Digital Library Appropriation in the Context of Sub-Saharan Countries: the Case of eGranary Digital Library Implementation

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ABSTRACT

Users of information and communication technologies (ICT) in the developing world encounter these technologies within their own situated, dynamic contexts. Their interactions with the technology are explicitly and implicitly affected by their political, cultural, infrastructural and socio-economic environment. In this poster, I present findings from ongoing sets of interviews with eGranary intermediary donors and agents, operating in seven sub-Saharan countries. eGranary is an offline library collection of open-source Web material, designed for use in environments with irregular or no internet connectivity. However little is known of the ICT's impact on communities, users' knowledge practices, or its wider effects, e.g. on pedagogy. Prior to establishing communications with end users, this study takes a preparatory step of consulting with Mediators in the field. These interviewees are familiar with eGranary's technology and their users' contexts, expectations and needs. The ultimate aim is to incorporate user opinions into eGranary re-designs. Findings from this research will contribute to better informing the structure, content and tone of planned future communications and questionnaires.

Keywords

Information and communications technology; digital libraries – design and construction; ICT implementation; developing countries; user studies; information search in education; sub-Saharan Africa

1. INTRODUCTION

Information and communication technology (ICT) implementations in developing regions are re-shaped over time via macro and micro contextual factors such as local culture, organizational dynamics, and by the sustainability of financial and political support and training [4], [8]. ICT is not a developmentally neutral force and therefore, in non-Western parts of the world, its adoption trajectory is difficult for designers to model [9].

eGranary (www.eGranary.org) is a low-cost, low tech library collection of digital information, designed for parts of the world where power supply and Internet/ bandwidth connection are unreliable or unavailable. The 6TB collection is offered in several configurations, such as a full-size, mains powered server, a 12-volt battery-powered server, or an external USB drive that turns any Windows computer into a server. When connected to a wired or wireless local area network (LAN), eGranary (dubbed the 'Internet-in-a-Box') delivers content instantly to thousands of desktops or portable devices. The interface includes Lucene and Solr-powered word search of over 35 million open-source educational resources; plus VuFind access to the curated catalog of 50 000 items. (Wikipedia, MIT courseware, TED Talks, full text medical journals, books, videos and open-source software). Built-in tools allow additional local material to be uploaded or created and edited. Regional Field Associates in 12 countries are local entrepreneurs with strong computer technical skills, who promote eGranary, administer training upon installation and, under a maintenance policy, provide technical support and distribution of updates. Over 1200 units have been installed in more than 50 countries globally: at primary and secondary schools, colleges and universities, medical and engineering schools, hospitals and medical clinics, NGO's, US embassies and US prisons. Some 80 percent of orders in the past two years are repeat business.

Over 800 units are currently located in Sub-Saharan Africa yet, despite continuing demand growth, very little is known about its remote end-users (students, teachers, local support technicians, administrative personnel), about how they use the resource, or about how it meets their educational expectations. The system's implementation remains unmonitored and little understood. eGranary's US developers at Widernet (www.widernet.org) wish to establish feedback communication channels with its users to shape future design enhancements. This research represents the first step of familiarization with the Sub-Saharan user's environment, via conversations with intermediary Field Agents and local donors there. These so-called Mediators are familiar with Widernet, with

eGranary's technological design objectives, and with their own end-users' situated contexts and experiences. Findings will assist in understanding the ICT's implementation in those contexts; and better inform the nature, style and content of future user communication between the US developers, and their geographically and culturally unfamiliar stakeholders.

1.1. The Research Environment

So far, the Mediators interviewed include a representative of the US State Department, and two representatives of an American university's Global Health Institute ("GHI"). This Institute donates eGranary equipment linked to local government approved CMS-based teaching syllabi. Their receiving institutions, located in Zambia, Kenya and Ethiopia, include local Ministries of Education, colleges, universities and private schools. Interviews have also been held with Widernet Field Associates in Nigeria, Ethiopia, Kenya and Zambia; future interviews will be held with Associates operating in Ghana, Mali, Sudan and Uganda. All Mediators have up-to-date familiarity with their clients' needs, while actively contributing to design collaborations with Widernet developers. Both the Mediators and users must constantly negotiate changing macro contextual issues such as irregular telecommunications (email, text, broadband), and inconsistent power supply (electricity, solar, generators, battery).

2. RESEARCH VALUE

The novelty of this research lies in its very recent descriptions of locally perceived factors that influence an evolving technology in dynamic African contexts. The material contributes to the body of investigation into the implementation of information systems in the developing world and its subsequent user interactions.

