Open access and open source: considerations for agricultural academic libraries in promoting collaboration and sharing of information and knowledge

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Open access and open source: considerations for agricultural academic libraries in promoting collaboration and sharing of information and knowledge

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Abstract

This paper discusses how the open access (OA) and open source technology can be utilized by the African agricultural academic libraries to improve the collaboration and sharing of information and knowledge among agricultural researchers and other stakeholders. This study draws from the literature review, and various case studies to discuss the application of open source technology and OA concepts in fostering the sharing of information and knowledge. This paper observes that if used effectively, open source technology can provide a number of tools that can be used by the agricultural academic libraries to improve the sharing of information and knowledge among their users on OA basis. Such tools include the content management systems, journal publishing software etc. Since the application of OA movement is still very low in Africa, this paper urges the African agricultural academic libraries to adopt the open access archives (OAA) in order to increase the accessibility, visibility, interactivity and usability of African agricultural research, thus accelerating the world's research activity. By implementing the OA archives, the agricultural libraries can also benefit from other value added services, which include search engines that provide citation and indexing services (e.g. Google), blogs, discussion lists and wiki, etc. However, more consideration should be put on the following in order to increase the usage of OAA, which are: OA awareness programs, technical abilities, standards and institutional policies which should strongly be supported by institutions and research funding agencies etc.

Keywords: Open access, open source, academic libraries, Tanzania, Open Access archives, agricultural information sharing

1. Introduction

The agricultural sciences in the developing world including Africa cannot be strengthened without the access to the global library of research information (Chan et al, 2005). However, the agricultural scientists in Africa are deprived from accessing the research information due to the rising of journal prices. Journal subscriptions normally increase at rate of 11-16% every year, beyond the reach of many institutions in Africa (Nyika, 2006). Further, the publications in mainstream journals face the problem of recorded prejudice against submissions from developing country scientists (Horton, 2000; Cetto and Hillerud, 1995). Few 'local' journals are indexed by the Science Citation Index, and those that are indexed have low impact factors (Adam, 2002: 726-729; Coura and Willcox, 2003: 293-297) so that scientists in developing countries are understandably reluctant to publish locally.

Many initiatives have been started to resolve the information access problem in the developing countries including Africa, but progress has been slow and, since they are generally dependent on grants or subsidies, are unlikely to be long-term solutions (Chan et al, 2005). Thus, most of the agricultural libraries in developing world still have small, older and incomplete collections. Additionally, most agricultural researchers are also deprived from accessing the local and world's published knowledge.

The Open Access (OA) movement offers many opportunities for the agricultural academic libraries to fulfill information needs of their information – deprived scientists. In particular, open standards and open source technology are opening many possibilities for reducing and even eliminating entirely the cost barriers to scientific publications. However, the major driving force behind the open access movement is not only the availability of new technologies, but a desire among researchers and scholarly associations to bring some relief to the decades-long "serials crisis". This crisis has eroded library access to journals as a result of increasing subscription costs (Kyrillidou and Young 2002: 448-456; Patel and Kumar 2001; Rosenberg, 1997).

However, the implementation of OA movement in most of the African agricultural academic libraries especially in the agriculture field is very low. This paper discusses how the open access and open source technology can be utilized by the African agricultural libraries to improve the collaboration and sharing of agricultural information and knowledge among agricultural researchers and other stakeholders. This study draws from the literature review, and various case studies to discuss the application of open source technology and OA concepts in the African agricultural academic libraries. Challenges and opportunities of implementing the OA movement through the use of the open source technology by the African agricultural academic libraries are also discussed.

2. Open access concepts

Open access is defined as that information which is digital, online, free of charge, and free from most copyright and licensing restrictions (Suber, 2005). As outlined in the Budapest Open Access Initiative, there are two basic strategies used to achieve the open access:

1. Self-archiving (making electronic pre-prints and post-prints available on author home pages or depositing them in digital archives and repositories); and
2. OA journals those that do not charge readers or their institutions for access instead the publishing costs are met by authors. In return, authors retain the copyright in their articles.

