) into active TB. Specific health complaints, including diabetes and HIV, weaken the immune system – the capital has high rates of both. More than 80% of London TB cases occur in people who were born abroad. It is not known how many people arrive with latent TB and it is not deemed cost-effective to screen for it. Low levels of awareness and late diagnosis by General Practitioners [lead to such high rates of infection]. (BBC, 2015, p. 2)

Without insight into the communities where outbreaks are most deadly, the ability to intervene adequately and provide quality care becomes compromised. Access to healthcare in and of itself does not enable people to lead better lives; it is the surrounding socioeconomic factors and the capability of healthcare providers to identify and treat diseases that are key. Thus equal distribution of healthcare does not necessarily mean equity in health if outcomes are inferior. In fact, equality of distribution may in fact lead to a loss in the quality of care, bringing about epidemics that could be contained had resources been allocated in a more equitable manner.

There is a sense that equitable healthcare can be achieved using Information and Communication Technology to collect, store and analyze data to arrive at treatment options and interventions. Healthcare provision in the USA is currently undergoing a transformation that promises to address the high cost and decreasing quality of care. At the center of this transformation is the EHRs technology, mandated by the Health Information Technology for Economic and Clinical Health Act. This act authorizes incentive payments through Medicare and Medicaid to clinicians

and hospitals when they use EHRs privately and securely to achieve specified improvements in care delivery. The transformation of healthcare through the use of ICTs continued with the passing of the Patient Protection and Affordable Care Act of 2010, which mandated the integration of physician quality reporting and EHR reporting. In requiring the creation of measures and reporting of the *meaningful use of the EHR* and *quality of care furnished to an individual*, the law links the adoption of the EHR with quality of care to the patient through objectives that measure the adoption of technology by eligible providers (Blumenthal & Tavenner, 2010; Noteboom & Qureshi, 2014).

In principle, ICTs can improve care through data collection and analysis and provide transparency required for multiple providers, insurers and government officials to be able to make informed decisions and arrive at appropriate interventions and treatment options. In practice, the mandated use of EHRs has actually taken physicians away from treating patients and focused their limited attention on manual data entry. Some physicians report that the quality of their care has gone down with the mandated use of the EHR largely due to increase in errors, lack of connectivity between systems and restricting physicians from applying their clinical skills (Noteboom & Qureshi, 2014).

Additional challenges to the use of ICTs to support healthcare access and delivery relate to the social and economic conditions in which people find themselves. An infoDev report by Chetley, Davies, Trude, McConnell, and Ramirez (2006) suggests that healthcare can enable poverty to be reduced. They state that while ICTs have a role in addressing the socioeconomic conditions that prevent people from leading healthy lives, there are many challenges which include but are not restricted to lack of power, connectivity and often dangerous environmental conditions. Connectivity problems relate to basic lack of access to electricity, solar power options, and power supply back-ups; insufficient infrastructure and connectivity access; and high costs. Then there are the challenges related to where the local content on disease prevention is created, by whom, the language and its relevance to the local conditions.

While the Internet can provide a wide range of users with timely, accurate, diverse and detailed health information, a key issue is the quality and reliability of health information. The capacity to have a skilled ICT work force is often needed for the effective use of ICTs in health. Systems professionals and technology products and services providers and project team leaders with high skill levels and experience in working in the sector introducing the ICTs are important components of success. Finally, there is little investment in ICTs for health in most developing countries. Very few government-run health services have properly functioning ICTs within them. If there is no reliable infrastructure to enable inter-organizational transfers of information, then it is difficult to have a national health information and IT infrastructure to underpin the delivery of healthcare (Chetley et al., 2006).

Mobile health (mHealth) for equitable healthcare

There is a sizable opportunity to create a better world with ICTs in the area of Mobile Health. Even with the challenges described above, cell phone usage is transforming healthcare in Africa. With one in six of the billion inhabitants in Africa now owning a cell phone, the surveillance, tracking and monitoring of communicable diseases has become much easier. According to Seth Berkley, a medical doctor and an epidemiologist with experience in Africa, the biggest impact may well come from the rich data the network of cell phones can provide. For example, crowdsourcing and automated data aggregation could be used to map the death toll from the Syrian uprising and cell phone data from 15 million people in Kenya could be used to help reveal how human travel patterns can contribute to the spread of malaria (Berkley, 2013). As human travel is one of the key factors affecting the spread of disease in Africa, a

group of researchers, including Caroline Buckee, an epidemiologist at the Harvard School of Public Health, have mapped precisely how human travel affects the spread of malaria in Kenya by using cell phone location data. By capturing the anonymized travel habits of nearly 15 million Kenyans by gleaning their movements from 11,920 cell towers, and then mapping the data against the incidence of malaria as recorded by health officials, future outbreaks can be contained (Talbot 2012).

