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Users encounter information and communication systems (ICT) within situated, dynamic contexts with political, economic, infrastructural and socio-organizational elements. Demand for eGranary's offline library of digital content continues to grow in parts of the world that lack Internet access, particularly at schools and universities. But uptake is scattered and inconsistent, and the library's impact on localized communities and its wider effects, e.g. on pedagogy, are poorly understood. This study analyses interviews with eGranary intermediary agents active in four sub Saharan countries. These Mediators reveal some of what is known about the context of eGranary adoption, adaptation and the issues that stakeholders negotiate in the process. This provides background understanding for future contact with eGranary end-users

Contextual characteristics identified include: reliability of technology and power supply; power-saving trends using smaller hardware and content structure; institutional and user preference for pre-tailored and/or local content; and desire for improved collection searchability.

Headings

Information and communications technology

Digital libraries – design and construction

Digital libraries – implementation

Digital libraries - use studies

Information resources – use studies

Region – sub Saharan Africa

CONTEXTUAL ANALYSIS OF eGRANARY IMPLEMENTATION IN
SUB SAHARAN COUNTRIES

by

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Chapter 1. Introduction

Global product development is both collective and distributed, grounded in the everyday practices of organizational members. (Orlikowski, 2002)

How can the potential of ICT's be harnessed in the developing world to address locally relevant problems? The problem arises because the two domains of developing countries and the 'mainstream' that is largely North America, differ so widely in diversity and significance of 'context, situation, work culture and interest groups. (Sahay & Avgerou, 2002, p. 74)

Scholarly research in the past two decades has paid increasing attention to gaining a deeper understanding of the complexity of ICT (information and communication technology) application in technologically underdeveloped environments. Discourse has progressed beyond the existence of a "technology transfer gap" (Sahay & Avgerou, 2002) between industrialized nations' built-in ICT design assumptions and norms, and developing countries' assumed need for such technical expertise. It is recognized that ICT is not a developmentally neutral force and that, in many non-Western parts of the world, its adoption trajectory is therefore not predictable (Thompson, 2002, p.370). Projects are re-shaped over time by local social systems, organizational dynamics, the extent of their inclusivity, and by the sustainability of financial and political support and training (Madon et al., 2009; Sahay & Avgerou, 2002). Attention has turned to the importance of recipients' macro- and micro-contexts. Some longitudinal research (e.g. Braa et al., 2004) has guided researchers' confidence in subsequent investigations, but the body of work is insufficient and too contextually varied to support theory

development.

Deployment of information technology (IT) in the developing world has an unpredictable, highly contextualized likelihood of full uptake or implementation per its original Western design. The political and economic landscape, socio-cultural heterogeneity, and resource security are challenging to anticipate or model. However, direct interaction between IT developer and user is widely accepted in most societies, to gauge a product's ongoing or after-the-fact impact.

This study uses interviews with intermediary agents who operate in sub Saharan countries, to develop an understanding of the regional context of the implementation of eGranary, a digital library ICT. The analysis seeks to identify contexts that apply to eGranary¹ users that can be used to better inform the nature and content of future user communication with the US developer, Widernet².

eGranary was developed in 2000 for Widernet, as an offline digital library collection of high-quality Internet resources. Dubbed the 'Internet-in-a-box', it delivers low-tech, low-voltage, nominally-priced copyright-free Internet material (Web pages such as Wikipedia, audio, video and multimedia software). The product is targeted for under-resourced communities in the developing and developed world, which lack Internet and bandwidth connection and/or adequate power supply. eGranary units have been installed in over 1020 rural libraries, schools, colleges, universities and prisons, across

¹ www.eGranary.org Digital Library produced by the not for profit, Widernet

² www.widernet.org, 100 S. Estes Drive Suite 30I, Chapel Hill NC 27514

more than 50 countries; of these, 800 units are in Africa. Although demand for the library continues to grow in technologically underserved parts of the world, very little is known about its remote end-users (students, teachers, local support technicians, administrative personnel, etc.), about how they use the resource, or about how it meets their educational expectations. Without user contact, the system's implementation remains unmonitored and little understood. Widernet's development and production levels of eGranary are currently at a scale where future design enhancements will benefit from closer investigation of its local adoption, while establishing ongoing dialog with all its stakeholders (Widernet, 2009, p. 41).

Research for this study was conducted with seven locally active intermediary agents (Mediators) who are familiar with Widernet US and end-users' situated contexts and experiences in Nigerian, Ethiopian, Kenyan and Zambian environments. Semi-structured Skype interviews were held in Spring 2016 with representatives of international agencies (the US State Department, and the Global Health Institute (GHI) of an American University), and with local Field Associates, who have longstanding familiarity with their operational environment, and eGranary's technological design, installation and objectives. The GHI donates eGranary equipment associated with its Moodle-based teaching syllabus to colleges in Zambia, Kenya and Ethiopia. Interviewees' client bases include local Ministries of Education, schools and colleges; affording them up-to-date evaluations of their customer's needs, and the ability to execute direct or indirect design collaborations with Widernet developers.

Walsham writes that qualitative, interpretive methods produce a reality-based understanding of the context of an information computer-based system, that then increases understanding of the accompanying organizational issues. (Walsham, 2011, p. 9) It is not surprising that in the growing field of Information Systems (IS) studies, Interpretivism has emerged as the leading analytical approach for research in developing world situations. It achieves more sensitive depiction, sense-making and understanding of the lived experience of impact phenomena. (Walsham, 2001, 2006, 2011; Avgerou, 2008). Accordingly, conversations were analyzed without reference to guiding modern theories of information use and exchange, or of design innovation and diffusion.

Research Focus and Originality

This study is focused on the identification of contextual features of eGranary implementation in developing countries, namely in the sub Saharan countries of Nigeria, Ethiopia, Kenya and Zambia. Research in these dynamic environments necessarily involves qualitative, interpretive analysis of semi-structured communications with regional eGranary Mediators (donors and Field Associates). The novelty of this work lies in the recency of its descriptions of the contexts influencing an evolving technology in a dynamic African context. The research also contributes to the growing body of coherent investigation into the application of information systems in the developing world.

This report continues with background (Chapter 2) about the subject environment and stakeholders, and the eGranary digital library tool. Chapter 3 presents a literature review of leading research on information systems in developing countries. Chapter 4 contains the phenomenology of Interpretivism and the study's research methodology, followed by the findings from numerous interviews and correspondence in Chapter 5. These are discussed in Chapter 6, and Chapter 7 contains the report's Conclusions and suggestions for future research.

Chapter 2: Background

IS in sub Saharan Countries

Significant developmental progress has occurred in the past five or six years, since installation of some seventeen fiber-optic cables linking the African continent to the rest of the globe (Song, 2015, pp. 13-14). The many landlocked countries continue to develop their access to the coastal cables with intergovernmental negotiation and investments in laying fiber backbone projects. But the continent's vast distances and geographies compound poorly coordinated intra-continental regulation and insufficient physical infrastructure. Access to the Internet remains weak and inconsistent. Service provision varies with to proximity to cities and availability of sufficient power supply; and these are interconnected with issues like fuel supply, affordability and political transparency. Despite widespread urbanization the majority of rural populations characterize "low spending power and economic uncertainty." (Newstex, 2015) A recent report (Miniwatts, 2016) suggests that as a whole, Africa has 72% mobile penetration but only a 29% Internet penetration rate.

Market liberalization, relatively high levels of investment and competition among telecommunication operators, have raised the use of services to an average 72% market penetration rate (Telecommunications: Africa, 2015) for the continent. But

some countries still have a legacy of politically controlled monopolies over telecommunications and revenue streams, which dis-incentivizes regional integration, innovation or competition between private operators. Telecommunications operators' fortunes fluctuate continually over time. (Africa Research Bulletin, 2015, Newstex, 2015) Two examples of liberalized telecoms markets are in Nigeria and Kenya, whose carrier networks have been able to offer long-distance backbone services wholesale to other operators, resulting in the most rapidly expanding telecoms markets in Africa, and making double-digit contributions to national productivity (Williamson, 2009; Keck et al., 2006). In Kenya in 2007, Safaricom (a Vodacom subsidiary) enabled the development of the innovative M-Pesa micro-finance system. This was an interactive, iterative 'bottom- up' response to specific local customer demand for mobile banking, in tandem with the local traditional banking system and other stakeholders (see Foster & Heeks, 2014 for a descriptive analysis).

eGranary

eGranary is a vast collection of mirrored material from the Web on a server, installed with wired (and LAN intranet) and/or wireless distribution, optional large battery backup and computer terminals, providing extremely high access- and download-speeds. Refreshed material is distributed regularly and is currently organized into one hundred general categories, plus 39 curated searchable digital collections (portals). As will be expanded on below, many subsequent modifications of content and hardware are broadening the library's appeal and applicability to donors and educators.

Missen (Missen, 2005 p. 193) writes that most institutions in developing countries are "many years, possibly decades away from reliable, robust ICT capacity and adequate Internet connectivity." More than 10 years later, and the increased, but expensive presence of Internet and broadband service across the Continent, demand for eGranary continues to grow. eGranary often "sells itself" (Missen, conversation) and in the past two years eighty percent of deliveries are repeat orders (Solis, 2016). eGranary is professionally promoted and supported worldwide, by Field Associates, and clients ordering from them or at Widernet's website represent government education ministries, private schools and more. Field Associates (four of whom are interviewed here) receive commission from Widernet, to cover technical installation, up to two weeks' training as needed; and added fees for ongoing telephone or physical support. A brief pdf user manual provides an introduction to set-up. On occasion, visiting Widernet US representatives hold local training symposia and make site visits. In general, however, it falls to the existing Administrator³ to digest and deal with a variety of entirely new educational and technical challenges that eGranary presents. In their 2009 Report, Widernet observe that technical problems, arising from low computer literacy, occasionally lead to obfuscation and system disrepair or abandonment.