2.1 Open access journals

OA journals share one attribute; they make their quality-controlled content freely available all over the world by using the economy model that does not charge readers or their institutions for access. There are several operational models in place, the simplest one as explained by Correia and Teixeira (2005) is where the journal is set up and run by a university department. Another model is where the journal receives some funding, either by grants or sponsorship, to support some of the editorial or management costs, e.g. D-Lib Magazine (D-lib Magazine, 2005). Lastly is the commercial publishing, which does not charge readers or their institutions for access instead the publishing costs are met by authors or institutions (Bosc, 2005), e.g. BioMed Central (BMC, 2006). Both BioMed Central and Budapest Open Access Initiative (BOAI) through its Open Society Institute (OSI) offer a full waiver of the article processing charge and also provide grants to publish in the OA journal to authors in low and low-middle income countries respectively (Open Access Now, 2005; Budapest Open Access Initiative, 2005). Thus, the scholars from developing countries can use these opportunities to have their articles published in OA journals.

However, journals that offer public, open access still represent only a small part of the publishing world. Falk (2004) reveals that there are about 1,200 OA journals among 25,000 scientific and scholarly journals published worldwide. This is because many scientific publishers argue that OA journals are not “professional”, and they increase the overall cost of scholarly publications (Falk, 2004). The situation however seems to improve as revealed from the Directory of Open Access Journals (DOAJ) (DOAJ, 2006). DOAJ shows that there are now 2064 journals and 83356 articles, where 509 journals can be searched at article level (DOAJ, 2006).

Further, OA also seems to gain its momentum where a number of commercial journals publishers tend to move into the OA stream, to name a few include: Elsevier, Springer etc (Falk, 2004). This is also true as compared to the results from SHERPA/ROMEO list, which reveals that there are 76% of publishers who allow some form of self - archiving out of 134 publishers (SHERPA, 2006). Hence, the authors can avoid copyright problems with the private publishers by openly archiving their articles prior to submitting them to publishers for peer review (Onsrud, 2004).

2.2 Self-archiving in Open Access Archives

The term 'self archiving' is often used to refer to the process whereby individual authors

submit their own papers to a server or archive of their choice. Open Access Archives (OAAs) are electronic repositories that may include already-published articles (post-prints), pre-published articles (pre-prints), theses, manuals, teaching materials or other documents that the authors or their institutions wish to make publicly available without financial or other access barriers (Lynch, 2003). There are various forms of OAA, which includes the 'institutional archives', whereby authors submit e-prints to a server administered by an organization or scholarly society, commonly their university or research institute; there are also discipline-based archives and other specialty archives, e.g. the Cornel University OAA for physics, mathematics, computer science and quantitative biology (Cornery University, 2006).

Many institutions and libraries in the world are now either on the move, or on the way of implementing the OA archives as shown from the surveyed online directories in table 1.1. These online directories were analyzed during February, 2006 in order to reveal the rate of OAA implementation worldwide.

Table 1.1: OA archives in various online directories (up to February, 2006)

Online directory	Number of OA archives
Registry of Open Access Repositories (ROAR)	635 OAI-compliant archives
Directory of Open Access Repositories – OpenDOAR	353 repositories
Open Archives Initiative - number of registered data providers	401 OAI-compliant archives
OAIster	611 repositories

Source: ROAR, 2006; OpenDOAR, 2006; OAI; 2006; OAIster, 2006

The major contributing factor for this progress is the development and adoption of the common technical standards, developed by the Open Archives Initiative (OAI). That standard is known as the Open Archives Initiative - the Protocol for Metadata Harvesting (OAI-PMH), designed for better sharing and retrieval of e-prints residing in distributed OAI- compliant archives (OAI, 2005a). With the OAI harvesting protocol, articles in OAI compliant servers form a global library that facilitates searching, data retrieval, cross-linking, as well as stable long-term archiving (Lynch, 2001).

3. Why Open source should be applied in open access of agricultural information?

Open source software are programs whose licenses permit users the freedom to run the program for any purpose, to study and modify the program, and to freely redistribute copies of the original or modified program (Open Source Software / Free Software References, 2005). Open source provides a number of tools that the agricultural academic libraries can use to develop OAA either from scratch or rebuilding the software from the existing solutions. The best-known and most widely used OAI compliant open source software are the Eprints (EPrints.org, 2005b), DSpace (Dspace, 2006) and CDSware (CERN, 2005). All of the recent versions of this software are easy to install and allow localization and further re-development as per institutes' local requirements.