Mobile Health (mHealth) is an emerging concept in healthcare in which mobile communications devices are used in health services and information. Mhealth has been defined as the use of portable electronic devices for mobile voice or data communication over a cellular or other wireless network of base stations to provide health information (Kahn, Yang, & Kahn, 2010). Devices such as mobile phones, patient monitoring devices, tablets, personal digital assistants and other wireless devices can be part of mHealth systems. MHealth systems use mobile decision support software applications (apps) to assist or direct healthcare professionals to make decisions, or they can assist patients to make decisions without waiting for input from a clinician (Klonoff, 2013). Mhealth appears particularly advantageous for conditions that require intense and ongoing monitoring, such as diabetes, and where people are of working age and not disabled. With mHealth systems, glucose data can now be automatically collected, transmitted, aggregated with other physiologic data, analyzed, stored and presented as actionable information (Baron, McBain, & Newman, 2012; Klonoff, 2013; Quinn et al., 2009). In developing countries, mHealth applications present opportunities for combatting infectious, chronic and communicable diseases (Kahn et al., 2010).

An area in which mobile healthcare provision is becoming more equitable is in enabling care to become more patient-centered. Studies have shown that the outcomes of patient-centered care have reported better recovery from their discomfort and concern, better emotional health, and fewer diagnostic tests and referrals (Cliff, 2012; Gabriel & Normand, 2012; Oates, Weston, & Jordan, 2000). Additional studies have also shown that the use of mHealth applications for patient-centered care reduce the cost of care significantly (Boulos, Wheeler, Tavares, & Jones, 2011; Payne, Wharrad, & Watts, 2012). Medical applications make smartphones useful tools in the practice of evidence-based medicine at the point of care (Mosa, Yoo, & Sheets, 2012). Motivated by rising costs of healthcare, patients can achieve significant improvements in their health outcomes at reduced costs when they use mobile applications. There are currently between 3000 and 7000 mobile healthcare applications available through Google Playstore and Apple Store to patients all over the world that support lifestyle changes such as fitness, calorie counting and Body Mass Index (BMI) calculation used to control diabetes (Boulos et al., 2011; García-Gómez et al., 2014; Kailas, Chong, & Watanabe, 2010). Such uses of mobile health applications give people more choices as to how they may go about leading healthier lives. Kahn et al. (2010) argue that mHealth may also have a non-health benefit: fostering local economic development beyond healthcare.

Evidence suggests that motivated patients can achieve significant improvements in their health outcomes when they use mobile applications (García-Gómez et al., 2014). Internet-enabled mobile applications allow active patient participation in decisions affecting their health status, health information, linking people and information through multiple digital devices to allow for person-to-person communication, and participating in support groups (Anderson, Rainey, & Eysenbach, 2003; Boulos et al., 2011). The use of such mobile applications is transforming the relationship between physicians and patients, offering greater equity in outcomes.

Mobile applications and internet access continue to transform healthcare by offering patients greater knowledge about their condition and the ability to actively participate in health-related decisions that affect them (Anderson et al., 2003; Boulos et al., 2011; Ventola, 2014). Physicians

and medical students are also increasing their usage to support their education and clinical practice (Payne et al., 2012; Ventola, 2014). The increased popularity of smartphones has led more patients to proactively manage their care while on the go using specific mobile applications containing functionalities such as GPS tracker for Alzheimer's patients, not available on desktop computers (Qureshi, Noteboom, & Schumaker, 2015).

Location-based mHealth applications can further assist the independent living of persons with disabilities and/or multiple chronic conditions and in epidemiology/public health surveillance, community data collection and remote monitoring of patients (Boulos et al., 2011; Mosa et al., 2012). Disease diagnosis, drug reference and medical calculator applications were reported as most useful by healthcare professionals and medical or nursing students (Mosa et al., 2012). Their reliability for making clinical decisions, protection of patient data with respect to privacy; impact on the doctor–patient relationship; and proper integration into the workplace remains limited (Boulos et al., 2011; Mosa et al., 2012; Ventola, 2014).