3. LITERATURE REVIEW

Studies of information systems frequently overlook their underlying technology or IT artifact [2]. 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 emerge from the target community's "ongoing and transitioning social and economic practices." It's stability and functioning are always conditional and may be challenged at any stage. Consequently, a system's degree of embeddedness into a culture is negotiated, constantly evolving and mutually interactive [2]. The technological features involved (such as infrastructure, accessibility, interfaces, standards, training, business models) are as dynamic and unique [1] as the human user. It is widely recognized that global contexts and organizational practices do not and cannot meet the homogeneity of time, equipment, utilities, financing or expertise that original IS designers assume [12]. And not surprisingly, research on the actual implementation process or development impact of ICT is rare [3]. Several years' research by Bonnie Norton, in Uganda, examines the effects of eGranary on new digital literacies in a poorly-resourced rural community. School children there are reported to have gained a strong sense of personal possibility and socially-imagined identities as global citizens. Ultimately though, eGranary's impact and uptake was affected by 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 [6]. Recent research with eGranary nevertheless notes that implementation of an eGranary digital library can potentially re-position a community from being 'information and technologically poor' to one that operates on resourcefulness, availability of technical and computer literacy, and satisfactory access to required digital information [5].

At present, two similar products are available to the market for offline free educational content: Outernet (https://outernet.is) broadcasts on-demand data files of information via satellite radio; RACHEL Offline (https:/racheloffline.org) is a free wi-fi enabled library of multilingual open-source material, that's similar to eGranary but lacks its storage capacity.

4. METHODOLOGY

Skype and email interviews with eGranary mediators questioned their activity, geographical range of operations, local physical infrastructure, problems experienced, user observations and personal suggestions for improvements. Interview material was approved by the researcher's institutional IRB ethics committee and all participants provided their written informed consent. Supplementary data gathering was obtained from Widernet. To date, (October 2016) interviews have been held with personnel active in Ethiopia, Kenya, Nigeria, and Zambia.

One of the limitations of this research is that findings are not globally generalizable - but they provide evidence for future user contact decisions.

5. FINDINGS

Mediator interviews reveal some major contextual features of eGranary's implementation in the four African countries. These illustrate eGranary's *physical context* - power, infrastructure, computing devices etc., and its *human context* - mediated IT delivery, technical training and users' interactions with the delivered product. In this research, Mediators are free to express their positive and negative views of eGranary, offer modification suggestions and make observations on end-users' perspectives.

5.1 eGranary's physical / external context

The macro environmental features of each country that eGranary users have to negotiate, include its economic situation, its supply systems for telecommunication and power, and the availability of suitable hardware. All four countries studied so far, are beset by irregular power outages. In Kenya increasing droughts affect the hydroelectric supply, while Ethiopia's largely rural population lacks any electricity, telecommunication and transportation infrastructure. Access to power is central to eGranary's operation. This affects product placement, the installation process, anticipated technical support needs, and design functionality. One Field Associate referred to the routine-ness of recurrent power outages thus: "Power cuts happen every day. You say 'Ugh, it just happened again...'" Widernet continues to expand energy capacity: their largest battery model holds 24 hours' charge. GHI

is trialing the use of full-sized solar panels in several locations, while considering smaller solar panels to power tablets. They both offer product packages with smaller devices to reduce energy needs and increase portability and volume of class dissemination. To improve *delivery of the ICT*, Widernet is attempting to compress sections of the library onto a flash drive (the "Pocket Library"). These changes in eGranary's processing capabilities are strongly contextualized, and may be improving the ICT's embeddedness in learning communities [7]. eGranary's *off-line* presence enables rapid download of high-bandwidth media (video) - a strong marketing point. Email communication is common and cellphones, mainly Samsung and Nokia, are ubiquitous. Tablets are very cheap and widely available. Low-cost use of SMS is ubiquitous, and Interviewees agree that using this as a survey vehicle, (perhaps delivering one question per day) could be a viable methodology

5.2 eGranary's human, socio-organizational context

• *Uniqueness, complexity and novelty*: Where government ministries fund eGranary purchases, they naturally retain *control* over access, and exert *influence* over content structure. Institutions can display their own virtual library collections (e.g. related to a national medical training syllabus) on eGranary's locally-shared 'web' pages; and these can be perceived as an admirable reflection of the country's digital progress and academic progress. Several Field Associates reported that purchase decisions are made at senior administrative level, without regard to the ICT's local viability, resulting in equipment neglect and obsolescence. Some host institutions' technicians have difficulty in understanding *eGranary's technical complexity*, and Associates work hard to remedy each situation. Nevertheless, they report that efforts towards equipment miniaturization, the concept of eGranary's having 'flipped the pedagogy' and it's popularity with more youthful users, are making the product conceptually more accessible and usable.

