IST-Africa
IST-Africa 2013 Conference Proceedings
Paul Cunningham and Miriam Cunningham (Eds)
IIMC International Information Management Corporation, 2013
ISBN: 978-1-905824-38-0

AFRICA BUILD Portal: Developing A Social Network Of African Health Researchers And Educators

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Abstract: The AFRICA BUILD project aims to develop and support health care, education and research centres in Africa through Information and Communication Technologies. One of the main outputs of the project is a collaborative platform which integrates a myriad of research and learning resources. This article presents the first prototype of this platform: the AFRICA BUILD Portal (ABP 1.0). The ABP is a Web 2.0 platform which facilitates the access, in a collaborative manner, to these resources. Through a usable web interface, the ABP has been designed to avoid, as much as possible, the connectivity problems of African institutions. In this paper, we suggest that the access to complex systems does not imply slow response rates, and that their development model guides the project to a natural technological transfer, adaptation and user acceptance. Finally, this platform aims to motivate research attitudes during the learning process and stimulate user's collaborations.

Keywords: Education, Sub-Sahara, Health Information, Capacity Building, AFRICA BUILD, Resource Integration, Social Networks

1. Introduction

The research environment is rapidly changing in Africa, leading to a significant amount of health-related research currently being carried out across the continent. Research and innovation are key drivers of development but, however, as previously stated, "It is not being turned into products or treatments in a systematic way, which would be of benefit to the continent" —B. Mayosi at Forum 2012, a three-day meeting on health research in Cape Town, South Africa.

A basic requirement necessary to transform health research into new diagnostic and therapeutic products is capacity building [1]. Higher education institutions can carry out

such process, but require more resources to build knowledge and expertise in Africa. Coordination and collaboration activities are also essential to create such an expertise.

Many reports suggest that the main research limitations in sub-Saharan countries include, among others: poor scientific education, lack of equipment, lack of scientific jobs, a dearth of funding and a lack of vision of the role that science may have to develop African countries [2]. To mention only an example, in Uganda —rated fifth country in scientific production in sub-Sahara— only 6 out of 27 universities offered science-related programmes in 2011.

Reports published on top scientific research journals —e.g. Science [3], Nature [4], the Lancet [5, 6] and the BMJ [7] — suggest that the role of health information is crucial to build capacity, in order to find and implement solutions to the major healthcare problems in sub-Saharan countries. For instance, ISHReCA, an African-led initiative proposed nine key requirements to strengthen health-research capacity in Africa [8]. They categorized these requirements within three main generic actions: to (1) improve research environments, (2) support individuals, and (3) support institutions. In addition, the authors focused on these nine requirements to suggest practical strategies for sustainable capacity strengthening in African institutions [9].

During the last decades, technology has been established as a powerful tool to increase access to information. Many initiatives have embraced this idea and numerous steps have been taken in this direction. Such as, for instance: (1) free or open access libraries as HINARI [10], Ptolemy [11] or AJOL [12]; (2) open source software initiatives as FOSSFA [13]; (3) distance education approaches such as RAFT [14] or the ITM advanced learning programs [15]; and (4) the explosion of learning management systems, such as Moodle. Furthermore, the World Health Organization (WHO) carries out a significant number of programmes and projects for education and research in Africa.

However, despite these efforts, scientific training is still limited within the African community of researchers. In such scenario, sub-Saharan institutions still need to find out how to share and make use of this vast amount of resources in a well-defined way.

Recently, the number of publications in Africa has grown considerably but frequently under the supervision of Western researchers and scholars. Research collaborations in Africa have been mostly with European and North American countries [16] until recently. Moreover, China appears now as an outstanding future support. Therefore, South-South collaborations should be a key point to establish a local research framework.

We present here the AFRICA BUILD Project, a European Commission-funded coordination action whose main goal is to develop and support health care, education and research centres in Africa. It aims to improve African healthcare by strengthening three main pillars: education, research and collaboration, through the use of state of the art information and communication technologies (ICT). The AFRICA BUILD approach aims to adapt and reuse already implemented resources by the consortium and others, by integrating them by means of ICT. We present below some of the main characteristics and achievements obtained so far by the project [17].

2. Objectives

The AFRICA BUILD project aims to develop a virtual platform where African health actors (students, professors, researchers and practitioners) could access a wide variety of biomedical informatics tools together with a myriad of learning and research resources. These resources are already implemented by the Consortium [18] and main efforts are focused on their adaptation to the African context and their integration in a collaborative environment.