With the rise of data analytics and multiple treatment options, physicians are faced with two conflicting ways of carrying out the treatment process. The first approach focuses on offering physicians the best available evidence about the most effective treatment for their patients. Evidence-based treatment options, also known as the data-driven approach to healthcare, rely on a combination of data from tests and bio-medical databases on a condition and scientific evidence. Such evidence-based medicine is disease-oriented with evidence based on randomized clinical trials. On the other hand, patient-centered care entails communication and joint decision making with patients whose preferences are taken into account when developing treatment options suited to the needs of the patients and have reported improved health outcomes. Patient-centered medicine focuses on patient participation in clinical decision making by taking into account the patients' perspective, and tuning medical care to the patients' needs and preferences (Barry & Edgman-Levitan, 2012; Bensing, 2000; Cliff, 2012; Oates et al., 2000; Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996).

While both approaches, evidence-based versus patient-centered, are valuable, they are in conflict with each other (Qureshi et al., 2015). Despite the potential of mHealth in overcoming such dichotomies to bring about improvements in the lives of people, the evidence is still incidental and based on a set of limited experiences from around the world. While the success cases of mHealth offer hope to those in need to basic healthcare, it is not clear if at all they can be sustained, scaled up or even replicated in communities around the world. There are as yet few if any studies that evaluate the success of mHealth in offering equitable healthcare to individuals and communities in need. Herein lie the opportunities for research in the use of ICTs to support health equity.

Papers in this issue: contributions to ICTs in healthcare provision and the government

The papers in this issue add to what we know about how ICTs may or may not support better healthcare, including mHealth applications and the role of government. They offer new ways of thinking about the role of government and how ICTs may support the quest for better access to and outcome from healthcare provision.

The first paper in this issue entitled "Three Strategies for Functional Architecting: Cases from the Health Systems of Developing Countries" is authored by Petter Nielsen and Johan Ivar Sæbø. The authors contend that health systems in developing countries are commonly struggling with multiple and overlapping information systems (IS). They suggest that there is a need to move away from this to reduce the burden of parallel reporting it creates and enable coordinated information collection and sharing. However, this is not straightforward as it prompts intricate functional architecting activities across a range of IS domains including health staff,

commodities, logistics, progress tracking, financing and health services information. This paper is based on a case study of a District Health Information Software and how it is involved in the current drive toward integrated systems. From focusing on aggregate health indicators for health management, it is becoming one component among others in larger architectures where it may take on many different roles. The aim of this paper is to strengthen our understanding of the opportunities and challenges related to functionally architecting integrated systems. Applying an information Infrastructure lens, the authors describe these processes as involving a range of different software components and actors not under any central control. They conceptualize functional architecting as activities performed by multiple actors to configure and re-configure the functional roles of independent software components. Based on the case study, their contribution is in identifying three different architecting strategies and conceptualizing them as connecting, encroaching and charting.

"Understanding Dynamic Collaboration in Teleconsultation" co-authored by Ziyu Yan, Xitong Guo and and Douglas R. Vogel is the second paper in this issue. The authors argue that while information and communication technology has been widely deployed in the provision of healthcare for decades, Teleconsultation, one of the new means of providing healthcare solutions, has been prevalently implemented in numerous countries. In principle, it is expected with great potential to improve the effectiveness and efficiency of healthcare service through wide accessibility and cost control. However, many teleconsultation systems have been installed but abandoned rapidly or used at a disappointingly low level. This paper explores the antecedents of low usage in post-adoption of teleconsultation service in clinical practice. The authors identify specific theoretical attributes targeted on the research problem and extend the Technology–Organization–Environment (TOE) framework into a multi-dimensional analytical framework. They design a comparative case study and conduct deductive analysis to test propositions using data from multiple sources. The proposed analytical framework and empirical findings not only provide theoretical contribution by articulating the TOE framework to reflect the specific and distinguished characteristics in teleconsultation services, but also provide implications for practitioners to develop better strategies for teleconsultation collaboration.