There are also a number of guidelines that provide a starting point to any organization such as the agricultural academic libraries to adopt and implement OA archives software. This includes:

- *A Guide to Institutional Repository Software*. This is a useful guide from the Open Society Institute that provides descriptions of major institutional repository software options and gives an in-depth comparison of them (Budapest Open Access Initiative 2006).
- *Free open source OAI-PMH 2.0 compliant software*. Although it has not been updated since November 2004, this chart from eScholarship@UQ at the University of Queensland is a very handy way to compare OAI-PMH compliant software options quickly. (Australian Partnership for Sustainable Repositories 2004)
- *OAI tools.* This list from the OAI describes a number of open source software that incorporates or provides OAI-PMH functionality (OAI, 2005b).
- *Institutional Self-Archiving Policy Registry*. This offers a registry of the open access archives which have already implemented the self archiving policy (Eprints.org, 2005b)
- *Open Source Software guide by Eifl*. This site provides a useful list of open source software that can be used by the academic libraries to implement the OAA, library management software and other types of open source software related to different library activities (EIFL.net, 2005a)

Open source also provides opportunity for agricultural academic libraries to establish their own OA journals. An example is the journal of management and publishing software distributed free through the Public Knowledge Project (PKP) in Canada (PKP, 2005)

On the whole, the only cost of setting up a preprint service at a typical university is technician time, server time (Onsrud, 2004*)* and the Internet connection*.* Time required for document conversion and submission will depend on the number of documents processed and whether authors do this themselves or whether libraries or computer departments provide a centralized service (Carr and Harnad, 2005). To sum up, the overall costs are likely to be low and will be more than repaid by increased visibility of the institution's research output**.**

3.1 Value Added Services

The most basic service is simply to allow a number of OA repositories (e.g. developed by using the open source technology) to be harvested and getting a search engine to order the yield and present it to the world. E.g. Scirus, Yahoo, DAREnet (i.e. offers the openly accessible content of all Dutch academic repositories) and several other search engines do, although they trawl the Web in addition to drawing on institutional repositories (Waaijers, 2005). On the other hand, there are other added value services which include Google Scholar, Thomson ISI's science citation index and Scopus from Elservier. These services have added a new dimension to the fore mentioned services by giving the citation index of each article as well. Further, since Google and Elservier use completely different business models, Google Scholar is able to provide its services for free to the end user, while Scopus and Thomson ISI's science citation index are very expensive. Additionally, when compared to Thomson ISI's science citation index, the free Google Scholar service was found out to be similar to Thomson ISI's science citation index for performing citation counts and could be used as a cheap substitute to

the costly Thomson service (Charbonneau, 2006).

Other services which can be developed by the open source technology and add value to the OA venues include:

- *Personal web sites and Blogs* (i.e. personal entries in diary-style) can be used by authors to self archive their contents online.
- *ListServs* can be used by libraries to establish forums for knowledge exchange and sharing including the OA issues among scholars, thus promoting OA movement.
- *Wikis* are on-line reference works (encyclopedias) which enable anyone to go online and contribute their ideas, knowledge or information.
- *RSS feeds* provide web content or summaries of web content together with links to the full versions of the content.

The African agricultural academic libraries can therefore use all these services to add value to their already established OA archives.

4. Agricultural academic libraries and OA movement

The agricultural academic libraries play an important role in the life of the agricultural universities and institutes. They are essential for research and academic studies. Faculty, researchers and postgraduate students depend on the library for awareness of developments and progress in their research fields and for the identification of potential areas of research. Hence, there is always a constant pressure upon academic libraries to be able to provide the most current information (Raseroka 1997). OA movement can help the agricultural academic libraries to get access to the current information at a lowest possible cost.

The use of OA has a lot of advantages to academic libraries. This is because these libraries have a close relationship with the university faculties, i.e., those who both contribute the most to scholarly journals, and have strong needs for access to the same materials (Giarlo, 2005). OA is also an issue worth investigation by academic libraries given the general trend of shrinking library budgets and growing journal prices (Rovner, 2005; Crawford, 2005b).