This article describes the first prototype of the platform which intends to achieve the following specific goals:

1. To facilitate access, in a homogeneous way, to available biomedical informatics tools.
2. To create a collaborative environment for health learning and research.
3. To foster South-South learning and research collaborations.
4. To provide an easy-to-use and accessible interface according to the connectivity characteristics of African institutions.

The prototype assessment is centred in studying how users (experts from four African institutions) perceive the platform during a training session.

3. Methodology

In order to achieve the prototype objectives the following considerations have been taken into account to enable users to:

1. Access a variety of scientific resources through the platform.
2. Carry out eLearning courses through the platform.
3. Interact through the platform following a friendship model.
4. Access the platform, through a friendly interface, even if they only have access through a low bandwidth Internet connection.

In line with these requirements, the authors have designed a social network model in which users interact around learning objects [19] and research objects —a set of scientific related data describing some specific issue. This model is modular, allowing the inclusion of new plugins that add or modify the functionality. Furthermore, the user interface has been designed to reduce the number of the HTTP requests and the size of the data exchanged.

4. Technology Description

The AFRICA BUILD Portal (ABP) prototype is an open collaborative tool providing the most common functionalities of social networks. Users of the ABP —African people involved in health educational and research area— interact with learning and research objects —they "like", "tag" or "share" courses, presentations, scientific news or publications, mobility offers, etc.

The ABP exploits a wide variety of geographically distributed resources. Normally, these resources are free and open source but some authors could be sceptical since they could lose ownership —or even control— over them. For such reason, the community of developers opted for a distributed approach in order to give more facilities to the resource creators.

Figure 1 shows a layered architecture, in which resources are distributed on the bottom layer, and users access them from the top layer, which is composed by the social engine and the web user interface. The authors selected an open source tool called ELGG [20] as the social network engine. This layout presented several challenges to the authors:

1. Integration of heterogeneous biomedical resources.
2. To foster the reutilization of already created learning materials.
3. To motivate research attitudes during the learning process.
4. To stimulate users' interactions.
5. To provide a feasible access to the platform according to the existing connectivity in some African institutions.

In order to address the first challenge two middle layers were implemented: the plugins and the wrappers layers. The top-middle layer is a set of ELGG plugins which integrate the different resources within the social framework. This layer facilitates a modular integration of the resources. On the other hand, the wrappers' layer has been designed to manage the resources' heterogeneity. Different resources (web services, databases, ontologies, web repositories, eLearning courses, etc.) must communicate with the plugins layer in a

standardized way. Therefore, this layer manages the differences among all these resources by offering to the plugins' layer data following a concrete schema. The ABP 1.0 integrates the Mobility Brokerage Service [21], a biomedical web-based marketplace for health mobility opportunities and requests, developed by the Universidad Politécnica de Madrid (UPM).

