

# Open Source Architecture for Africa - A Bottom-Up Approach to Innovation Building in the Context of Construction in Rural Africa

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**Abstract:** Construction projects in rural areas of Africa, though highly standardised, perpetuate crucial shortcomings such as lack of local value added and lack of adopted solutions to environmental challenges. A major factor for this status quo is the lack of visibility, dynamic exchange and knowledge of successful innovative construction projects. As a solution the author proposes a Wikipedia-like internet platform that can be used to publish and collaboratively edit construction drawings, drafts and project documentation of construction projects in Africa. The precise objective of this platform is to provide free access to knowledge, lessons learnt and good practice in the area of architecture by sharing all contents under a licence that allows commercial and non-commercial use. Furthermore a concept is presented how such a platform would be disseminated to secure visibility, frequent input and exchange.

**Keywords:** Open Source Content, Knowledge Management, Open Source Technology, Wiki, Architecture, ICT4Dev, eBusiness, Creative Commons

## Introduction

### *Methodology*

Extensive field research has been conducted in Burkina Faso, West Africa, to identify the needs and problems of stakeholders of construction projects in rural Africa, as a side effect of the author's aid engagement there. In addition, a knowledge management platform for development work in Burkina Faso was launched earlier this year, using Wiki technology [1] and the founders of several successful knowledge management and open content initiatives were interviewed on success factors and their leanings about the use of social software.

### *Open Content and Development*

According to the UNCTAD Commerce and Development Report 2002, publishing is one of the most important channels for disseminating knowledge, thus improvements or expansions in publishing lead to further creation and dissemination of knowledge and in turn to increased economic and social development [2]. However the report and its successors in the following years do not mention open content as a potential knowledge creation dissemination strategy for developing countries even though the report does outline the potential of an open source approach to software development. The potential of open content approaches for development still needs to be explored.

### *Status Quo: Construction in Rural Africa*

There are basically two types of construction projects in rural Africa:

- Traditional housing: Usually one-storied clay houses made of adobe bricks and roofed with traditional materials or steelplate, with short lifetimes and high maintenance efforts after rainy seasons.
- Modern buildings built with concrete bricks

Let's take a closer look onto the latter. (Note: I am mainly referring to rural Africa but very similar rules apply to the huge one-storied outskirts of African cities.)

For example, an elementary school in West Africa is a highly standardised building always [3] consisting of:

- An oblong building housing three class rooms of ~60sqm each, each class room being accessible directly from outside, sometimes with a porch
- Sitting on a ~0.5m high foundation protecting it from rainy season floodings
- Built with hollow tiles, fettled
- With a wooden or metal truss (wood being vulnerable to termites)
- A flat or saddleback roof made of steelplate
- Metal fin doors and metal fin windows without glass



Fig. 1: Maternity Ward in Vipalogo, Burkina Faso

Some of these characteristics are regulated by the authorities, for example the use of adobe bricks is - with some exceptions - not allowed. Such a school is accompanied by stand-alone teachers' houses (of the same materials), one per class. Schools with six instead of three classes feature a second identical building. In Burkina Faso alone, thousands of these buildings are spread across the country, with dozens new ones being built every year.

A range of other examples function similarly:

- Primary health care posts and local hospitals
- Maternity wards

- Housing for state personnel
- Pharmacies
- Administration buildings
- Wells
- Latrines
- Private sector (businesses and housing)
- etc.

Thus, architecture and construction projects in Africa are highly standardised and follow pragmatic principles: They provide cheap functionality and survive a few decades against the climatic exposure. Of such construction projects, hardly any value added remains in the village or the region: projects are carried out by construction firms from larger cities, and nearly no material and little or no labour is provided by locals. In some countries - at least in Burkina Faso - cement and steel is imported from neighbouring countries. From a cultural perspective these buildings do not represent any type of African identity.