Over the past two decades, many products have been introduced across Africa, originating from the US, Great Britain, France, Scandinavia, Japan and elsewhere.

³ "Administrator" refers to the local host institution's staff member(s) who is/are responsible on-site accessibility, training and promotion and user support. This is usually the host institution's Librarian. This person may or may not also be a 'Champion', a term used by Widernet to describe a (self-appointed) enthusiast for the ICT.

(P3) But all have eligibility, budgetary, scalability, language and other cultural limitations; and no single technology has achieved universal appeal. Examples of other digital libraries of scholarly material HINARI, OARE, and AGORA, which are free to a strictly limited number of economically disadvantaged countries. Others combine licensed with open source costly research material (e.g. AJOL, TEEAL). The ADLSN (African Digital Library Support Network) serves a growing sub Saharan community with open-sourced cloud-based software for the creation and hosting of members' digital collections. IBM, like eGranary, delivers Web content wirelessly to tablets, but with an annual re-licensing fee.

As with any IS, access to and use of eGranary in developing countries, involves a balance of information selection, information need, purpose such as for teaching, availability, technological literacy, and implications for pedagogy. Users must constantly negotiate changing macro-contextual issues such as irregular telecommunications (email, text and broadband), and inconsistent power supply (electricity, solar, generators, battery). Yet implementation of eGranary can quickly re-position a community from being 'information and technological poor' to one that operates on resourcefulness, availability of technical and computer literacy, combined with satisfactory presentation of required digital information. (Maron, Missen, & Greenberg, 2014)

Chapter 3: Literature Review

Part 1 explores research perspectives on the implementation of ICT in developing countries. The technologies discussed are assumed to be technologies developed by and for industrialized countries; this section therefore addresses the principles that inform the (evolving) research activity on implementation of the ICT's or IS's in the developing world. Part 2 presents research on ICT's in Africa in particular; and Part 3 investigates some of the major research on eGranary library. I am extremely grateful to Amy Badham NS for sharing her bibliography with me.

3.1 IS and ICT implementation in developing countries

"Information systems are social systems" (Land & Hirscheim
as cited in Cornford & Smithson, p. 22)

"As [information systems] transcend organizational and national boundaries and support global economic and political activities, knowledge of the conditions and the processes of socio-technical change in developing countries acquires general significance for IS research and practice." (Avgerou, 2008, p. 134)

In the multidimensional field of Information systems and human interaction, references to 'IT' (information technology), 'ICT' (Internet and communications Technology) and 'IS' (Information Systems) are not used consistently by the authors

included here, though some, such as Avgerou, consider ICT to be a sub category of IS. I follow their abbreviations throughout. I also classify eGranary as an ICT, to reflect its dual components of information system, technology and communications hardware.

Scholarly interest and research in the field of IS research in developing countries has grown since the 1980's, in parallel with awareness of the socio-cultural and technological effects of globalization. During this time, attempts to introduce digital technologies designed by and for industrialized countries, into developing countries, have highlighted the inequalities and philosophical misperceptions that had motivated it about. Even in 2000, Avgerou and Walsham urge that those involved in IT design, implementation and management "must improve their capacity to address the specific contextual characteristics" of the organization" within which they work. (Avgerou & Walsham, 2000). Orlikowski & Iacono (2001) observe further that information systems studies frequently overlook their underlying technology or IT artifact. This IT is not "natural, neutral or just given": each is located in time, space, and discourse, in a defined community. Each becomes a composite of "fragile and fragmentary components," that emerges from the target community's "ongoing and transitioning social and economic practices." It's stability and functioning is always conditional and may be challenged at any stage. The technological features involved (such as "infrastructure, bandwidth, interfaces, accessibility, standards, training, business models, citizens' rights and responsibilities") are dynamic and unique: and no single theory could encapsulate its application. (Orlikowski & Iacono, 2001, pp. 131, 132). These points have added relevance to ICT applications in the developing world where,

as Avgerou and Walsham comment above, commonly-held assumptions about implementation, operation and adoption need to be entirely re-examined and reconstituted.

The field is not sufficiently established or geographically consistent to have developed unifying theoretical guidelines. But it is widely recognized that global contexts and organizational practices do not and cannot meet the homogeneity of time, equipment, finance or expertise that are assumed in the original IS design. (Heeks, 2002, p. 105; Sahay & Avgerou, 2002) In a review of global ICT development, Heeks finds that only latterly have scholarly communities begun to consider the direct outcomes of ICT, or a technological system's impact on socio-economic development. Research on the implementation or development impact of ICT is even more rare. (Heeks, 2010, p. 7) Conditions of dominance, inequality or poverty may even hinder the socio-economic growth promised by an IS introduction (see Avgerou 2011, pp. 662-3 regarding India's software industry); and the introduction of IS or ICT in developing countries does not necessarily result in even development for all. Avgerou refines the term 'socio-economic effects', as the focus on the contextual "contingencies" of an ICT's social embeddedness. Context is seen here as the dynamic, emerging construct of local socio-cultural and institutional features which interact with the ICT. Actors at all levels have "hidden intentions and power dynamics, which maintain or worsen current unevenness of wealth and opportunities for fulfilled lives, among countries and categories of people." (p. 657) Consequently, a system's degree of embeddedness into a culture is negotiated, constantly evolving and "mutually reconstituting." (p. 655)

One of the few longitudinal studies in this domain captures these dynamic forces. Braa, Monteiro & Sahay, 2004 address the diffusion of medical technology application in poorly developed urban parts of South Africa. They highlight the effects of the inherent assumption of standardization, that was assumed in the ICT's original design, and which had overlooked the roles of actors and alliances they form, had failed to accommodate the environmental "fragmentation and nonexistent infrastructure"; and was not aligned to the local National Health system. The research proved instrumental in leading to policy change but, as Walsham critiques, "no explanation is given from the viewpoint of the people affected." (Walsham, 2001, p. 199)

Even where the IS promoter and the receiving community share a high-level common technical language and ways of acting, societies essentially differ in their tacit knowledge and approaches to sense-making. Nicolson et al. describe using intermediaries to relate the interests of the respective (British and Indian) software developer communities to one other; while maintaining organizational flexibility such as setting up local joint ventures, and ensuring continued education, training and intercultural understanding (Nicolson & Sahay, 2006, p. 681) Systems implementations may follow progressive transformation, with untested outcomes of IS delivery, (e.g. project initiatives delivered by donor agencies), but follow a process of knowledge transfer with adaptation to local conditions. The transformation may even become disruptive, and contribute to a lasting change in the host's society, economics and politics (Avgerou, 2011). This more fundamental change may introduce an entirely new business model or affect the existing balance of power (Heeks, 2002, p. 14).

By contrast, an inherently inappropriate ICT may fail to achieve the organizational effect for which it was designed (Sahay & Avgerou, 2002, p. 73). Technology design embodies a certain rationality of the socio-political and cultural context in which it was designed, and a similar rationality may also influence ICT investors or donors. The outcome of implementation in a developing world situation subsequently leads to a 'design-actuality gap' between the original rationality and the recipient's prevailing spectrum of social, political and technical actualities (Heeks, 2010). Heeks goes on to identify several categories of the gap between the designer's assumptions about the user's skills, activities, culture, objectives etc., and the user's actual, contextualized experience:

"information (data stores, data flows, etc.); technology (both hardware and software); processes (the activities of users and others); objectives and values (a key dimension, through which factors such as culture and politics are manifest); staffing and skills (both the quantitative and qualitative aspects of competencies); management systems and structures; other resources (particularly time and money)." (p. 105)

The process of implementation may lead to local improvisations that close the gap. But doing so affects, and is affected by the context of execution, and may be harder to achieve in developing countries than in industrialized countries. The likelihood of implementation success or failure relates to the cumulative extent of the gaps listed above, on design rigidity constraints, and on the strength and sustainability of improvisational adaptation (p. 105). The corollary is that efforts to reduce or close design-actuality gaps can improve the likelihood of success, involving actuality improvisation, design improvisation or both. (p. 108)

The concepts discussed above -context, mediation, transformation, embeddedness and design-actuality gap - will be re-visited in Findings and Discussion sections below. Local eGranary design modifications (improvisations) that enhance and broaden the original version's applicability, illustrate Heeks' design-actuality gap facets. At the same time, findings hint at local socio-cultural effects on embeddedness.

3.2 ICT implementation in Africa

The following section presents insights from selected reports on the applications of IS in Africa. It is included to inform the reader and is by no means complete.

Historic attempts to introduce sustainable technology transfers and ICT-based systems to developing countries, may have attempted to address perceived "uncompetitive local industries and dysfunctional public administrations" (Sahay & Avgerou, 2002, p. 73). Although much research focuses on the associated experiences and consequences, developmental benefits have proven hard to realize (Avgerou, 2011, p. 135).