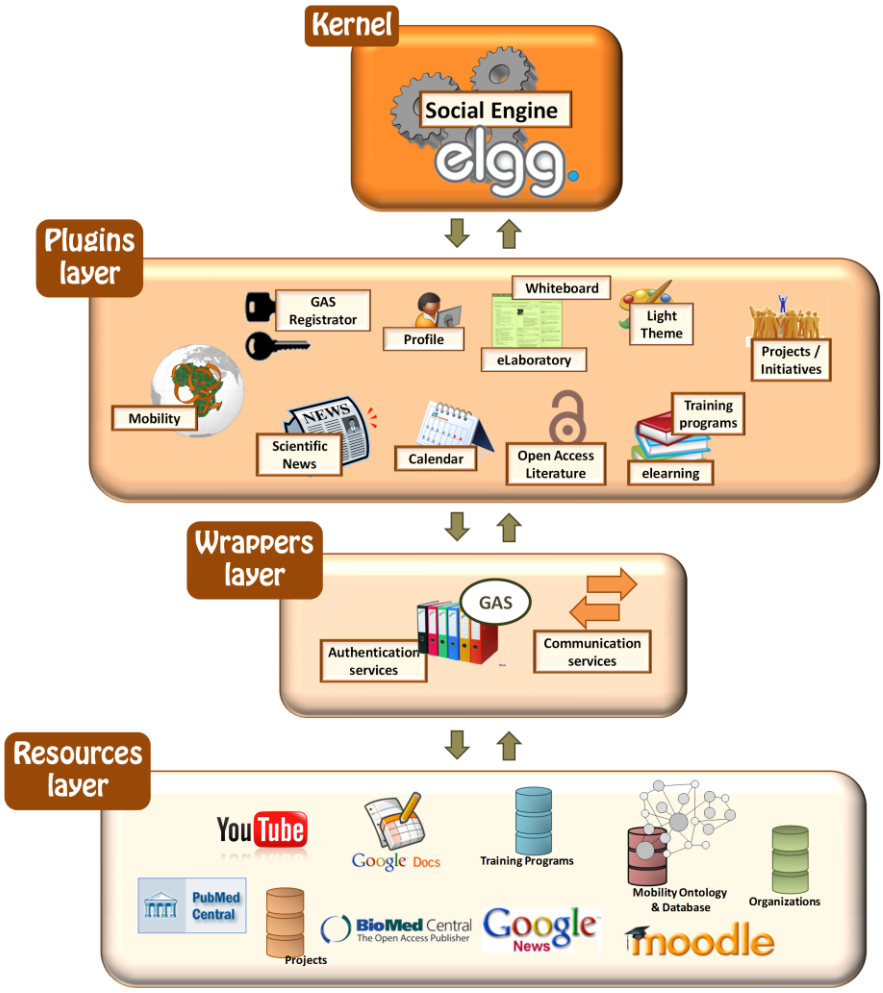

Figure 1: AFRICA BUILD Portal Distributed and Layered Architecture

The second challenge was addressed by supporting learning features on Moodle [22]. The ABP 1.0 accesses and registers learning data through an extended set of web services already provided by Moodle 2.2.3. The ABP 1.0 allows the access to several Moodle resources, as URLs and files, and some of the Moodle activities, as assignments, quizzes and SCORM objects —the Sharable Content Object Reference Model, a standard of the ADL (Advanced Distributed Learning, http://www.adlnet.org). Thus, any institution could plug in its Moodle instance and make their courses immediately accessible via the ABP.

By integrating biomedical research resources and tools in the same platform, authors aim to motivate research behaviour during the learning process. Research activities are supported through the ABP 1.0 due to the integration of PubMed Central, BioMed Central and Google News. Furthermore, two databases were created for storing African training programs and research projects and organizations. This integration opens several new possibilities such as, e.g. automatic research content recommendations based on the courses lectured.

Authors decided to embed all these features in a social context in order to stimulate user's interactions. ABP 1.0 implements a "followers" friendship model. It facilitates to users the possibility to be regularly informed about the activity of their colleagues and, consequently, foster collaborations among them.

Finally, by reducing the number of HTTP requests and the corresponding transfer sizes, the authors aim to make this complex platform suitable for low bandwidth connections. In the next section, a study of some of the most used actions of the system is presented. By contrasting the corresponding loading times and usability acceptance; the authors aim to show how a trade-off between complexity and usability is possible.

5. Results

Before starting the two project pilots (training programs in the fields of HIV/AIDS research and reproductive health research) the prototype was assessed in terms of usability.

Usability is the ease of use and learnability of a human-made object —in this case a Web User Interface. To measure usability, the authors prepared a survey, which indicated to the experts to carry out some actions in the platform and evaluate their experiences. For each action, seven questions were asked:

1. Do you feel that you successfully completed the task?
2. Is the software easy to use?
3. In relation to other software that I have used, I found the ABP tool to be…
4. The tool is well organized and functions are easy to find.
5. I immediately understood the function of each button.
6. All the functions I expected to find in the application were present.
7. My overall impression of the ABP tool is…

Experts were requested to answer these questions through a Likert-type scale, for each navigation process —the registration process, the learning process and the use of the open access library plugin to carry out some scientific paper searches.

Virzi [23] carried out three experiments that relate the proportion of usability problems identified in an evaluation to the number of testers participating in the study. One of his findings was that 80% of the usability problems are detected with four of five subjects. Moreover, he stated that additional subjects do not tend to reveal new information. Based on this study, the authors selected just eight health informatics experts from 4 different African institutions to answer the survey. Averages of these values are presented in Table 1.

Table 1: ABP Usability Assessment

ABP task	Exp1	Exp2	Exp3	Exp4	Exp5	Exp6	Exp7	Exp8
Registration	4.00	4.50	3.00	4.33	3.83	2.83	5.00	4.00
eLearning navigation	4.17	3.83	4.50	4.33	2.67	4.33	5.00	4.33
Research navigation	4.83	3.83	3.83	4.00	2.33	4.00	5.00	4.17

The average usability index of the “Registration” test is 3.936; the average index of the “eLearning navigation” test is 4.145; and the average of the “Research navigation” test is 3.998. All the averages are around 4, which mean a very good usability.