In few cases NGOs have tried out new approaches to architecture, use local materials or leave the trails of plain pragmatism. The primary school building in Gando, Burkina Faso, that has been awarded the prestigious Aga Khan Award for Architecture [4] or the NGO “SARCH – Social Sustainable Architecture” [5] serve as examples. Often different approaches are also able to reduce project costs or - as in the case of the Gando-project - improve the interior climate, which is important for an education building in a hot country. Due to the lack of "economy of scale", such efforts rarely withstand a strict economic examination, except of course if the parties involved all deliver pro bono.



Fig 2. Elementary school in Gando that has been awarded the Aga Khan Award for Architecture

Building expenses are either borne by foreign NGOs or by the state and thereby often indirectly by bilateral cooperation of by international entities such as UNESCO. Often financing NGOs do not have the necessary experience for such projects and get overcharged by construction companies or results are of low quality. Usually no architects are employed for such projects as budgets are too tight.

Construction is - as much as any other subject in rural Africa - often driven by risk management. Errors in such a low-resource environment can have severe effects. If a

village's management committee (a civil participation microstructure implemented by a WHO endeavour called Bamako Initiative) needs to build a new centre for primary health care, and spend their \$15,000 budget on new methods which then result in delay or premature termination of the project, this can have fatal effects on patients from that village. Innovation equals risk and is therefore being avoided.

## **Vision**

An egoless, cooperative and evolutionary architecture as instrument  
for a more social, sustainable and African building practice

A way to introduce innovation in small-scale situations as described above is to enable the transfer of knowledge across projects, villages, or even countries. The internet is the ideal medium for that, it can create the necessary "economy of scale" for innovative concepts, while minimising the individual risk.

It is a widely accepted fact that knowledge has become the main motor of development in the modern world: "Concepts, ideas and images - not things - are the real items of value in the new economy. Wealth is no longer vested in physical capital but rather in human imagination and creativity." [6] As Africa is the least developed of all continents, knowledge is its most important opportunity. As much as knowledge is a matter of education, it is a matter of networks: networks that enable communication and thus transfer of knowledge. The innovative use of mobile phones in Africa [7] shows how much the presence of such networks are needed for development.

For effective creation of shared knowledge on construction in Africa, it is necessary to create an environment that is open to all stakeholders, professionals and hobbyists alike, and to abandon the constraints of intellectual property.

## **Objectives and Target Groups**

### *Objectives*

The objective of Open Source Architecture for Africa (OSAFA) is to create know-how transfer between stakeholders of rural construction projects in Africa.

- Know-how in the form of information (e.g. What are the regulations for building health posts in Rwanda? How does wood compare to steel in the light of lifetime, maintenance and material price, say for a truss?)
- Know-how in the form of contacts (e.g. A local NGO in Nigeria searching for European architecture students who would be willing to take pro-bono assignments.)
- Know-how in the form of concretely outlined architectural patterns and even entire structures - ready to clone. (e.g. An NGO or an architect from Mali wanting to build an exact copy of Francis Kéré's School in Gando)

Objectives such as "architecture with higher artistic value", "construction projects with longer lifetime for fewer costs", "a new, truly African form of architecture" or "better exchange of ideas and influences between western and African architects" have been deliberately omitted. The author's goal is to provide an optimal flow of know-how between all stakeholders - "of whatever kind that know-how is". Good software permits organic growth and empowers its users to interpret it in a way that fits their needs and ideas - not

those of the software author. Know-how is good *per se*. Of course, it is predicted that most results mentioned will be achieved by OSAFA, as well as many others not yet envisaged. The task is to make all that possible, not to steer in one or another direction. For example, Wikipedia [8] has evolved in ways its inventors had never expected: they just did the right job in providing an open environment with a balanced Architecture of Participation [9].

### *Target Groups*

Target groups of OSAFA are all stakeholders in African architecture, for example:

- Architects building in Africa (mainly but not only of African origin), looking for creative input, contacts or simply sources to "steal" from (yes, that's ok.)
- Architects who want to contribute to Africa's development
- Architects who simply dream of having "their" house built dozen times all over the continent or who use the platform to make a name for themselves
- Government entities, NGOs or businesses looking for ready-to-deploy plans, industry contacts or any kind of in-depth information
- Construction companies
- Students looking for a place to publish their work

Geographically, the main target group is located in Africa, thus all technical parameters must be tailored to the lowest common denominator: A cybercafé in Sub-Saharan Africa. This means documents need to have small file sizes, be optimised for small screens, not use javascript or flash, and so on.