The vast majority of the African population is illiterate and rural (GeoHive, 2015), lacking amenities such as electricity. What is known about technology penetration in many poor developing countries, is often a generalization of the rural and urban conditions: it is rural communities who remain excluded from economic markets, due to their exclusion from electricity, paved roads, telecommunication and other facilities that support digital technologies, and seldom benefit from deregulation or privatization 17

(Nwagwu, 2006, p. 175). Where an ICT is available, electricity supply is usually unstable and technical support lacking (Ng'ambi, 2006). Several authors (Korpela, Soriyan, Olukunbi, & Mursu, 2000; Okunoye & Karsten, 2002, 2003) identify "root causes" or preconditions⁴ which differentiate the African context, from the "much more affluent, less constrained settings" for which the ICT's were originally designed. Korpela et al. elaborate that, in practice, the following constraints form powerful hindrances to ICT uptake: inadequate physical infrastructure, lack of funds, shortage of skilled personnel, an authoritarian administrative culture, and bureaucracy and management inexperience. Most critical, the authors suggest, are the local economic and political stresses that cause "insecurity of life and uncertainty of future." From an external donor's perspective therefore, the risk of an IS project's failure is elevated, which leads to greater critical scrutiny of its effectiveness and/or sustainability than would be applied in more affluent countries. They conclude that, while IS systems are globally applicable, their methodologies should include adjustment to local "organizational, social and political" preconditions. (Korpela et al., 2000, pp. 138-140). It is impossible to verify the above portrayal of a context described in the year 2000, but current research continues to document the presence of the contextual 'preconditions' they described (summarized in note 4 above).

Around this period, NEPAD⁵ and many individual governments' launched initiatives to increase computer literacy education (e.g. Nigeria's 1997 National Policy on

⁴ Preconditions that influence African contexts: "particular personnel and organizational factors; ethnic culture; administrative culture; social factors e.g. political history; economic factors, e.g. poverty vs. affluence; geography and climate" (Korpela et al., 2000, p. 138).

⁵ NEPAD: New Partnership for Africa's Development

Computer Literacy for all schools). But research in 2014 finds continued low to very low computer literacy levels among both Nigerian library staff (Obaje, 2014) and the majority of secondary school teachers sampled. (Oluwatayo, 2012) Their common explanations are the lack of electricity and affordable access to computers. A report on progress at NEPAD's trial e-schools in Kenya includes mention of the schools' need to secure their own satellite Internet link, from the outset, which had been the result of the Education Ministry's abrupt decision not to provide any project finance. (Nyagowa et al., 2014). Carrim and Taruvinga (2015) conclude from their analysis of South Africa, Southern Africa and the African Union, that ICT use has benefited institutional administration, communications, lesson preparations and has possibly reduced costs; but that after all the levels of commitment, ICTs' effects of on learning and learners' cognition have yet to be adequately researched. (Carrim & Taruvinga, 2015)

The 2000 Millennium Development Goals targeted primary schooling in Africa, which left secondary and higher education institutions 'starved' of foreign investment in capacity and skills training. 'Legacy' (colonial era) and many new private universities have attempted to meet the Continent's exploding demand. But inadequate infrastructure and depreciating teaching quality remain as much of a challenge as are the pressures students face: of affordability, employment demand, limited opportunities and even (frequently) gender discrimination. (Pfefferman, 2015) Michael Joseph, past Safaricom CEO, listed uncertainty in the business environment as the greatest challenge generally faced by business innovators in Africa, such as caused by physical insecurity, and the lack of power or roads and airports. (Menske, 2015)

3.3 eGranary implementation

An unpublished report on research undertaken by Widernet (Widernet, 2009) uses a combination of user questionnaires, teacher surveys (at unspecified locations), focus groups (Nigeria, Ethiopia, Zambia) and server logs to evaluate eGranary's utilization. Survey response rate was extremely low, partly due to impractical survey distribution (bulky paper format or online; the latter mode excludes most users and may have introduced gender bias (Missen in conversation)). Findings included that participants felt excluded from the Widernet Project and its operations, and that sometimes "cultural barriers" hindered local operatives from seeking technical help. Since the report was written, many more Field Associates have been employed to provide faster technical assistance and extensive training programs for users.

Norton's research on new digital literacies in poorly-resourced Ugandan communities, finds that eGranary use had profound effects on school children's sense of possibility and socially-imagined identities as global citizens. Downsides that reduced eGranary's impact and uptake (Norton, & Williams, 2012, p. 124) were the community's lack of electricity, lack of technical support, lack of African-specific resources, out-of-date information, difficult searches and having only a single digital library to serve the community. Once selected students had become local "experts" their community status rose. Norton et al. noted that access to eGranary's material had led to changed existential and cognitive effects on students (Norton, 2013, 2014; Norton & Williams, 2012).

Norton also presents some useful guidelines for successful ICT implementations in

Ugandan communities (though these seem universally useful):

“Collect empirical data that can be used by policy makers and curriculum planners; recognize local differences between rural and urban areas; promote professional development of teachers and teacher educators; integrate in-school and out-of-school digital literacy practices; and provide opportunities for Ugandans to both access and contribute to global knowledge production.”
(Norton, 2014, p. 114)

Norton’s suggestion, that external research and observations be contributed back to the host environment in the form of participative feedback, suggests use of the Critical Social Theory, another Interpretive IS research methodology. Walsham cautions that the role of immersed researcher as IS analyst and commentator requires extensive prior field work and subject mastery to better understand how IS practice can be improved (Walsham, 2011, p. 13).

Medical practitioners in developing countries have extremely limited access to the latest online medical information (even from HINARI), due to inadequate or prohibitively priced access to both medical journals and to the Internet itself. eGranary presents itself as a solution to this "bandwidth gap." Tailored medical material can be downloaded to personal devices to enable the practice of evidence based medicine and use of clinical decision tools. At the time of writing, Mayo Clinic Proceedings had granted eGranary access to its entire digital archive (Roberts, Missen, & Grimes, 2007)

Chapter 4. Methodology

"... all that can be promised in advance is that 'understanding will be increased,' and that that increase will be noticeable to a variety of audiences" (Lincoln & Guba p.225).

4.1 Knowledge Gap

Product developers at Widernet currently lack a viable method to determine details about how the eGranary digital library is being utilized by its end users, what it is being used for, who exactly users are and what experiences, complexities or limitations they face. Before establishing direct communications with unknown eGranary users, via untested methods, it is worthwhile to consider the suggestions and opinions of its intermediary parties - the Field Agents who market the IS and provide technical back-up, and the Donors who purchase eGranary for their educational use. This research focuses on identifying the implementation contexts that they reveal in their experiences and views. This information will contribute to the necessary first level of understanding needed to inform future communication with end user groups.

4.2 Phenomenology of Interpretivism

Performing research with mediators of eGranary use located in Africa, is a highly

phenomenological situation and clearly best suited to qualitative investigation (Punch, 2014). An understanding of cultural contexts may reveal the process of IS appropriation under normal circumstances, but the "internal variety" of culturally and geographically remote cultures is too great for ready generalization (Walsham, 2001, p. 200).

Studies of IS implementation in organizations or societies have evolved over the past thirty years, away from theory-driven, positivist approaches with pre-determined, subjective measures of success/failure as an implicit dependent variable (Heeks, 2002). Land & Hirschheim (1983, cited in Cornford & Smithson, 2006) were possibly the earliest to describe information systems as social systems, a construct of the system's performance and users' goals, values and beliefs. Hirschheim used the term 'interpretivism' to underline a researcher's unavoidable lack of neutrality in interpreting records or observations of human behavior (Cornford & Smithson, 2006, p. 61). The social context of an observed ICT has emerged as a central feature in the analysis of its implementation (Sahay, 1997). Interpretivism, a critique of positivism, is an epistemological position (Walsham, 2011) in which a construct of humans' subjective social and experiential reality is drawn from meanings and understandings of their accounts - commonly by way of interviews. The majority of research in the past 15 years, adopts the interpretivist method in Developing World situations, the perceived meanings and values of the IS to the end user. (Hirschheim and Boland cited in Foreword to Walsham, 2006; Walsham, 2002; Avgerou, 2008). The interpretivist methodology has now become widely adopted for organizational and socio-

technological studies by the leading authors in the field, namely Orlikowski, Avgerou, Heeks, Sahay and Walsham.

A basic assumption of interpretive research is non-determinism, whereby neither human actions nor technologies have direct causal impacts. Rather, the technological consequences of a new ICT (the content of the change) arise from social, cultural and cognitive forces of the organizational setting and often drive overall "socio-organizational performance" (the context of change) (Byrne & Weilbach, 2008, p. 221). Put differently, a particular organizational context endows the technology with social meanings which then shape the implementation process independently of its material properties (Sahay 1997). In under- or poorly-resourced settings, interpretivism accommodates a less deterministic record of foreign contexts (Walsham, Robey, & Sahay, 2007). In these circumstances, too, the interactions or discrepancies between an IS's (Western) technological design, and the end user's physical, sociological and technical capacities, are most evident - conditions which again lend themselves to interpretivist sense-making.

At best, interview findings in this research work are subjective, incomplete and inconclusive. They provide a snapshot of conditions in Spring 2016 with a specific purpose - to gain a clearer understanding of eGranary's operational environment and identify the environmental contexts that affect its adoption.

4.3 Research Design, Data Collection, Data Analysis

Summary: Research involved conducting semi-structured interviews with eGranary Mediators who are actively involved in its implementation in African countries.

Transcripts were then analyzed for common themes and contexts that apply to the ICT and its users.

The interview protocol

The use of a semi-structured interview protocol enabled some comparability between subjects and ideographic sense making, Besides, interviews are exploratory and their analysis is descriptive of user communities' situationalized experience of eGranary. Ethical interviewing is a central concern in this context (Allmark et al., 2009) and question material, including secondary modifications, were approved by the IRB. Questions were designed by the researcher and supervisor, and designed to elicit broad illustration of the participants' eGranary related activity, geographical operations, their scope and physical infrastructure, problems experienced, their observations of the user and personal suggestions. Several participants were contacted again by email or phone for explanation or further elaboration on talking points. Supplementary data gathering and fact-checking was obtained from Widernet, Chapel Hill.