On the other hand, a demo course entitled “A short introduction to Medical Informatics” was carried out through the ABP 1.0. The UPM took the teaching role and staff from the African institutions (at least two persons at each institution) participated as students. The course was comprised of a set of slides to be followed by the students. Another feature was a chat service which involved the teacher lecturing from the slides and then answering questions from the participants. Participants were requested to measure several loading times of some important actions carried out during this course. Figure 2 summarizes the average loading times.

Loading times depended on the characteristics of the Internet connection in each institution and the quality of this connection —the actual day when the test was carried out. Different “Loading Times” measures were collected on different days from each institution. To have a general overview of loading times, the average was computed by using all the measures from all the institutions of each ABP 1.0 action. Because of the characteristics of the Internet connection differ considerably from one institution to another and due to the

instability of the connection from one day to another, the standard deviation is also presented.

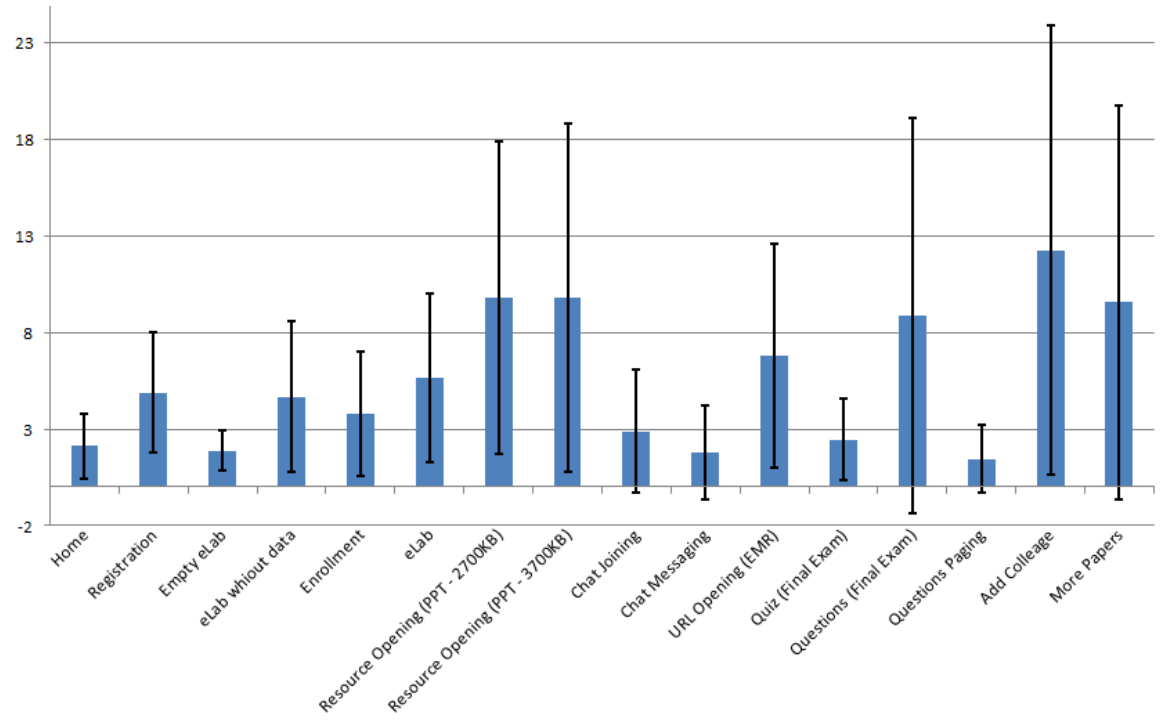

Figure 2: ABP Average Loading Times Together with Their Standard Deviations

6. Expected Benefits

Some years after the boost of the Web 2.0, several social networks emerged on the landscape. Some of them dedicated to health as Doctors Hangout (http://www.doctorshangout.com/), Sermo (http://www.sermo.com/) or PatientsLikeMe (http://www.patientslikeme.com/). And some dedicated to education as SchooX (http://www.schoox.com/), Khan Academy (https://www.khanacademy.org/) or Sophia (http://www.sophia.org/); and few dedicated to both as CureTogether (http://curetogether.com/). Generally, existing health social networks are oriented to share experiences among patients, physicians or both. Few of them have eLearning features and even a lower number provides research resources. On the other hand, social networks dedicated to education usually have a robust set of eLearning features although they do not include research resources and tools. The ABP is located in the intersection of these two fields, by providing a complete set of eLearning features linked with research resources. Moreover, all these features are contextualized to the health field and to the African needs.