Furthermore one of the major roles of the university library is to be a centre of all locally created information whether generated through consultancies, student research projects, academic research or government generated data such as statistics, and other government documents. Therefore the application of OA in the form institutional repository provide a very useful means of facilitating such a role

5. Implications of OA for agricultural information sharing and networking

The sharing and networking of the agricultural information through the OA movement together with the application of open source and other value added services can bring many benefits to the scholars. Especially to those reside in developing countries, since they have the least means to access the worlds' knowledge. The major benefit brought by OA to the agricultural information sharing and networking is the improved citation and research impact. For example, Lawrence (2001) found an "average of 336 per cent more citations of online articles compared to offline articles published in the same

venue". Harnad and Brody (2004) study also indicates that compared with articles that have not been made OA by their authors, OA archived articles are cited between 250-550 per cent more often. Other OA benefits include: (1) wide access to international research output; (ii) International access to agricultural research generated in developing countries including Africa; (iii) Promotion of institutional research output; (iv) OAA allows improved access to subsidiary data e.g. grey literature (v) Facilitating peer review, thus reduce duplication of research efforts among agricultural researchers (Chan et al, 2005).

6. OA adoption in the African Academic Libraries

Generally, the OA adoption in Africa academic libraries including those in the agriculture field is still very low. The INASP study reveals that African university libraries tend to move into the areas of electronic theses and dissertations as well as the digitisation of local collections, rather than in the direction of setting up full-scale information repositories – although information repositories may be the end result (Durrant, 2004). As a matter of fact, this situation is mostly contributed by the lack of awareness about the OAA.

Although, the awareness of OA in developing countries especially Africa academic libraries is still minimal, a number of universities and funding agencies in some African countries have already established OA archives. Statistics produced from the registry of Open Access Repositories (ROAR) show that out of 635 OAI-compliant archives, five of these repositories come from Africa (i.e. four from South Africa, and one from Namibia) (ROAR, 2006). The Directory of Open Access Repositories (OpenDOAR) also reveals the same results that out of 353 repositories, five of these repositories come from Africa (OpenDOAR, 2006) and three of them are agricultural based.

Nevertheless, there are also international and local efforts that provide the poor developing world academic libraries including those in Africa, with a subsidised free access to the selected journals. Such initiatives include: HINARI for health research (supported by the World Health Organization), AGORA for agricultural and food research (back by the Food and Agricultural Organization), and the Programme for the Enhancement of Research Information (PERI) through International Network for the Availability of Scientific Publications (INASP). These schemes provide researchers with virtually free access to papers in the selected journals. The drawback, however, is that, since the range of journals covered is limited, this will not necessarily provide as much exposure for the work of scientists within these countries as could, in principle, result from a policy of OA archiving (Dickson, 2005).

On the other hand, there are also other initiatives which provide access to information on OA basis to the developing countries academic libraries including those in Africa. These include the Bioline3 and the British Medical Journal initiatives, which provide 29 journals free to the world's 100 poorest countries. Another example is Extramed (http://www.iwsp.org/ExtraMED.htm), which publishes the full text of over 300 biomedical journals that are not indexed in Medline on a CD-ROM. These CDROMs' are made freely available to the South (i.e. developing world) and at a reasonable cost to the North (i.e. developed world) (Durrant, 2004).

6.1 Various case studies of OAA establishments in the Africa academic libraries

Although, the trend of OAA adoption in Africa is almost insignificant as compared to the inaccessible agricultural information, there are a number of African academic libraries and initiatives that have made a move towards the OAA establishment. Such as the South African Site Licensing Initiative (SASLI) of the Coalition of South African Libraries Consortia, with the support from the eIFL programme, it has held many workshops in order to promote OAA creation in South Africa.

First workshop was held in August 2004 to engage the library, higher education communities, research offices and government funding bodies with implementing the dual strategy of OA as recommended by the Budapest Open Access Initiative (BOAI) (Chan et al, 2005). A follow up workshop on institutional archives was conducted in May 2005 and four institutions in South Africa have begun implementing OAA (Chan et al, 2005). This includes the two repositories for e-theses and dissertations implemented by using ETD-db open source software and other two digital repositories for various types of information materials ranging from dissertations to articles, conference papers etc. The later two were developed by using the e-prints open source software. However, De Beer (2005) reveals that the OA adoption in South Africa to date has been disparate, uncoordinated and decentralised. The OA awareness is also shown to be very low among the academicians. The author argues that the enabling policy environment which already exists in South Africa should be used to mandate that scholars make pre-prints and e-prints of their research available via an OA venue. Secondly, that they would report on having done so as part of the annual statutory reporting which they already do.