Research subjects and sampling

The seven interview candidates act as mediators between eGranary's US developer Widernet, and African locations. Four were proposed by Widernet (directed sampling) and three were recruited from interviewees' recommendations

(snowball sampling). Four are eGranary Field Associates, from Ethiopia, Kenya, Nigeria and Zambia, actively involved in the promotion, sale, installation and provision of eGranary technical assistance. Two more are medical practitioners from the same American University's Global Health institution, who use eGranary in a modified format for medical education in several global locations; and one interviewee is a US official who, for several decades, has been directly involved in promoting in many African countries.

Individualized recruitment letters were emailed to subjects, including an explanation of the proposed research and a letter of consent. These are in Appendix A and B. No incentives to participate were given, no inclusion or exclusion criteria were applied, but and all subjects gave their informed consent to participate. Subjects were approached with a recruitment letter and letter of consent. They were then sent the 6 pilot questions (see Appendix C) in advance of the interview, in the interests of sticking to the promised 30-45 minutes of their time, and to establish the independence of the research agenda from Widernet's operations. Interviews took place via Skype at times of subjects' choosing and subjects were free to digress from set talking points. After the first three interviews, it was decided to expand the protocol with an IRB-approved introductory explanation of the research purpose (Appendix C2). This had the noticeable effect of relaxing the conversation, clearly returning content initiative to the interviewee and reducing the need for prompts.

Data preparation and exploration

Fourteen conversation transcripts and two email responses were iteratively coded

for emergent themes, using Atlas.ti software. Though they were anonymized, speakers' country codes were retained as the country contexts they refer to can be idiosyncratic and variable. This was decided in agreement with Avgerou's views that the implementation and potential embeddedness of technology is a contextual process of socio-organizational change, of contexts at local, national and even international organizational levels, and lastly, of the cultural, social and cognitive forces that drive them. (Avgerou, 2001)

4.4 Research Limitations

This research contributes to the body of knowledge called for by Walsham, Avgerou and others, to expand understanding of the applicability of IS in the Developing World. It follows the established interpretivist methodology, which naturally gives rise to certain limitations and weaknesses:

Due to constraints on research time and scope, the sample of interview subjects in this study under-represents the institutions and countries in the African continent and around the world that host an eGranary libraries. The methodology means that data is intensely subjective; and interviewee characteristics and material they covered in 13 hours of conversation is variable (and not all questions could be dealt with equally in the time available). Naturalism and veracity were traded off against the short conversation time, geographical distance, cultural differences and the researcher's inexperience with professional interviews. Nevertheless, data could be reduced into a relatively few themes, even generating some redundancy, which

attests to improved trustworthiness of the findings. For reasons suggested above, though, the findings necessarily lack depth or nuance. Much remains unknowable, particularly about the highly significant political and physical contexts (such as infrastructure) that users face.

A further limitation is that findings are not globally generalizable; and clearly there is a need to replicate this initial study in different environments. This project focuses on eGranary use in only four out of 54 African countries.

Chapter 5: Results

"eGranary is very, very useful for students ...it is almost a lifeline" (P7)

Five major themes that emerged from transcripts and other research material, namely Context: Physical infrastructure, Context: eGranary-related environment; Product effectiveness and Mediator Approbation; Limitations of eGranary; Modifications and Suggestions.

Semi-structured interviews were well-suited to remoteness of the study setting and were accommodative of interviewees' culture, preferences, requirements, English language ability. Above all, the structure suited the interviewees who willingly gave their personal time to talk. The major affective constraint was the length of conversation times.

On one plane, the findings reveal two levels physical context: one set of comments concerning the availability of IT and infrastructure; and a second set reflecting eGranary implementations, the 'ecosystem' of delivery, installation security and so on. Three more categories are related to human interactions with the delivered product, the human context. These are the Mediators' - sometimes as proxies for users – positive views, negative views and modifications of eGranary.

A secondary analysis, which is consistent but less tidy, reflects interpretations of the

indirect description of users' perceptions of eGranary. Vocabulary used here is taken from the seven keywords used by Morville (2004) to describe usability of device design. Where relevant, these are indicated in capitals letters within the Discussion (Chapter 6) of each category.

More Interviewee background from interviews

Two American interviewees are active medical educators with an American University's Global Health Institute, hereafter referred to as GHI, which maintains close contact with Zambian Ministries of Health and Education. The Institute donates eGranary libraries packaged together with Moodle based teaching material, in close collaboration with local University Medical Departments, nurse training colleges, 14 teacher training colleges and three pilot projects with high schools. University students there enjoy unrestricted access to the entire eGranary collection, often taking advantage of eGranary's WiFi connection after hours. Secondary school students tend to use eGranary at the direction of their teachers, who gain proficiency at state teacher training colleges. GHI is beginning to expand their expertise into agriculture and veterinary science teaching, and plan to deliver medical teaching material to Kenyan and Ethiopian universities, colleges and schools. They recently began small operations in Malawi and South Africa (high schools).

"We started developing all the various portals, mostly the health portals, at that point. Ones that were labeled Zambia or (GHI) portals. So we engaged our students and got that content built up, and then subsequently, this Belgian NGO was looking to do some work in primary and secondary school education, and then that's when the Zambian Knowledge Portal was developed. They identified the resources, and we helped them get them in. I had a person

essentially full time and also paying [Widernet] to get all the content stuff ... And then the first big sets of installation. We put one in each of the universities that was there, and those have probably gotten the heaviest [eGranary] use in terms of sheer numbers, because they have 10,000 students" (P1).

The third American interviewee has travelled widely in Africa, with postings in Kenya, Nigeria and Egypt, and has displayed and promoted the eGranary digital library since its inception.

Four African interviewees are Associates who install and supply technical support for eGranary in urban and rural settings. Each has many years' experience with the product, negotiating local infrastructural and client constraints, and devising technical adaptations to their situations. Their country of origin is given if pertinent to the material. One Associate has developed a successful education package incorporating eGranary, named 'Girls Can Code', and actively liaises with local and international (US) government agencies. Another Widernet Associate is mainly employed by an Africa-based technology and innovation training hub, affiliated to GHI.

Context: Physical infrastructure

- Physical infrastructure in the form of electric power supply, has one of the most pervasive determining influence on life in Africa and particularly on eGranary application. All four study countries are beset by irregular power outages, which cause eGranary to crash and require trained re-installation. Nigerian power supply is locally generated but the supply chain is notoriously corrupt, which has driven reliance on external generators.

"We have major, major power problems. And it's not even about how available

power is, it's how much people didn't have access to power in Nigeria. There are some places that do not have any power lines at all. We're still even dealing with power getting to those places. Then we have the issues of the non-availability for where the power actually is, and power lines even are - We have those problems with power. This current government is making a lot of effort to try to deal with these issues, because there's so much deep-seated corruption in that sector. Because the people who get to import these alternative power supply plans, like the generators, are making tons of money from China and all those other places." (Nigerian Associate)

Electricity availability in Zambia is state-owned but availability is regional, mostly urban; and power outages are reported to be so commonplace as to be unremarkable.

"Around here power outages are actually normal. Losing power in the middle of your work is not a train smash, like, "Oh, yeah. OK." It happens every single day, and it's not always anticipated." (Zambian Associate)

eGranary installations in Kenya experience virtually no power problems since every educational system, including rural primary schools, has access. But increasing droughts are affecting the hydroelectric supply. (P5) The population in Ethiopia is largely rural, without infrastructure such as electricity, telecommunication and transportation. Ethiopia has access to hydroelectric power, and a solar panel plant was recently constructed Addis Ababa.

The standard eGranary product has a 12-volt battery with a 24-hour charge life. Combined with the product's WiFi capacity, Widernet's collaborator-developer GHI, is engaged in further rationalizing content and reducing hardware size. By reducing demand for the entire library all the time, via specialized teaching components, P1 is able to experiment with ways to reduce power needs, therefore reducing battery sizes and device sizes (tablets are modern and cheap), while increasing maneuverability in teaching environments.

- Local production of ever-smaller solar power panels in Zambia, Nigeria and elsewhere, facilitates GHI's efforts to downsize eGranary content delivery in tandem with reduced device size and lower energy needs (see 'Modifications' below).
- eGranary's offline presence enables rapid download of high-bandwidth media. eGranary is designed for use in all locations that lack Internet access and broadband. Even where Internet service is available, such as on Zambian and Ethiopian campuses, (where a Norwegian NGO bulked up spare bandwidth capacity to create giant LAN's between universities (P3)) eGranary's constant delivery of rapidly downloadable, bandwidth-heavy items (video) is a strong marketing point (P4, P6. P7).
- Despite discrepancies in access to power and telecommunication throughout the continent, economic activity everywhere means that email communication is common (P4, P5) and cellphones, mainly Samsung and Nokia, are ubiquitous (P4, P5, P6, P7). Tablets are very cheap and widely available. Low-cost use of SMS is ubiquitous, and P5 and P6 agree that using this as a survey vehicle (e.g. a short question per day) could be viable.

Context: eGranary - related environment

- International influence: a large number of Western governments, NGO's, Development Organizations and corporations are active in promoting literacy and education in Africa. P3 commented on a the number of un-coordinated and increasingly financially unsustainable projects by Japanese, Scandinavian, German, Dutch, French, British and especially Chinese donors, who's efforts include have building cultural

institutions and libraries, and providing language teaching.