• eGranary's *product effectiveness and success* is boosted by skilled and committed Mediators. One Associate is very active in promoting educational endeavors in Ethiopia and has designed educational software solution ('Girls Can Code') that integrates eGranary resources.

• *Downsides of eGranary:* the equipment has a *long shipment period* and its *cost and technical requirements* are a disincentive to many in this region. A few Associates report that customer institutions' technical personnel are *reluctant to complain* or seek outside help, for fear of appearing unqualified or making other colleagues seem so. These factors speak to the ICT's lack of technical accessibility to an unknown number of people, having an unknown effect on its uptake. Clients may perceive that eGranary can rapidly become *out of date*, especially as updates are only distributed every 12-18 months. Some clients consider eGranary as being *inferior to the Internet*. Of direct concern to developers are criticisms about eGranary's *lack of searchability:* eGranary mirrors a sizeable portion of the Internet's static content. Material is 'ordered' by librarians at Widernet, but it lacks the levels of searchability available to live Internet material. Widernet's

manually created subject-based portals and users' own collection creations are all searchable, but this takes commitments of time and expertise. 'Publishing' on eGranary has raised copyright concerns among African teaching faculty. Another repeated criticism of eGranary is that, while it is extremely valuable for scientific, mathematical and medical fields, it *lacks local language material* or *content on local issues and personalities*, particularly in the liberal arts and literature fields.

• *Modifications and suggestions*: Associates' suggestions include making 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 use; more promotion of searchable eGranary 'Web' collections, and for even greater use of tablets and WiFi. In general, s indicate the desire for smaller, more agile technical delivery of more manageable portions of Web content.

The interview conversations reveal some of the activities, issues and successes that underpin implementation in the four African countries, drawn from the experiences and opinions each has formed there over the past three to eight years. Establishing existing modifications has involved a great deal of their professional time, commitment and expertise. Mediators' descriptions of eGranary's implementation – both with and without the GHl's CMS component - appear to have been physically successful in generating enthusiasm and demand among urban and rural communities. They provide general impressions of the nature of purchasing institutions, the physical circumstances, interactions to modify delivery to the user, and some usability concerns. But certain factors about the ICT use remain unclear: the motivations and aspirations behind eGranary's selection over other products, 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. And the conversations do not accurately reveal the extent to which the ICT has been successfully adopted and embedded in the educational systems it is serving.

6. CONCLUSION

Interview findings with Mediators provide a glimpse of the end user's experiences, successes, support and of the Mediators' own contributions. They reveal that, in the sub-Saharan countries studied here, adequate power supply is the primary and most critical requirement for this digital tool. As is the case elsewhere in the world, access to power is often deeply politicized. Widernet and the GHI actively experiment with reducing eGranary's power needs, and this may become an issue of increasing importance to some users, institutions, even entire regions. Ongoing attempts by Widernet an the GHI to condense content on to flash drives or apps will require smaller device capacity and lower power needs, but they have yet to be formally user-evaluated. Increased use of small WiFi transmitters could reduce dependence on fixed eGranary server components and avoid its technical vulnerability to power cuts and crashes. 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. Analysis of interview findings also provides

indications of users' (individual students, teacher/professors, librarians or technicians) sense-making and practice; such as in their perceptions of eGranary as a digital alternative to live Internet, its search shortcomings, its lack of domestically-sourced material, its technical complexity and the pride scholars and faculty take in their self-published material. This research is in the process of establishing a contextualized understanding of the unknown, distant end user. The final product will provide future survey creators with some foundational perspectives, themes, needs, conflicts and general vocabulary about the issues that are likely to preoccupy the user who negotiates an environment shaped by eGranary. This work also contributes a unique record of the human endeavor surrounding the eGranary ICT implementation in parts of sub-Saharan Africa.

Future work

The next phase of this work is to create situationally-aware surveys, in collaboration with Mediators and those who are willing to spend time ensuring reliable procedures. Survey methodology needs to be established, such as via SMS, offline Qualtrix questionnaire or other. Queries should reflect that conventional concepts of users' mental models, choices and decision-making are altered in the eGranary context. Teaching staff and students can be questioned on user experience issues, such as their perceptions of eGranary's usefulness, ease of use and whether the library meets pedagogical objectives, expectations and values. Questioning could reveal the scope and nature of users' eGranary use, their own experiences of some of the 'Downsides' identified by Field Associates in section 5 above, what benefits they derive from the library in real time, and what educational and socio-cultural contributions eGranary makes to its communities.

It is possible that historical sets of web log records can be obtained, that reflect utilization of a curriculum-based subset of eGranary resources, by trainee nursing students in a central African country. Analysis of longitudinal data might illustrate professional students' evolving interactions with eGranary, under comparatively controlled, replicable circumstances.

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