Fig. 3: Typical African Cybercafé, in The Gambia

Only an average 2.6% of Africans have access to the Internet [10]. Nevertheless personal experience shows that a major percentage of the stakeholders of construction projects - NGOs, students, businesses or architects - do at least use the Internet for email and basic research tasks.

Most of the target group speaks a European colonial language, generally French or English: the project can start using those two languages. At a later stage OSAFA is meant

to also embrace the most important African languages such as Arabic, Swahili, Hausa, Fulfulde or Afrikaans, as well as Portuguese.

## **Authorship and Legal Setup**

### *Learnings from the Software World*

Open source models have shaken up the fundamentals of the software world in the last decade. The examples are numerous: Linux widely dominates the market of server operation systems, leaving Microsoft far behind. The freely available database MySQL has far and wide outnumbered installations of products from Oracle and Microsoft. This very article is written on open source Wiki software that was written for the biggest encyclopaedia in man's history: the open source project Wikipedia that has long ago overtaken Britannica.

Open source means that the source code of a software program is freely available to everybody, with far reaching consequences. Open source programs usually start as a response to an individual problem. As the source code is public knowledge, anyone can in theory change the program or develop it further. So the program is passed on to the public via the internet, who often start to add functionality of their own. This may lead to niche solutions with just a handful of spare-time developers or to a big community of developers, many with a commercial interest, that move the project at breathtaking pace, giving big corporations hard times who are trying to produce competing commercial solutions.

Eric S. Raymond, evangelist of the software world, describes the ecosystem of successful open source development: "Your program doesn't have to work particularly well. It can be crude, buggy, incomplete, and poorly documented. What it must not fail to do is (a) run, and (b) convince potential co-developers that it can be evolved into something really neat in the foreseeable future." [11]

Although open source software is usually free of charge, it has become a multi-billion dollar industry. Companies charge for distribution and after-sale services, to gain market dominance and visibility or to sell hardware or accessories like books. Individuals use open source to gain visibility, leading to project or book contracts and conference assignments. And beyond commercial interest a huge number of hobbyists use it to distribute their ideas that would otherwise rest unknown to a general public.

Architecture could largely profit from an open source approach: People with shared interest would start to participate in the innovation process; residents, spatial planners, architects and other stakeholders would be able to challenge and contribute to professional solutions. True innovation is interdisciplinary and integrates end users.

Key lessons learned regarding the success of open source software development (D.Keats, 2003 [12] ):

- Version control is necessary
- Form collaborative virtual teams with a variety of skills and skill levels
- Gatekeeper plays a vital role in quality management
- Peer review is a powerful means of quality assurance
- User feedback is essential
- Development is a cyclical process

The open source model shakes up the economic and social principles of intellectual property, a fact that is probably the biggest obstacle for its success in the construction industry. However the needs and political interests in context of African development can be the catalyst of change in favour of a collaborative model for innovation building.

### *Creative Commons Licence*

In analogy to existing licences in the open source software world in 2001 Lawrence Lessig, law professor at Stanford University, founded Creative Commons, an organisation enabling copyright holders of all sorts of digital content to grant some of their rights to the public while retaining others.

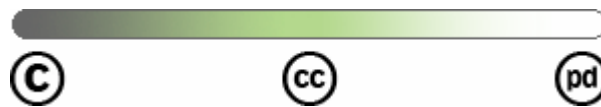


Fig. 4: Creative Commons defines the spectrum of possibilities between full copyright (all rights reserved) and the public domain (no rights reserved). CC licences help copyright holders keep their copyright while inviting certain uses of their work — a "some rights reserved" copyright.