In collaboration with other International agencies, some African libraries have also managed to establish the OA archive. For example, the OdinPubAfrica which in collaboration with other twenty four African countries, has managed to implement OAA known as the African Marine Science Repository since 2003, by using the Dspace open source software (OdinPubAfrica, 2005). The Institute of Marine Sciences of the University of Dar es Salaam in Tanzania is also a partner in this project. According to Nyika (2006), the e-repository has enabled the Tanzanian Institute of Marine Sciences (IMS) to achieve the following: wider dissemination of IMS research finding; increase in citation index; enhanced access to journal articles published by other scientists in the region; and increased research cooperation among scientists in the region. However, despite those achievements, the institute still faces some problems, which include the lack of willingness of the authors to archive unpublished articles and slowness of the Internet connectivity.

Makerere University Library in Uganda is also collaborating with the University of Bergen Library in implementing OA archive by using the BORA initiative as their model. Bergen Open Research Archive (BORA) is the institutional repository established by the University of Bergen library since November 2004 by using DSpace open source software. Currently, the Makerere University repository is still in its initial stages, aiming at digitizing the information sources and assessing the copyright issues and document formats (University of Bergen, 2005).

Further, the other example of digital repository is from the University of Namibia library, which has established the OA repository by using the Dspace open source software. Prior to training its staff on contents submission, the University has also approved the

Open Access Initiative and the signing of the Budapest Declaration for UNAM as institution. However, as Morgenstern (2005) notes the library still faces some problems in populating the repository because most of the scholars are worried about the peer review and quality of paper. This is mostly due to lack of awareness about the OA issues.

6.2 Challenges of implementing OA in the Africa academic libraries

The reviewed case studies revealed that the major problem that faces African academic libraries including those in the agriculture field relates to the slow pace with which the institutional archives are filled. The key complication is always associated with the lack of awareness about OA issues especially the copyright issues (Morgenstern, 2005; Nyika, 2006). This is because of that many authors who have published with the commercial publishers fear to deposit their papers on the OA archives because they think it would constitute violation to the publisher's copyright (Rajashekar, 2005). While, other authors concern is that placing material in the OA archives precludes its later publication in scholarly journals (Gadd et al, 2003) and the potential loss of integrity of their papers (Gadd et al., 2003). Likewise, librarians are also reluctant to archive papers that are published in western journals on faculty's behalf for fear of putting their institution at copyright risk (Rajashekar, 2005). What authors and librarians often fail to realize, however, is that the momentum of the OA movement is accelerating and commercial publishers are realizing that there is no point or possibility in opposing OA itself (Harnad and Brody, 2004) as revealed from the SHERPA/ROMEO list (SHERPA, 2006). Thus, the institutions have to define strategies that address the issues of copyright, quality and secrecy (Waaijers, 2005).

Lack of peer review process on most of OA archives/repositories tend also to inhibit many authors to submit their contents because they feel that the quality of their research writings is not assured, thus loosing their reputation. However, lack of pear review process has not limited some of the OA archives to have extensive usage and high citation of their contents. For example, the papers in Los Alamos Physics Archive are initially deposited as un-refereed preprints, and they are always replaced by some authors when the final revised draft is accepted for publication (Hitchcock, et al 2000). Yet, Los Alamos is actively used and cited by the physics community (Youngen, 1998: 448-456). However, this does not mean that the peer review process is compromised, sacrificed, or put at risk; nor do authors have to give up, even temporarily, submitting to their established journals of choice. All they have to do is self-archive their preprints and post-prints in their institutional e-print archives or repositories given that they are allowed by their publishers to retain their rights (Hanard, 2001).