- Preference for national uniqueness: Before operating in a country, eGranary installations must first be negotiated at government ministerial level or with top administration of educational institutions. (P1, P2, P3, P5, P7)

"The requirement for eGranary is very high but we need it to work and be approved, so that the government may accept as a resource for education for [inaudible] education so that it might be the service throughout the country. ... I'm trying to just contact the person from Ministry of Education and I'm trying to give a demonstration." (P5)

Content is vetted for adherence to national standards and culture, before being distributed to universities, colleges and schools. In general, many purchase decisions are made by senior government administrators, without regard to their viability on the ground, resulting in obsolescence of unused equipment. (P3, P4, P5) For instance, at the insistence of the Zambian Ministry of Education, the GHI (with student assistance and Widernet) was prevailed upon to map the country's medical training syllabus from eGranary into the Moodle packages they were supplying. This precedent has since made it problematic to enlist local added contributions. (P1) There is the belief among local authors that contributing their own content or course material might result in their loss of personal copyright. (P4, P5, P6, P7) Zambian teaching staff might be more willing to save course references and material if they believe that the Moodle package keeps their material "localized to their environment" and not openly distributed, according to that Associate. An exception to local reluctance to contribute syllabus-related eGranary collections was by expatriate teachers in a rural, industrialized area, who mapped an Art History syllabus to eGranary's content: *"They got all their students using the eGranary to*

the extent that it actually broke down because it was overloaded."

- Availability, time to delivery and installation: Orders can be placed online to Widernet's website but delivery can take several months to ship if the local agency doesn't have hardware available. Client institutions, faced with many competing technology offerings, are reported to find this off-putting.

Based on network availability, start-up can take an hour to a day (P4, P5). But this may take two or three days, depending on the skills and needs of technical staff, teaching faculty, administrators and librarians (P4). The disuse or obsolescence of eGranary units noted by P4 and P5 are the consequence of purchasing eGranary without making the extra investment in needs assessment, training, technical support and maintenance package.

- Technological training and back-up: Field Associates remark that eGranary's technical complications slow their work. Installation was described as being "not as easy as it was marketed to be," and that "eGranary has one shortcoming: it's technical uptime ...eGranary's based on a technology that's not very reliable." During initial installation, and frequently after power cut crashes, servers have to be re-configured and the library system re-installed, requiring advanced expertise. An Associate estimates that at three out of five installations, back-up staff have insufficient skills to handle "technical challenges" and that technical support usually involves phone conversations to walk the institution through repair steps. Another frequently encounters supposedly "highly technical people" struggling to understand eGranary's technology, although eGranary does not involve new technology, and that sometimes return follow-up

training is needed.

- Novelty and teacher-technology interaction: P1 and P4 view the eGranary as 'flipping the pedagogy' in that teachers using it no longer need blackboards to display information and resource searching is student-driven. P7 mentions a "normal generation gap" in software use, between current students or "younger generation lecturers who are comfortable with using the technology"; and faculty, "who have not used computers that much in their work or in their own education." Historically these lecturers have distributed course material on shared CD's or flash drives, but will upload material to Moodle (but see reluctance and concerns described above). In general, more experienced teaching faculty are less technically proficient and P3 mentions a study (not sourced) that indicated that only 30% of [Zambian] teachers could use PowerPoint. P4 finds that technological skills are linked more to proficiency than age: "*There's not always an age difference, but younger teachers are quicker to adapt.*"

The Zambian Ministry of Education allows college and university students full access to eGranary material. Schools there have much more limited access to hardware; and teachers direct pupils to a few, specific sites. In Zambia these teachers will encounter eGranary in their training colleges.

"In the secondary schools the focus is the lecturers. They use the eGranary mainly for teaching purposes, for pre paring their lessons, and for guiding their students. Sometimes they'll need to show a video from the eGranary, or few times they would ask their students to log on to the eGranary, because we've given them 10 tablets. They would ask their students to log on to eGranary and access a resource." (Zambian Associate)

- Personnel unwillingness to complain: It is difficult to record the extent or overall effects of peoples' unwillingness to complain about (for example) a malfunctioning aspect of technology, for fear of looking inept or causing someone else seem so; this observation was made by an Associate in this study, and also in the Widernet 2009 report.
- Security: In one Zambian location, the recent theft of large solar panels from a health clinic adjacent to an experimental solar-powered eGranary project, has given GHI added motivation to devise the use of smaller portable display hardware, requiring smaller, portable panels.

Product effectiveness and Mediator appreciation

- Local buyer and user recognition: The National Museum of Kenya uses its eGranary for access to periodical literature.(P3) Where eGranary content delivery is effective and streamlined, its user demand has become extremely high.

"Most higher education institutions find eGranary material to be very relevant to teacher education and medical sciences, eGranary's content adequately provides the full seven years' coursework, including community medicine so repeated updates are unnecessary for this field ... [University] students are highly reliant on eGranary. You find students would now use it for other studies, other than what we expect them to use it for. They 'll experiment with everything ... They use it very, very regularly ... it is almost a lifeline." (P7)

"It's difficult when you're comparing Internet and eGranary, you get so many -- I have never found so many challenges, so many queries with people from the rural part of the country. And there's a good uptake when it comes to rural than urban in terms of procuring the eGranary...about 70% of my business is rural. The teachers are interested in making their own curriculum. The last eGranary I watched was -- I actually took to rural areas and when I was installing I found so many teachers waiting for me to use the eGranary, and I

was like, "You mean?" This has become something so big to an extent you secure the day for all teachers, and I trained so many teachers. Not even the use of eGranary or the people that were technically using eGranary within their institution. But I had almost 40 teachers coming to train for eGranary. And they were going with a mind that we need to buy this eGranary but now the problem is finances, lack of money. That really is a problem. What they like most about it is actually they use Khan Academy - they can stream and they watch videos on how to do what it is. Do geometry, and they like that part of it by the way." (P5)

- Donor and local vendor recognition of eGranary's value: The four local Associates contacted highly supportive of eGranary and have worked with Widernet for between three and eight years. The GHI has been associated with installing donated eGranary libraries since 2006.

"Most [citizens] reside in rural areas [with no electricity telecommunication and transportation infrastructure, or access to digital or book resources]: introducing eGranary to such areas with low voltage devices gives great help to the student and community as a whole. As eGranary is a huge resource of about 35 million, searching through and locating specific resource might be a problem. But each student and teacher [having] their own collection and sharing between themselves through CIP [a client's personally created web page], will reduce their problem." (P5)

"Students have limited access to additional reading resources in almost all subject areas, and eGranary fills this need...for our medical students, it's been a very, very good tool for their work, it's almost like a lifeline" (P7).

Another advantage to students is that eGranary's WiFi capacity can be left switched on overnight, enabling students to sit outside a library building and complete school work.

Limitations of eGranary

- Product Competition: Many digital projects in Africa, funded by NGO's and international governments, involving e-reader (e.g. Kindle) projects, other tablet

learning projects, and some with local language translation (e.g. a San Francisco project for Kenyans, the 'Open Learning Exchange' in Somalia) compete in eGranary's space (P3). IBM currently has developed a WiFi hard drive and a library of Web material that serves eight users, is moderately priced and readily available.

- eGranary content is perceived as inferior to Internet: If an Internet connection is available, school children are reported to switch to using the Google search engine (in which case, the Associate urges them to at least use Google Scholar.)

"[Kenyatta University, Nairobi] had 30,000 students and one megabit of bandwidth, in their entire library - their entire campus. In a beautiful library built by the Chinese. But the library director was not interested [...] in eGranary. It wasn't prestigious. It was more prestigious to have online databases that people can't use." (P3)

- eGranary content is perceived as already being out of date: Although access to latest educational material in traditional book form is increasingly remote, there is the perception among purchase decision-makers that the eGranary hardware and content might become similarly obsolete.

"We've had the question of updates quite regularly. There's a bit that needs to be updated [on eGranary], but in most schools, [here] and across the world, the texts on physics and chemistry are the same ones that were written in the '80s. The need for updating is overridden by the need for materials, basically. What they need mostly, first, is to have the material there. Once they've had the material, we provide updates, mostly after a year or so we swap the hard drives." (P7)

But another Associate repeated the point that eGranary and associated software are not the latest versions and that it "would be better" to have them updated:

"The tools (such as Moodle, Word Press, etc.) and software in the eGranary are not latest version and need to be updated."

- Poor search experience and searchability: Associates note frequent encounters

with 'dead links' and 'blank pages' in eGranary:

"There are blank pages, that does not have any relevant information, but appear in the search. This needs to be reduced if not removed as a whole" (P5).

"Now the disadvantage or the problem with eGranary that I have seen is, some links are dead. There are some links that you cannot get it. It cannot get through. But how I normally manoeuvre with it is I normally copy the URL. I've been training them to copy the link and paste in Google URL" (P6).

Searching eGranary's 35 million documents is problematic in Africa with its underfinanced education systems and weak infrastructure. User creation of customizable 'web pages' (CIP) is the system's means to disseminate or share information collections, but this requires time commitment and technical skill to make it searchable.

"The problem of most of the schools and universities is to develop their own Digital library. Though they can do pages using CIP it is not searchable. Hence adding a customizable portal [specialized collection created by Widernet] to eGranary helps them to create their own portal." (P5, correspondence)

- Lack of local content curation or portal creation: A Belgian NGO, VVOB, who had created the first eGranary-linked syllabus material used at 14 Zambian teacher training colleges, introduced the GHI to eGranary. But in order for the GHI to begin expanding Medical education there, the Education Ministry has required it to map the health curriculum to eGranary resources, at their own expense. They were also unsuccessful in asking local faculty to upload course resource materials as the latter were worried about loss of copyright on their work. (P1) Where teaching staff have electronic material to share with students, it may fall to their librarians to remind or persuade them to share their course material through eGranary.