For example the author has copied the graphic above from the website of Creative Commons where it was published under a "CC Attribution Licence", meaning that the author is free to use it as long as it is attributed to its authors - which is being done with this sentence.

To choose an appropriate licence from Creative Commons one has to answer the following questions:

- Do I want my work to be attributed to me?
- Do I want to allow commercial uses of my work?
- Do I want to allow modifications of my work?
- If yes, do I impose the condition to publish the resulting work under the same or a similar licence ("Share Alike")?
- Which jurisdiction should the licence fall under, a certain national or a generic one for international use?

The Creative Commons licence scheme fits our needs for Open Source Architecture for Africa extremely well. We will want to enable rights holders to publish their work enabling free use while retaining some rights. To motivate rights holders to share their work "Attribution" should be enforced. Commercial use will have to be allowed as there is hardly any non-commercial form of construction projects. Modifications would have to be allowed to create an innovation ecosystem and to enable adaptations to local conditions. These modifications would be forced to be made available under a similar licence ("Share Alike"), to feed the innovation ecosystem. A generic jurisdiction would be used as the target market is an international one.

The resulting CC licence from these considerations is the Creative Commons Attribution-ShareAlike Licence. [13]

In addition to legal considerations Creative Commons also provides visibility for OSAFA: The search engines Google and Yahoo as well as Creative Commons itself provide search interfaces tailored for finding content under CC licences.



## Detailed Description of Service

### *Technology*

The technology powering OSAFA must fulfil the following conditions:

- It must reflect the collaborative nature of the concept enabling all stakeholders to contribute, discuss and augment.
- It must enable the use also by computer-illiterate users, thus being easy to use and understand.
- It must be usable in the low-tech conditions of Africa, i.e. small screens, slow computers and most importantly low bandwidth.
- It must be easily accessible for search engines.

There are various approaches to open-sourcing intellectual property. In the software world, the model of Sourceforge.com dominates, giving access to source code, release, contact and licence information as well as providing space for social interaction between contributors. Yet, due to its hierarchical structure and technical nature, it doesn't foster its use by end-users. Another example of a high volume system is Wikipedia.org, which has in the mean time become the biggest encyclopaedia in history: technically a collaborative workspace being edited by its users.

Technically, all sorts of online publishing methods can be used including weblogs, mailing lists and discussion boards. To ensure sustainable content organisation and enable users to "rip, mix, burn" [14] and to actively contribute to projects, articles and concepts it is necessary to provide methods for collaborative editing and version control. Wikipedia successfully uses Wiki technology for that purpose, enabling users to contribute to texts, categorisation and navigation, and all sorts of multimedia content. The technology has also proven successful in managing vandalism and other problems [15].

This approach is also most appropriate to OSAFA, as texts, all sorts of media for project documentation and source files from computer-aided design can be collaboratively edited and managed. Also Wiki software meanwhile has reached a mature and scalable level.

### *Scope*

The objective of OSAFA is innovation building and technology adoption for construction projects in the African continent by providing a collaborative workspace and by eliminating the inhibitions of intellectual property.

Primary scope will be the sharing of floor plans and project descriptions. In addition to that every kind of exchange of information on prices, materials, suppliers or best practice will be welcome and fostered by the initiator. The makers of successful bottom-up knowledge-management approaches are usually being surprised by the uses their users make of their software. All of those user-based initiatives will be supported as long as in line with the general objectives of OSAFA.

### *Standards and Templates for Content*

To channel contributions into standardised, reusable architectural projects, norms and templates will have to be defined up-front, along with best practice examples. The



following information is needed in order to replicate a project, on the example of a house (note that also a water pump is a possible construction project):

1. 2D Floor plan and foundation layout (in any graphic format)
2. House and detail cross sections (in any graphic format)
3. Project description: materials used, regulations considered, etc. (prose)
4. Information about the author(s) (prose)

In addition to these fundamental contents projects may also include:

- Sketches and 3D-renderings (in any graphic format)
- Source files in the format(s) available (CAD/CAM/CAE files, etc.)
- Photographs or videos of the building or of models (in any graphic format)
- Budget calculations and/or scans of budget estimates (prose or graphic)
- Scans of invoices (in any graphic format)
- List of contacts (prose)
- Other kinds of prose or multimedia content the author considers useful

As with Wikipedia, every content page and multimedia file features a discussion page that the general public can use to comment and ask questions on. It may be advisable to restrict access to project descriptions (of projects already built once or more often) to only the author and administrators, and to use the discussion pages for contributions and corrections. The exact policy is yet to be defined.