Lack of a clear institutional policy also inhibits the OA archives from being populated (Chan et al, 2005), e.g. Namibia University repository is nearly empty. This is true as revealed from Brody and Harnad (2004) that the OA archives with an institutional self-archiving policy (i.e. Southampton Department of Electronic and Computer Science since 2002 and Southampton University since 2004) had high usage. While, archives without an institutional self-archiving policy were nearly empty, in some cases for several years. Swan and Brown (2004) also found out that the vast majority of authors (81 per cent) would comply willingly with a mandate from their employer or research funder to

deposit copies of their articles in an institutional or subject-based repository. That's why, in 2005, OA activists approved the Berlin 3 institutional policy commitment. This calls for universities and research institutions to establish policies requiring academics to self-archive, as well as encouraging them to publish in open-access journals (Suber, 2006)

Other challenges include the following:

- *Poor coordination among academic libraries* when establishing OAA is another problem which hinders the implementations of OAA, e.g. the South African academic libraries (De beer, 2005).
- *Few African library consortia*. These consortia could be used to work together with other international agencies to further the implementation of OAA in the African Academic Libraries. Such as the case studies revealed that it is only the South Africa academic library consortium that is working closely with other international agencies (e.g. Eifl.net) to promote the awareness and implementation of OAA to the academic libraries.
- *Other challenges* include the following: weak institutional infrastructures, poor funding due to a tight research budget, and the absence of a critical mass of scientists to form a viable research community (Harris, 1996: 737-739). Moreover, even more progressive research groups may find OA archiving a threat to their attempts to generate income through publishing efforts (which many find a valuable source of funding, particularly when government support is low) (Dickson, 2005).

7. Opportunities for Africa agricultural academic libraries to adopt OA

There are many opportunities provided by various initiatives that the African agricultural academic libraries can use to establish OAA. Such initiatives include the EIFL.net. This works with the different consortia from transition and developing countries on the development and adaptation of manuals and guidelines on OA. It also provides training and organizes workshops on OA in eIFL participating countries. Previously OA workshops were held in South Africa, Ukraine and Lithuania. It is also creates institutional repository pilot projects in a limited number of countries initially, which can later be replicated across the eIFL.net community (i.e. transition and developing countries). Currently there are fifty member countries of which seventeen come from Africa (EIFL.net, 2005b).

Through OSI Information Program of the BOAI, the agricultural academic libraries are also presented with the many OA opportunity, which include the following: various guides are provided for Business Planning for Converting a Subscription-based Journal to OA, Guide to Launching a New OA Journal, and EPrints users' manual; Grants to libraries, publishers, universities and other various stakeholders to support advocacy and education promoting the growth of OA. BOAI also supports the creation of institutional repositories to the universities and research institutes (Budapest Open Access Initiative, 2005).

Another opportunity can be taken from the fourteen countries that make up the Southern African Development Community (SADC). They have agreed to co-ordinate their science policies and work together to develop the region's science and technology infrastructure (Malakata, 2005). Therefore, the major higher educational and research institutions in these countries can take the opportunity to set up an interoperable OAA.

This would enable the researchers in these countries to share their research findings freely at a very low cost.

8. Conclusion

The financially challenged agricultural academic libraries in developing countries including those in Africa stand to gain more than anyone from OA movement. As a matter of fact the agricultural libraries in developing countries should take a leading role in the OA movement by establishing OA archives in their institutions. This will to increase the accessibility, visibility, interactivity and usability of African agricultural research, thus accelerating the world's research activity. Similarly, this would enable the scientists who often have difficulty in getting their work published in the international scientific journals to benefit from seeing it placed in OA archives in which it would be globally accessed. However, the number of African agricultural libraries prepared to establish their own electronic archive so far remains disappointingly low. Only few African countries have managed to implement the OA archives by using the open source technology. This paper also recommends the following towards implementing the OA archives:

- Agricultural libraries are argued to put more considerations on including both types of knowledge content (both formal and informal) when developing the OAA. This would enable such libraries to foster both formal and informal scholarly communication.
- African agricultural universities and funding agencies should establish policies that require the academics to self-archive in OA archives, as well as encouraging them to publish in OA journals and other commercial journal which are on OA basis.
- Institutional, national and regional programs should be organized to raise awareness of OA and the related initiatives through conferences, workshops, and training.
- Agricultural librarians should play a great role by promoting and demonstrating the benefits brought by OA such as the increasing number of citations (Lawrence, 2001; Harnad and Brody, 2004). Also the impact factors as revealed from the Romeo site (SHERPA, 2006)
- African agricultural academic libraries should coordinate and collaborate in terms of library consortia and with other international initiatives when implementing the OA archives

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