The Zambian government required that 400-500 hours of British video demonstration material be locally re-filmed for local context (P1).

- Lack of local (language) content:

"Even though everyone in speaks English (or French), at least in urban areas, dozens of local languages are spoken in the home and eGranary does not address this with distributed content." (P3)

Associates in countries with active literary traditions, were very vocal on the issue of eGranary's lack of local content, which are not easily findable, if at all.

"I would like to see more—I know that we'll not have real [country] institution-centric information, but if we can have more African, Western-African materials. Names that we can call -- even if they're not typical [local] names. Writers, authors, these sorts of things. If those books are called, then they can say, "Oh, this guy is from Abidjan," or, "This guy is from Tanzania," or "This guy--" That would be a good thing. 'Cause everything right now, it's just very Western.... I've found that the people who appreciate it most are the people who teach the sciences: courses like medicine, physics, which is the same everywhere you go. Engineering. People who teach literature are not too keen 'cause then the material is something they can't relate to." (P4)

- eGranary library has limited appeal outside of the educational field: Local tech

developers are attracted to other consumer-oriented activities:

"There are high-tech incubators [e.g. in Kenya], such as the iHub, which have huge amounts of bandwidth, and people wanted to come in and develop apps (for M-Pesa for example) ... They had all kinds of DVDs on business, and entrepreneurship, and marketing, and were not interested in the scholarly knowledge stored in eGranary." (P3)

- eGranary library perceived as unaffordable:

"We have a group of people who buy for schools and institutions. They have the contractors. We usually just get a bid from - they usually just bid to the schools. They buy eGranary with so many other things attached. The market in itself is actually pretty large. Selling to schools, we're selling to libraries, we're selling to

a few individuals. There is some-- I wouldn't call it competition, because these other sources are pretty expensive. And the competition exists, but they are pretty expensive, and they work by subscription. And you have to be online to have them. Sometimes we do better, because we are off/line, and off the internet, and cheaper" (P4).

"It's expensive for institutions to buy, because where fiber optic and Internet are available in the capital city for an institution to pay for Internet that's not being funded very well, it tends to be expensive" (P5).

- *eGranary is not disability friendly*: An Associate who is very active in promoting accessibility to the disabled comments:

"Most of the eGranary content and details are not screen compatible, hence at least content in the disability portal should be compatible to \screen reader."

Modifications and suggestions

- *Power source and provision*: Parts of Africa have seen sizeable investment in solar panel manufacturing (P3, P4). The GHI, is attempting to reduce eGranary's energy requirements by moving away from the current system's 12V battery with its maximum 24 hours' life. Trials began in February 2016 with the use of solar panels at three secondary school operations in Zambia though security concerns caused them to move one pilot project to a safer rural location. The ultimate aim is for an eGranary to run on its own battery and charged once a day (electricity or solar) for energy efficiency (the current devices have a battery life of 10 to 12 hours).

"Around here power outages are actually normal. Losing power in the middle of your work is not a train smash. Like, 'Oh, yeah. OK.' It happens every single day, and it's not always anticipated.

This year we've had a lot of investment in solar panel manufacturing. We have about three or four different new companies that are dealing in solar. They've become slightly cheaper. They're definitely more innovative. They're smaller.

They're easier to carry. They're mobile. That has changed a lot. But that also relates directly to the amount of power that you would need to use on a computer, as opposed to a device that's the size of a small pizza box, for example, the size of a hard drive. What we're looking at, if you've seen on the market, now there's battery-charged, WiFi-enabled hard drives. This is the concept we want to move to.... We've given [local high schools] 10 tablets. When using solar power, it makes a lot of sense to use tablets which only need smaller, quicker panels to recharge.” (P7)

- eGranary use on student phones: On the theme of GHI's push to modify delivery medium, "now everybody has a computer in their phone, in their pockets" (P2).
- Power: battery storage: P1, P7, GHI and Widernet plan to move content onto smaller WiFi enabled hard drives which require smaller batteries with 90% cost savings (P1).
- Hardware and delivery system:

“With WiFi-enabled hard drives, "each individual can have tablets that contain information specifically for their class. They aren't necessarily connected, but they can then study remotely at their leisure. By reducing the hard drive's content and smaller battery, you can put it on tablets and, with its WiFi, the whole class has eGranary access.” (P1, on work with the GHI)

- Content: derivative software (Moodle package, 'Girls can Code') The GHI, and increasingly Widernet, are active in development of more specialized tailored 'portals' that contain resource collections to match educational syllabus needs.

"They're actually teaching them programming and one of those girls, 16-year-old has become a webpage developer and makes money, and she's the one who's put on the secondary education site. She's already put it up" (P1, about 'Girls Can Code' software).

There is interest in developing an app for delimited eGranary access on mobile devices. Widernet confirms that apps will be used for small subject-related libraries of schools and universities.

"Normally to access eGranary from a phone, you'd have to set it as a proxy on

the device. But an app is an easy and practical solution" (P7).

"For phones, I remember I saw a chip, a small chip that you can put eGranary on your phone and it says you can add it to your phones. If we got that also, it would make it easier if everyone buys an extra SD card so that they can process ... And then I believe the size of eGranary doesn't matter, but the content of eGranary matters. The smaller it is, the better, whichever the size, the better. But the content in eGranary matters a lot" (P6).

- Content: Miniaturization or reduction of content into sections: The library "should be re-conceptualized as a sum of its parts (medical, health promotion, nursing, school or country portals). Then, to really raise its levels of use, the divided content can be moved from desktops to tablets, and no longer connected to a central server." (P2)

- Content: Searchability:

The GHI makes associated eGranary material more searchable with close curation and limited subject scope

"We add a Moodle link to eGranary material that is searchable, either with a search term, through articles or topics that are already pre-described, or they can jump to a different medium e.g. video and they get a list of everything there. That way professors, teachers would have an opportunity to pull together the pieces that they want, the references that they would want their students to look at and then put it in a course shell." (P2)

"The other part of eGranary in our experience that I know is that the search engine-- not the search engine, the Moodle part of eGranary. It actually makes our students realize that they can do more neat things. Because I remember I gave them access rights and I tell them, you can come and create a nice webpage, do your own assignments there and complete everything, and I never knew that we have some good students who can do more than I thought, you know. And they did more good websites within eGranary" (P6).

P5 believes that better training students and teachers to share their CIP's will improve the library's searchability problem.

- Feedback to designers: There is strong interest in the development of a mobile

survey app (for situations with adequate Internet access); and in the creation of a Qualtrics survey, which can be distributed online, or offline as a screen document. One Associate prefers to maintain one-to-one client feedback with countrywide in-person visits or regular phone calls, with personal direct queries to Widernet as needed.

The GHI also has access to its own students' web log records which they believe will provide invaluable insight into information search skills and how their teaching material is being used.

Only one Associate (Nigeria) out of the four interviewed, does not have dealings with operatives at the GHI (which donates eGranary packaged with Moodle-based teaching material). The GHI has a close working relationship with the Zambian Associate and has begun to expand its educational operations to Kenya and Ethiopia. Nevertheless, the Nigerian Associate contributes information on almost all other categories than device miniaturization. Specifically addressed were Nigeria's problems with power delivery and users' desire for content to better reflect their local needs.

Chapter 6: DISCUSSION & ANALYSIS

Overview

Mediator interviews reveal some identifiable factors and contexts of eGranary's implementation in the four African countries. The first is purely contextual (physical/technological context), the second is the context that surrounds the IT delivery, training etc. (mediated context). Three more represent human interactions with the delivered product, (human context). These positive views, negative views and modification suggestions are held by the Mediators, but sometimes made on behalf of users' views. These contexts are discussed below

The above human context is highly social: what is represented are oblique, proxy hints of user encounters. Using Morville's (2004) User Experience Basics terms (useful, desirable, usable, valuable, findable, accessible, credible) to loosely describe signs of end-user interaction with eGranary, second-level analyses are included in CAPITALS in the Discussion where they occur. Note that allocation of these keywords is entirely subjective and liable to the familiar weakness of assigning conceptually advanced labels to unfamiliar circumstances. However, a choice of seven terms is less likely to err and the aim here is to convey a sense of the user's engagement, rather than to be accurate and categorical. (Transposing the three concepts of usability as it is understood in the developed world, is likely to be even more problematic; see e.g.

Norton, 2003)

Discussion

The geographical spread, institutional variety and constant growth in worldwide demand, attest to the eGranary's value and usefulness in delivering high quality learning resources at a low cost. But certain factors about its use remain unclear: the motivations and aspirations behind its selection, the dimensions of existing infrastructural provisions; how the system and the information it contains is being used, and whether it meets users' needs or requirements. The interview conversations reveal some of the activities, issues and successes that underpin implementation in sub Saharan countries. They provide general impressions of the nature of purchasing institutions, the physical circumstances, interactions to modify delivery to the user, and some usability concerns.

The physical / external context affecting eGranary's IT

Interviewees represent a region of significant resource uncertainty: even under ideal circumstances of supply and demand for eGranary libraries, the ability to operate them begins with the macro-environmental conditions of each host country. The macro- environment can be conceived of as an outer network of technical, political elements including authoritarian influence, economics, telecommunications and power supply systems, supply and demand (of everything), and technical proficiency.

Power: Interview content indicates that, to Mediators, not users, access to power is a central element of eGranary's operation. Concern about power affecting product

placement (P5, P7) the installation process, anticipated technical support needs (P4, P7) and design functionality (P7 with GHI experimental design). The availability of power, Internet and broadband services are all subject to a combination of political power (sometimes corruption), regulatory constraints and regulators' misperceptions, infrastructure and geography (especially urban vs. rural distances). For example, access to power in Nigeria is vulnerable to political and economic forces beyond market predictability or control. The GHI is taking a proactive approach to these issues: efforts are underway to trial use of full-sized solar panels and the potential use of much smaller panels to power tablets. P1 and P2 contemplate transmitting eGranary lesson material to smaller devices, such as phones, with lower battery power requirements.