The third paper in this issue by Manoj Thomas and Poornima Narayan is entitled "The Role of Participatory Communication in Tracking Unreported Reproductive Tract Issues in Marginalized Communities." The authors posit that vertical models of communication and information transfer have the tenacity to be static and have proven ineffective to reach those living in the lower socioeconomic group of the society. In this context, a fluid model that emphasizes participation and communicative action is more meaningful for information sharing and knowledge gathering. The study proposes the informate–communicate–educate framework to serve as a guide for developing ICTs applications and mHealth solutions. Based on this framework, an mHealth application (K-unit Health Information Dashboard, KHID) is developed to facilitate the reporting and tracking of reproductive health issues among women living in marginalized communities in the State of Kerala, India. Through a participatory process that uses the horizontal model of communication, the paper demonstrates how the KHID application enables knowledge sharing, and disease surveillance to address reproductive health issues.

The fourth paper in this issue entitled "E-Governance and Public Service Delivery at the Grassroots: A Study of ICT Use in Health and Nutrition Programs in India" is authored by Amit Prakash. As E-Governance projects continue to witness sustained policy focus in low- and lower-middle-income countries such as India, not many e-Governance projects are, however, associated with improved performance, leading to an enhanced public value, especially in the grassroots delivery units of government organizations engaged in provision of development services to people. Based on a case study of Information and Communication

Technology use in public health and nutrition programs in the Indian province of Karnataka, this paper argues for a need to shift the design focus of e-Governance projects. While the grassroots functionaries in such organizations have a critical role in meeting performance goals, e-Governance designs have been largely oblivious to the need of improving their overall work content and environment. The findings suggest that it is time e-Governance projects in government organizations engaged in public service delivery acknowledge and rectify this incongruity to be more effective in achieving a broad set of governance outcomes and justify huge investments being made on them in relatively resource-constrained regions of the world.

"A Study of Local Government Website Inclusiveness: The Gap Between E-government Concept and Practice," by Barry A. Cumbie and Bandana Kar, is the fifth paper in this issue. This study examines the concept of electronic government (e-government) inclusiveness and evaluates the inclusiveness of local e-government websites. Inclusiveness sets e-government apart from other types of websites (e.g. commercial or organizational sites) that only serve exclusive market segments. An evaluation for inclusiveness of 101 local government websites from Mississippi (an underdeveloped area by many health and social metrics) revealed (1) a high frequency of issues that prevent inclusive service (on average each site had 291.83 issues), (2) high variability in terms of number of issues (range ¼ [2, 3171]) and (3) widespread absence of websites (87 of the 188 municipalities and county seats did not have discoverable websites). These results suggest there is a need for more inclusiveness, but the allocation of resources to accomplish this may not be feasible. To address this, two strategic options are presented to IT policymakers who seek to leverage e-government for development: an idealistic approach with traditional IT investment for future returns and a pragmatic one that resembles an entrepreneurial IT start-up venture. The study contributes in three ways to what is known: The authors identify the concept and criteria of e-government inclusiveness; develop an automated, software-based, and replicable evaluation method that can be used by local governments to improve a website's inclusiveness; and present strategic options for using e-government to promote social and economic development.

The sixth paper in this issue is entitled "Scientometric Study of the Progress and Development of e-Government Research During the Period 2000–2012" and is co-authored by Manuel Pedro Rodríguez Bolívar, Laura Alcaide Muñoz and Antonio M. López Hernández. The authors contend that many countries have implemented changes in public-sector management models, based on the strategic and intensive use of new ICTs. From a critical standpoint, this paper analyzes and characterizes the contributions made by research in the field of e-government, identifying future areas of interest and potentially valuable methodologies. In addition, it compares research efforts focused on developing countries with those concerning developed economies, in order to identify research gaps and possibilities for improvement in the context of e-government research in developing countries. Diverse scientometric approaches are employed in this analysis of papers published by international journals listed in the SSCI index in the fields of Public Administration and of Information Science & Library Science. The findings reveal the existence of various research gaps and highlight areas that should be addressed in future research, especially in developing countries. The authors found that research approaches to e-government remain immature, focusing on particular cases or dimensions, while little has been done to produce theories or models to clarify and explain the political processes of e-government. In addition, significant differences are found between the impact of scientific output and patterns of scientific production as regards developing and developed countries.