## **Setting the Ball Rolling**

For most benevolent observers of social software and Wikis it seems compelling that the pure existence of such a platform with a mission statement that makes sense and a target group will attract users and content. Unfortunately this is not the case.

Experience shows that Wikis will only work as soon as they have achieved a critical mass of content and reached a critical mass of users. Depending on the size of the niche, for approximately the first six months the initiators of OSAFA will have to contribute content all on their own. This is by contacting NGOs and architects, convincing them about the concept, documenting their projects and spreading the word among stakeholders. This is called the seeding phase.

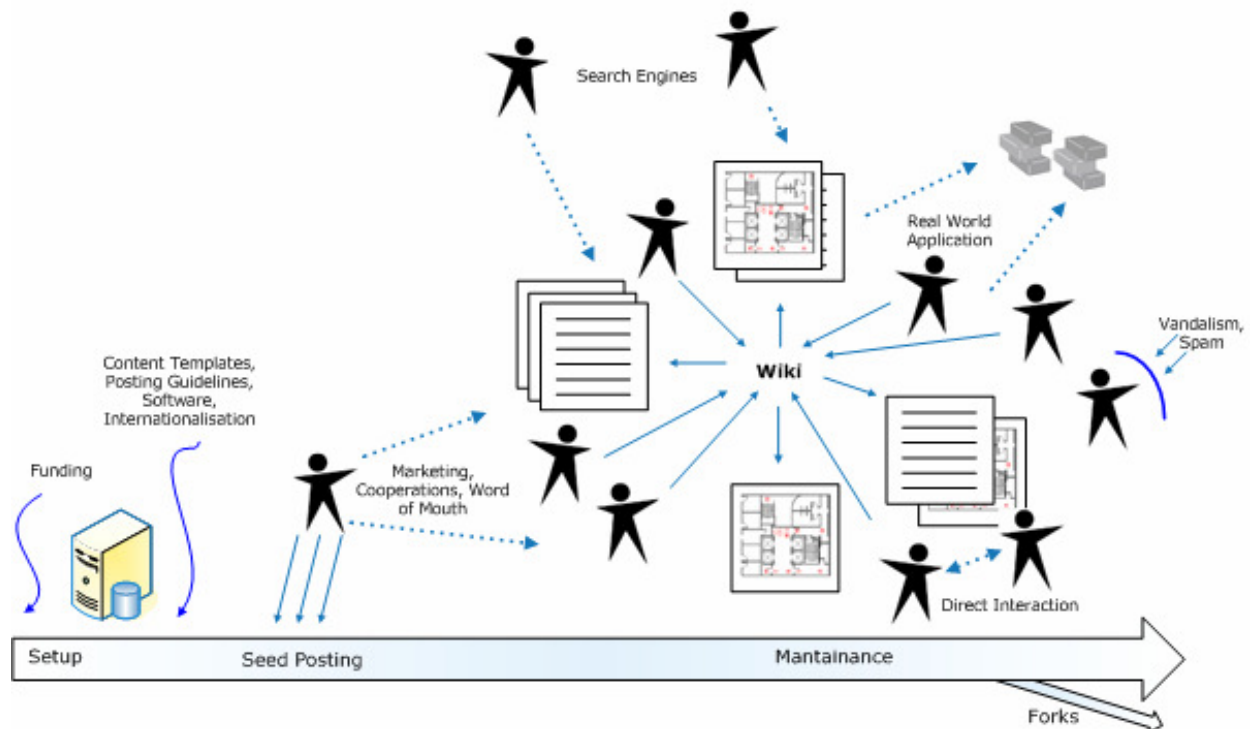


Fig. 5: Expected life cycle of OSAFA. The critical phase is seed posting, when a critical mass of content is being produced that is set to attract further users that eventually form growing community.