Authority / control: Interviews reveal that when government ministries enable eGranary use (or GHI's eGranary/Moodle modules), they retain control over who has access to it (University students or high school scholars). With time and repetition, this is improving in Zambia, and efforts are currently underway to convince the Ethiopian Government to adopt the same GHI model. As an aside, P2 related that a Professor colleague, travelling with an eGranary to Ghana in the hope of installing it there, faced months waiting for both the Education Ministry and the University's permission to install. **IT Delivery:** Widernet's current effort to develop the eGranary library as a "Pocket Library" on a flash drive (Missen, correspondence), and the GHI's existing ability to technologically adapt eGranary's delivery method with smaller devices, corresponding with Orlikowski & Iacono's (2001) perspective on identifying the IT's role as a distinct component of ICT study (see discussion on page13). Widernet

continues to work on enlarging battery capacity: the largest holds 24 hours' charge and kicks in at power outages without information loss. As mentioned, the GHI is experimenting with reducing device and battery size to increase portability and volume of class dissemination.

Research in this study did not yield enough understanding of eGranary's IT evolution, but it is suggested that a theoretical concept, of artifact 'miniaturization' (e.g. of delivery unit size, device size, content format, device and server energy requirement, mobility/portability, affordability, perceive-ability) encompasses the ways in which eGranary's processing capabilities and effects have contextualized, possibly even become embedded, as the IT product is developed, implemented and used (Orlikowski & Iacono, 2001, p. 121).

eGranary's human ('socio-organizational') context

Uniqueness and nationalism: It is natural for Government Ministries to have a role in determining appropriate educational content or to insist that medical video material be attuned to their location, but P3 and P6 refer to different Ministries' rivaling comparison of syllabus standards. This could then affect the user's perception of the eGranary's DESIRABILITY and it's being viewed from a prestigious perspective. But eGranary's long order period and **technical requirements** have been seen to deter potential buying interest. Associates describe the difficulties that some host institutions' technicians have in understanding the technical complications of eGranary and some also comment that it is actually more complicated than even they had been

led to believe. Certainly, Widernet's 2009 Report and one Associate in this study, report some Administrators' **reluctance to complain** or seek outside technical help, for fear of looking unqualified or making a colleague seem so. These factors could speak to the ICT's lack of ACCESSIBILITY. But the number of occurrences and their effect on eGranary's overall uptake and potential role for a community, are difficult to measure.

On the other hand, equipment miniaturization, the concept of eGranary's 'flipping the pedagogy' and the use of digital material by younger or more youthful users all make eGranary more ACCESSIBLE, DESIRABLE, USEFUL and USEABLE. Only direct querying of students and staff will reveal the broader picture of the extent to which the classroom structure has really changed, is in flux or resisting change.

Product Effectiveness & Mediator Appreciation

Associates are extremely loyal to eGranary, driving great distances for give technical support (An Associate recently traveled from Nairobi, Kenya to Khartoum, Sudan to install an eGranary there), are quick to laud its role in the lives of thousands of scholars; and are very appreciative of teachers' strong interest whether they have access to eGranary or not. (P4, P5, P6, P7).

Limitations of eGranary

Items in this category were understood to be permanent issues, not born of brief misunderstandings. Client perceptions that eGranary is **out of date** is true in a strict sense: updated hard drives are physically distributed and may occur once a year at best.

An Associate responds by saying that specialized education materials don't need to be updated frequently, especially compared to dated textbooks. Likewise, perceptions that eGranary is **inferior to the Internet** is true for a fortunate few who are familiar with the Internet. But for others in Africa, for example, there is little alternative to making the best of what eGranary has to offer. Criticisms of eGranary's **searchability** are also valid and must affect user's view of eGranary as not being **USABLE, ACCESSIBLE, FINDABLE** or **VALUABLE**. Many users are familiar with traditional library searches and some have exposure to the Internet and live Google searches. eGranary mirrors a sizeable portion of the Internet's static content but despite having been 'ordered', it lacks comparable levels of Internet searchability. But manual creation of subject-based portals by Widernet librarians, addresses a small portion of resource find-ability. Maron et al., (2014) describe early efforts to crowd-source metadata creation with a view to automating classification of eGranary's vast content in the future. And eGranary offers a feature which allows users to create their own collections, and create searchable Web sites (CIP's) with website development tutorials incorporating MySQL and PHP software (Solis, 2016). Outside of GHI's packages, the searchability issue is clearly a source of concern to all Associates and CIP creation results in authors having 'copyright' concerns.

eGranary users seem reluctant to display their own web-pages on open eGranary and this may be for several reasons. They may not have the confidence to make their efforts public, they may not be convinced of the usefulness of creating potentially redundant Web collections; or they may not wish to lose sovereignty over their work. P1 describes the reluctance of the Zambian Medical and Education Ministries to map their

own syllabus-related material to eGranary. It is possible that the unstructured mass of eGranary's (English language and culturally remote) resources is also daunting to digital non-natives.

Nevertheless, searchability is a systemic challenge that is faced by many stakeholders throughout the implementation environment. Widernet developers and associates are also active in evolving eGranary's structure and the nature of its content, in response to the direction of mediators' efforts. They have created topical searchable "portals" and facilitated the insertion of adaptations (such as adding GHI's Moodle) for end user access to eGranary resources. These are in the fields of medicine, nursing, public health, rural agriculture, life skills, disability rights, etc. The 'Girls can Code' educational package is another constrained modification. A re-usable "Pocket Library" of approximately 1000 Web pages stored on a flash drive, is in the early stages of development and will function as a mobile, exchangeable information portal. Other criticisms of eGranary that have not been addressed, despite their mention in Widernet's 2009 report, are Granary's **lack of local language** material or **content about local issues** and personalities, particularly the case in the Arts fields.

These are seemingly intractable problems for eGranary as it is currently structured; and theoretically they could represent the points over which users make decisions about whether to use the digital library or not.

Without problematizing users' interactions with eGranary's content (pedagogy, searchability, authorship), closer evaluation of the quality of their perceptions of usefulness (to themselves) and usability will help focus designers' attention to what

content and presentation formats have greatest user value.

Modifications and suggestions

Associates' suggestions were either for more use of phone apps, for example in distribution of packets of information or as a vehicle for user feedback (with SMS), greater integration of solar energy, more promotion of searchable Customer Information Web pages (CIP) and more widespread use of tablets and WiFi. Combined they point to desire for smaller, more agile and more manageable portions of the Internet. And together they seem to aspire to fulfilling all of Morville's user experiences.

Analysis

These observations not only inform the vocabulary of future direct communication between the developer and users, but provide a record of improvisation and adaptation for future design concepts, and point to the "social phenomena" that caused the "socio- technical interaction" (Avgerou, 2013, p. 413). They also capture some influential facets of eGranary's implementation in four African countries, drawn from operatives' experience and opinions they have formed there over the past three to eight years. Existing modifications have involved a great deal of their professional time, commitment and investment. And descriptions of eGranary's implementation -

with and without GHI's Moodle component - appear to have been physically successful, at least, in generating enthusiasm and demand among urban and rural communities. But little is known of the subsequent lived experiences of individual students, teacher/professors, librarians or technicians, their daily routines, issues, choices, expectations, empowerments, hindrances and successes. Mediators' conversations do not reveal the extent to which the ICT is embedded in educational systems it serves, nor have they measured adoption success (though the GHI is eager to analyze web log records of Zambian nursing students).

Active customers communicate their perceptions of eGranary's shortcomings (queries about updates, requests for local curriculum material or lack of searchability and local content) to Associates. The Associates are less concerned with frequent power failures (a norm) than they are about resolving accessibility via devices, and ensuring that the client's support staff has adequate technical capacity. They travel great distances and invest much effort in working with Widernet and GHI on product improvement, or discussing options to improve user feedback during this research.

Most of the environmental (unpredictable power supply, internet/broadband, scalability of distribution) and user issues (content size, searchability, local content) that Associates mention, were raised in the Widernet 2009 Report; in Norton, Early and Tembe, 2010, and in Norton & Williams, 2012. With the a more contextualized understanding of eGranary's environment, generated from this research, and in collaboration with Mediators in the field, future direct communication with user could

reveal the scope and nature of their eGranary use, a better measure of users' physical, mediated and personal contexts, the actual perceived importance of the 'Limitations' identified here, and how users continue to benefit from access to eGranary's digital material.

Chapter 7: CONCLUSION

This research provides a glimpse of the end user's sense-making via the experiences, successes, support and contributions of eGranary Mediators, many of whom feature in this study.

eGranary sales and installations in Kenya, Ethiopia, Zambia and other countries are negotiated with authoritative parties, who control the library's availability and content, without necessarily consulting user institutions below about needs and capacity (P4). But, from the research stand point of this research, negotiation for eGranary's adoption is not considered problematic or even 'contested', and apparent political reluctance is possibly another dynamic variable in the status quo of doing business in the region. Another critical requirement for this digital tool is electricity supply, which is, as with most of the world, often deeply politicized. This is another highly variable and unpredictable element of the status quo of life in the study region. Widernet and the GHI vendor donor adapt their product by experimenting with the original eGranary design, modifying its hardware and content to improve user adoption of their modified product. (It is logical for the developer to wish to problematize the lack of regular power supply, to self-motivate adaptive designs). They recognize that their adaptations, in the form of content miniaturization (into Moodle class resource lists, portals or linked to shorter programs like 'Girls Can Code') and reduction of delivery device size (especially

via cheap tablets), contribute to the best means of facilitating and expanding wider classroom use in this context (P1). Parceling content into appropriate units conforms to teaching needs; and is manageable and attuned to students' needs. Smaller units of content require less device capacity and size, less power consumption, while portability and management are increased. Increased use of small WiFi transmitters reduces dependence on fixed components eGranary's technical vulnerability to power cuts and crashes are averted. Even the use of phone SIM cards instead of flash drives for resource collection sharing is more attractive to young students and communities who's only technological device is a mobile phone. Medical level students are highly dependent on their access to reliable, up to date eGranary material. eGranary students everywhere, appreciate its rapid video download speeds and WiFi access to the library at all hours.