Christine Richter and Yola Georgiadou co-author the seventh paper in this issue which is entitled "Practices of Legibility Making in Indian Cities: Property Mapping through Geographic Information Systems and Slum Listing in Government Schemes." The authors contend that because property mapping through the use of geographic information systems (GIS) and slum

listing are practices of official knowledge production in government improvement schemes in Indian cities, their comparative analysis of these two practices is in concert with recent amplifications of Scott's analytical scheme around the notion of legibility making. In both cases knowledge production in practice encounters an "amorphous state." Government representatives and interests frequently intermingle with non-governmental representatives and interests. This influences knowledge production in practice with different implications for government scheme implementation and participation in urban governance. We find that slum listing supports scheme implementation better than GIS property mapping. The latter seeks to translate the notion of a clear delineation between state and non-state into organizational and technical design for legibility making. It stops short of reaching larger aims of the scheme and comes to focus on the problem of incomplete knowledge and mechanisms of self-referential monitoring. The more organic practice of slum listing involves dispersed paper and desktop technologies and relies on traditional sites of knowledge production in the city. It is adjusted to and enacted by an amorphous state. The official knowledge produced is temporary in nature, and as such allows for incremental and partially reversible scheme implementation. Slum listing retains channels of negotiation with city administration and politicians, which are vital for poorer sections of the urban populace. The study is relevant to policy and future research because, as of 2012, the new national slum improvement scheme requires implementation of GIS also for slum data collection and management. The contribution of this paper is in understanding whether the new scheme will run into similar problems as GIS property mapping or whether it puts at risk existing channels of negotiation.

The eighth paper in this issue entitled "What is the Right R&D Strategy for Overcoming the Difficulties of the South Korean IT Industry?" is co-authored by Eunil Park Sang Jib Kwon, Heetae Kim, Jay Ohm and Hyun Joon Chang. This study proposes new strategies for the IT industry in South Korea, provides objectives for the South Korean IT industry and articulates the roles of the Korean government agencies, companies and users. Specifically, it covers South Korean IT strategies employed during several periods, including a stagnant period and a more recent period reflecting new successful IT environments of developed countries. South Korean IT companies should recognize the importance of user interface and user experience technologies as a next key global IT industry trend. Raising this awareness is critical in increasing the global competitiveness of the Korean IT industry. The authors conclude that the South Korean government agencies should take a more active role in constructing and improving interactive environments that would benefit both companies and users. For future research, they state that it is imperative to investigate the specific roles of companies, users and government agencies with respect to IT usage.

View from practice: are we making a better world?

The two papers in the view from the practice section of this issue offer very keen insights into the question of whether we as an academic community are building a better world with the research we conduct on ICTs. The first paper entitled "Are we Building a Better World with ICTs? Empirically Examining this Question in the Domain of Public Health in India" is authored by Sundeep Sahay. He argues that as social scientists engaged in Information Technologies for Development (IT4D), a question we need to necessarily engage with is "are we building a better world with ICTs?" A first step in this paper has been the reformulation of the question which Professor Walsham raised: "What distortions and obstacles are created by the historical, material, and institutional conditions, and how these shape our efforts of ICTs creating a better world?" (Walsham, 2012, p. 1). This reformulation is done to bring in more explicitly the political dimension into the question, and to nuance the technological deterministic argument

implied in the question of technology (always) creating a better world. Taking an empirical example of an ICT intervention from the public health sector in India, deliberately chosen to emphasize distortions typically seen is similar Information and Communication Technologies for Development (ICT4D) projects, the analysis focuses on understanding the conditions of distortions, why they occur and what can be done differently to contribute to our notion of a better world.

The second practice paper in this issue entitled "How ICT4D Research Fails the Poor" is authored by Roger W. Harris and offers a compelling call to action to make contributions that do make people's lives better with ICTs. The author suggests that research can improve development policies and practices and funders increasingly require evidence of such socioeconomic impact from their investments. This article questions whether ICT4D research conform to the requirements for achieving socioeconomic impact. The author reports on a literature review of the impact of research in international development and a survey of ICT4D researchers who assessed the extent to which they follow practices for achieving socioeconomic impact. The findings suggest that while ICT4D researchers are interested in influencing both practice and policy, they are less inclined toward the activities that would make this happen, especially engaging with users of their research and communicating their findings to a wider audience. Their institutions do not provide incentives for researchers to adopt these practices. ICT4D researchers and their institutions should engage more closely with the users of their research through more and better communications with the public, especially through the use of ICTs.

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