Even thereafter it will take at least another year until contributions of users will outnumber contributions by the initiators of OSAFA, when more thousands of content pages exist. On the other hand that content will induce an increasing curve of growth, mainly by word of mouth and with the help of search engines. Young African architects will take a chance using the platform to reach a maximum number of users with their ideas, which can eventually lead to a situation where OSAFA plays a major role in rural African architecture.

### Seed Content

Concretely two NGOs have already agreed to participate in OSAFA and submit their projects:

- The Burkinabé architect Francis Kéré from the German NGO "Schulbausteine für Gando" who has built a primary school, several teachers' houses and a sustainable, low-cost kraal. The school project in question has been awarded the Aga Khan Award for Architecture and could represent a revolutionary and replicable approach to edifying architecture in West Africa.
- The Austrian NGO "SARCH - Social Sustainable Architecture" that pools German and Austrian architecture faculties with South African NGOs to construct buildings with social purposes in townships of South African cities. So far four projects have been constructed, with another six in preparation for 2006.

There are numerous NGOs who have built or are building in Africa, and also organisations of architects such as Architects without Borders, Architects for Humanity, so there is near to unlimited potential for seed content.

### References and Foot Notes

- [1] <http://www.burkina.at>. Audience: German-speaking aid workers.

- [2] UNCTAD, 2002. Commerce and Development Report 2002. New York: United Nations Conference on Trade and Development.
- [3] With rare exceptions where schools are built with adobe bricks or solid stones (those mostly date back to colonial times).
- [4] See for example Washington Post: A Lesson in Simple but Edifying Architecture, <http://www.washingtonpost.com/wp-dyn/articles/A46072-2005Jan28.html>
- [5] See <http://sarch.twoday.net>
- [6] In Jeremy Rifkin: The Age of Access - The New Culture of Hypercapitalism, Where All of Life is a Paid-For Experience, March 2001, Penguin Putnam, New York
- [7] See Jonathan Donner: The use of mobile phones by microentrepreneurs in Kigali, Rwanda: Changes to social and business networks, [http://arnic.info/workshop05/Donner%20\\_MobileKigali\\_Sep05.pdf](http://arnic.info/workshop05/Donner%20_MobileKigali_Sep05.pdf), October 2005
- [8] <http://en.wikipedia.org/wiki/Wikipedia>
- [9] [http://www.oreillynet.com/pub/a/oreilly/tim/articles/architecture\\_of\\_participation.html](http://www.oreillynet.com/pub/a/oreilly/tim/articles/architecture_of_participation.html)
- [10] Eric S. Raymond: The Cathedral and the Bazaar, <http://www.catb.org/~esr/writings/cathedral-bazaar/>, August 2000
- [11] According to <http://www.internetworldstats.com/stats1.htm>
- [12] Collaborative development of open content: A process model to unlock the potential for African universities by Derek Keats; First Monday, volume 8, number 2 (February 2003), [http://firstmonday.org/issues/issue8\\_2/keats/index.html](http://firstmonday.org/issues/issue8_2/keats/index.html)
- [13] For the full licence see <http://creativecommons.org/licenses/by-sa/2.5/legalcode>, for a human-readable summary see <http://creativecommons.org/licenses/by-sa/2.5/>.
- [14] "Rip, mix, burn" refers to Apple Computer's popular 2001 advertising campaign for its iTunes music software. The slogan addresses the ability Apple users have to "rip" or upload music onto their hard drive, to mix or arrange songs according to their preferences and "burn" or create new CDs of their compilations.
- [15] "Wikipedia - Replies to common objections", [http://en.wikipedia.org/wiki/Wikipedia:Our\\_Replies\\_to\\_Our\\_Critics](http://en.wikipedia.org/wiki/Wikipedia:Our_Replies_to_Our_Critics)