But in these environments, eGranary proves to be a technically complex system, whose installation requires close supervision and sometimes extended training. According to an Associate, a sudden power failure not only leads to information loss but also requires that the system be re-booted, with suitable expertise.

Beyond this point in the typical eGranary environment, little more is known about the scholar user, the team of teachers, librarians, administrators or technicians who keep the material available for learning use. Little is known about specific provision for eGranary user technical training needs (typing, learning to search), their ages or gender or about their interaction with a medium in a foreign language and designed for foreign consumption. These concepts also apply to the unknowns of the rest of the community, and will make for very worthwhile future

investigation.

Mediators report some second-hand objections that have been raised: the lack of local content with which students can identify, the fact that eGranary caters strongly to the medical and scientific fields but not to local fine arts and literature; and issues surrounding the undesirability of, or inability to create personal content. Many problematic characteristics of eGranary delivery and use have long been known from prior research. Widernet is currently at a ready point to address the direct needs of its large but globally diversified group of users.

This research provides an analysis of parts of the eGranary working environment and provides some foundational understanding of the dynamic physical context that certain users are situated within. There are indications, too, of their sense-making and practices (Avgerou, 2011, p. 650).

What is evident so far, is that efforts are already underway in the field, to modify the Western ICT to meet foreign user environment and cultural norms. eGranary's current situation in this African region clearly reflects a "concept of culture which is dynamic and emergent, 'constantly being maintained and changing', an ongoing accomplishment" (Westrup et al. in Avgerou 2011, p. 654). With "enormous effort" the multidimensional ICT and host culture are already transcending the dichotomy of either fitting in or conflicting with its domestic environment, either succeeding or failing. Instead the eGranary library is undergoing a process of "mutual reconstitution" of the IS and the cultures that influence it (p. 654). The contextual influences of eGranary's implementation in certain African contexts that are

identified here, can not only inform the vocabulary of future direct communication between the developer and users, but they provide a record of ongoing improvisation and adaptation for future design concepts; and point to some of the "social phenomena" that caused the "socio-technical interaction" (Avgerou, 2013, p. 413). It is hoped that results will strengthen Widernet's ability to engage with its users' sense-making experiences and, as Heeks (2010) puts it, strengthen efforts to close the gap between design and reality.

Further research

In-depth survey information is the next phase to investigate eGranary's socio-cultural and economic development contributions to communities large and small. It will assist researchers to identify gaps in service and measure and improve what is currently on offer. Most important, survey contact with end users at all levels opens channels of communication with developers, extending a sense of ownership and the possibility of the technology's becoming better embedded in modernizing education systems.

One aspect of user experience studies, which is believed to influence the choice to adopt the system or not, is the user's perception of eGranary's usefulness, or the belief that its use will help the user perform better. Perceived ease of use, another determinant of a system's acceptance, is the user's belief that the system is relatively free of effort (Davis, 1989). These two are subjective appraisals and may be

problematic to interpret in a traditional educational setting - certainly, 'mental models', 'choice' and 'decision' need to be re-considered in context. Perhaps more nuanced questioning could seek to query users' views on eGranary's design usability as described by the 7 Principles of Universal Design: equitability, flexibility, simple and intuitive in use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use (Center for Universal Design NCSU, 1999).

Analysis of longitudinal surveys could record evolving changes in people and institutions as they interact with the simultaneously evolving eGranary IS, socio-economic context and broader national environment. (Avgerou 2011) Although Heeks' 'Design- Actuality Gap' was put forward as a heuristic tool to explain after-the-fact failure of an IS in developing countries (see Literature Review, p. 14), some of its categories may be of use in evaluating user-level IS adoption, disinterest or abandonment. "Objectives and Values", (which Heeks describes as a "the key dimension, through which factors such as culture and politics are manifest" (Heeks, 2002, p. 105)), "Management Systems and Structures" and "Other: Money" may have significant roles in facilitating eGranary's adoption and capacity to make change.⁶

⁶ Note that Heeks' terms 'objectives', 'values' and 'management systems and structures' and 'money' should only be interpreted in a contextualized sense, and with a development studies base.

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APPENDICES

APPENDIX A: Introduction letter sample

Dear

I am a Master's student at the School of Information and Library Science at UNC Chapel Hill, and my Master's thesis research is to establish an effective means of communication to help directly monitor eGranary user satisfaction

The study is titled "Towards identification of a reliable methodology and query format to evaluate eGranary Digital Library user satisfaction: Analysis from interviews with intermediary Field Agents and donors."

Ultimately, I aim to find a sustainable method to enable ongoing communication between eGranary's developers and its end-users, but I would like to begin by having a general conversation with you about the broader environment of your work. --- has recommended that I get in touch with you, considering your training and experience of your customers and the product, in the hope that you could share your views and analyses.

I would be very happy to phone or Skype, at a time that is most convenient to you, or exchange emails -whatever suits you. I've attached a copy of my pilot questions, which I hope won't take more than 30 to 45 minutes of your time. These will help me develop a more focused set of questions for a second phase of focused questions.

I hope that you will consider participating in this study. If you are interested in learning more about it or to agree to participate, please feel free to contact me at [ngafinowitz at unc.edu](mailto:ngafinowitz@unc.edu).

Thank you so much for your time and consideration and I look forward to hearing from you. With kind regards,

APPENDIX B: Online Adult Consent Form

This study involves exploratory interviews towards original qualitative research, in partial fulfillment of a Master's Degree in Information Science at UNC Chapel Hill.

The aim of my research is to identify from interviews of Field Associates and other intermediaries: what is a sustainable methodology and query format to monitor eGranary end-user satisfaction.

Phase I pilot questions are informal and unstructured, to establish the general environment and vocabulary of eGranary's context and processes. Phone or Skype interviews with four to six participants are expected to take 30 to 45 minutes. With the participants' permission, conversations will be recorded in order to focus attention on the conversation. Recordings will be professionally transcribed, de-identified and analyzed. Then, combined with further literature research, a second set (Phase II) of targeted questions will be created and presented to the same or more participants, at a future date.

Please sign below if you are willing to have this interview recorded. You may still participate in this study if you are not willing to have the interview recorded.

D I do not want to have this interview recorded.

D I am willing to have this Interview recorded:

Signed: _____ Date: _____

Strict confidentiality of the records will be observed: interview transcripts and all identifying material such as names, email addresses and correspondence will be printed and stored in a sealed envelope. Once the transcripts, notes and/or memos have been de-identified and anonymously re-coded, electronic versions of all the above material will be deleted. This means that there will be no way for anybody to ever link your data or the results of the study to your identity.

Interviewees' participation is entirely voluntary and with your informed consent. There are no risks or benefits to you for participation. Refusal to participate will involve no penalty, and you are free to withdraw or discontinue participation at any time. This research involves no experimental procedures; no risks or discomforts are foreseen and no alternative procedure toward the stated goal is being considered.

If you have any further questions about the study please contact me, Nicci Gafinowitz: ngafinowitz@unc.edu. Dr. Cliff Missen: missen@unc.edu or my thesis Advisor Dr. Mohammad Jarrahi: jarrahi@unc.edu. If you have questions about your rights as a research participant, please contact the UNC Institutional Review Board on 919-966-3113 or by email to IRB_subjects@unc.edu, and reference study number II.:Q533 approved on 20 October 2015.

I have read the above information, and have received answers to any questions I asked. I consent to take part in the study. You may eSign the document (2 places); or type in your name and date (2 places), save and return email this attachment; or you may email a reply to this communication, agreeing to the terms of consent to participate in the study described above, and stating whether or not you agree to record the interview conversation.

Signatures

APPENDIX C: Interview questions

- Without making any mention of your name or location, other than by continent, could you describe yourself and your working day as it relates to eGranary
- Could you talk about the context and experiences of the locations where you've worked with eGranary?
- What sort of physical or other problems have you encountered in setting up and using the system?
- What are the ways that eGranary addresses locally relevant problems? What downsides have you found? In your experience, how long does eGranary take to settle in and show regular, sustained use?
- Are there some improvements that you would suggest to eGranary designers or something that is unnecessary.

APPENDIX C2: Addendum to interview protocol, the introduction

"This study aims to evaluate how eGranary fits into the socio-economic context of your particular society, both urban and rural, and university, school, public library etc., together with the fluctuating physical environment (cost, demand capacity, technological expertise and equipment, training, energy availability, Governmental and Ministerial politics). Rather than a top-down approach I would like to see things from the bottom, and for now from the perspective of the person in the middle.

I hope that your answers will help me understand the environment and customers you work with, the problems you encounter, any adaptations you find yourself needing to make, and changes you'd like to see solved by the designers.

Finally, I would be grateful to learn anything you can tell me about your end-users and how Widernet can stay in touch with them directly to capture direct feedback while they're actively engaged with the site.

I would really welcome your thoughts about this approach.

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