Furthermore, the AFRICA BUILD project is committed to achieve a further self-sustainability. Thus, the ABP adopted an open source software (OSS) strategy. The authors are aware that adoption of OSS is not only a choice of software, but also a means of acquiring knowledge [24]. Therefore, the platform design and development follows an open source development model, in which technological transfer is carried out from the beginning. In line with this idea, the AFRICA BUILD project aims to constitute a developers community, initially composed by technical staff from the African partners, and led by the project coordinator, the UPM. Moreover, by involving African technicians from the beginning, the developed software should be closer to African needs, in addition to ownership feeling and subsequent commitment for sustainability.

At the time of writing, the community of developers comprises 17 members actively participating in design and coding. Several communication tools were set up from the

beginning of the design phase, as a forum, a wiki and a bug tracker system. All these tools are storing valuable information for the technical sustainability of the portal.

The core of the ABP 1.0 (Social Engine) is hosted in the UPM and the resources that enrich the application are hosted by their owners. The authors opted for this schema after a meticulous analysis of the hardware and connectivity capacities of the participant African Institutions. Most of them are not yet able to host one application like the ABP, with all its characteristics. However, one of the African partners, belonging to the consortium, has an advanced infrastructure to host the ABP in a foreseeable future. Therefore, the project consortium plans to create a mirror site of the core, once a complete evaluation (after the project pilots) is carried out.

Although during the project pilots, users of the ABP 1.0 are thoroughly selected, the authors plan to open and massively advertise the portal. Any user interested in health research could access the platform for free. Some of the activities that users could carry out within the ABP are as follows: they could study or lecture courses; create contents; look for possible research collaborations or get content recommendations; and make use of powerful biomedical informatics tools.

7. Conclusions

This paper has presented a preliminary analysis of the ABP prototype's usability focused on low bandwidth connections. Our results suggest that the ABP 1.0 shows that it is possible to build a complex platform, in which health actors could access a myriad of scientific resources, with acceptable response rates. Actions needed to follow a course through the ABP 1.0 usually do not take more than 13 sec. in the different institutions —in the worst case around 25 sec.

Although massive open online courses (MOOCs) are increasingly receiving attention, usually eLearning activities are private and carried out through institutional learning management systems (LMS). The ABP adopted a social network model, with eLearning facilities completely embedded, and together with a variety of scientific resources integrated within the same environment.

During this first stage of the project, the developers' community implemented an architectural model, completely distributed and modular. Several plugins were implemented for accessing different research resources such as PubMed Central, BioMed Central, Google News or the Mobility Brokerage Service. On the other hand, the set of web services originally provided by Moodle has been enhanced in order to facilitate a complete eLearning experience in a social context. Finally, every resource inside the platform is enriched with social features such as "like", "tag", "share" or "follow". We foresee that these features will foster interaction among users around the contents and, consequently, more research collaborations.

This entire infrastructure is accessed through a light user interface in order to allow every user access even if they have low bandwidth internet connections. Furthermore, the use of a web-based rather than a desktop platform enables institutions to set up, maintain and manage more software. This option facilitates mobile devices to access the portal too.

After the completion of this first prototype, the authors noticed that although connectivity problems are still a constraint, it is feasible to build adapted interfaces for accessing complex systems with acceptable response rates. We think that ICT projects in Africa should focus their efforts on these issues in order to ensure sustainability and user acceptance. Furthermore, we noticed that although some African users do not have advanced ICT skills, they usually access the most popular social networks to find collaborations and support. Finally, by following an OSS development model, supported by African developers and coordinated by a European institution, it was observed that technological transfer is possible and both adaptation and user acceptance increase.

Future steps include (1) the integration of the AJOL library and DUDAL, a distance education tool for webcasting under low bandwidth Internet connections (http://raft.unige.ch/dudal/); (2) the enrichment of the databases of African training programs and research projects and organizations; (3) the implementation of the course authoring interface; (4) the inclusion of contents from the Institute of Tropical Medicine (ITM), the World Health Organization (WHO) and the University of Geneva (UniGE) —which are partners of AFRICA BUILD; and (5) launching and evaluating various pilot experiments in the fields of HIV/AIDS research and reproductive health research, which should provide additional data about the success of the AFRICA BUILD approach.

Acknowledgements

This work has been partially funded by the European Commission through the AFRICA BUILD Coordination Action under the 7th Framework Programme (Grant Agreement no. 266474).

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