Notes on Using Information and Communication Tools to Strengthen River Basin Organisations in SADC

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1. Background

This short discussion paper forms part of the GTZ-funded project "Transboundary Water Management in SADC" (05.2005.6-001.00), held from October 2008 to September 2009.

A key brief of the project is to "propose tools and processes that will empower River Basin Organisations (RBOs) to deliver on the current and/or improved mandate". A specific deliverable required to meet this brief is "a portfolio of tools and approaches ... presented in electronic (Web/CD) format (platform), which is accessible to River Basin Organisations (RBOs)."

2. The Role and Purpose of Information & Communication Tools

Adopting ICT (or IT systems), as an organisation or as an individual, is not straightforward. As in a "real life" adoption, there are many issues beyond the technical that will affect this. In other words, it is not just a case of selecting appropriate hardware and software: due consideration must be give to the nature of the organisation itself and its place in the broader context; the people who work for and with the organisation; and all the processes that are already carried out there.

Before embarking on the use of ICT, one should be aware that:

- ICT are not, and never can be, a substitute for the many and varied interactions amongst individuals.
- ICT are not a "magic bullet" that will somehow make instant sense of disorganised and random items of data and information.
- ICT are not of benefit to organisations, or groups of people, that have no clear idea as to what they are trying to achieve, or what the best way is to do something.

In particular, successful adoption of ICT by an organisation depends on how well individuals understand and adapt to the required changes (for more on this topic, see *"10 principles of effective information management"* [32]).

3. Potential Components of an RBO Information System

It is clear that, even within the SADC region, there is no single "model" for a transboundary RBO; each basin has its own set of issues and people who deal with them. Each organisation has its own mandate and purpose and activities and, while some of these may be in common, its the differences that often provide the challenges. Because of this, its unlikely that a "one size fits all" approach for an IT system will work for each and every RBO.

The likely components of an RBO Information System (RBOIS) are strongly linked to the operational model adopted by the RBO. If the RBO has a strong management component, then functions such as Financial Management and Monitoring and Modelling will require specific IT components. Many of these are available as "off the shelf" systems; though they usually require some degree of customisation to fit the particular needs. On the other hand, many of the "development" functions, such as Policy and Strategy Development and Transaction Advisory Services require a more general type of system - potentially a so-called "Knowledge Management System" (KMS).

The term KMS is really too broad to have specific meaning, although commercial software vendors like to use the term to promote their products. Its more useful to think of what type of functionality is required and select tools or systems that can support this. For many RBOs it is likely that storage and management of detailed data and information would happen at country-level; though there is a strong case to be made for improved access to that data that is not dependant on any specific format or tools. If the term "knowledge" is taken to include policies, strategies, practices, methods, and approaches, then a system that supports their storage, searchability and retrieval would be extremely useful. Furthermore, given the distributed - in both space and time - nature of people who make up an RBO, then a collaborative, web-based platform makes the most sense.

4. Technology and Communication Considerations

The web is a vast breeding ground for new types and forms of information technologies. Both small and large organisations, as well as numerous individuals, are constantly evolving the way it works now and looking for new ways it can work in the future. The rate of change is very high: it has been said that one month on the web equates to one year of "real time". Within this dynamic "information ecology", a few key trends can be observed.

Open Standards and Open Information

In order for people and their tools to work meaningfully together, there is the need for protocols, tools and information to adhere - as far as possible - to jointly-developed, commonly-held and license-free ("open") standards. For example; the "HTTP" protocol (visible in the prefix to most web page addresses) is one that all devices linked to the web understand and can operate with - if that were not the case, the web as we know it simply would not exist. Much of the information on the web is also in an open standard format, i.e. HTML, the specifications of which are administered by the neutral World Wide Web Consortium [18]. Again, if each company or organisation produced web pages in differing (and possibly proprietary) formats, information access and sharing would be hugely hampered and virtually impossible.

For those with restricted funds and lack of access to learning opportunities, the increasing availability of so-called “open content” - information that can be freely accessed and shared – is growing continuously [34]. RBOs in SADC have the option

to make use of this material and also “contribute in kind”, thereby helping to bootstrap each other through joint growth and development of knowledge.

Open Source Software

Beyond standards for information formats and protocols is the issue of the tools used with and for them. For electronic devices, this inevitably means software. Prior to the availability of the web, much software was commercial in nature - that is, the code was not available to the end user and payment for its usage was required. The exception tended to be in academic environments where the strong science and humanities base drove the need for learning through information sharing. It was in such an environment that one of the most significant pieces of software developed in recent times - the GNU/Linux operating system - was created. GNU/Linux is a very well-known example of open-source software. According to the OSI [3], open-source software "must be distributed under a license that guarantees the right to read, redistribute, modify, and use the software freely" [4]. The current, and increasingly strong trend of adoption of open-source software is driven by its low entry cost (typically no licensing fee), its perceived reliability and quality (less susceptible to hidden security risks) and its strong emphasis on community involvement. For end users and organisations, it places control of what they are doing in their own hands. For software developers in developing nations, it offers the chance to develop critical and valuable skills by “rubbing shoulders” with leading developers and make a contribution to a key driver in both the local and the global economy.

Cloud Computing

One of the more recent "buzz words" to emerge on the web is "cloud computing". M. Tim Jones, writing for IBM, defines it as "the provisioning of computing resources (computers and storage) as a service" [28], and John Foley, on Information Week expands this to say that it is "on-demand access to virtualized IT resources that are housed outside of your own data centre, shared by others, simple to use, paid for via subscription, and accessed over the Web" [29]. Some of the newer hosting organisations, such as Elastra[31], are already altering traditional "monthly subscription" funding models to service-based, "pay for usage" ones. Cloud computing makes sense for many small- to mid-sized businesses, as it frees them from the need to maintain an expensive full-time information technology centre in-house. For "virtual organisations", especially ones such as transboundary river basin organisations, that are formed in the collaborative space between multiple agencies, it could offer a simple and relatively low-cost way to 'outsource' this overhead and focus instead on the information and services they are striving to provide.

Social Networking

Wikipedia defines as a social network "a social structure made of nodes (which are generally individuals or organisations) that are tied by one or more specific types of interdependency, such as values, visions, ideas, financial exchange, friendship, kinship, dislike, conflict or trade." This is a very broad definition. In terms of the web, social networks have increasingly become enable through some form of on-line presence. Two of the most popular - in the Western World, anyway - are Facebook and MySpace - with a combined user-base of over 300 million people. While these are typically more for casual linking, business models based on these approaches are also developing - LinkedIn has a user base of 80 million users with individuals adding

information about their jobs and careers. Individuals or communities with web access in developing nations can readily make use of these existing platforms to develop relationships and empower themselves in ways that go beyond just friendships.

Crowd Sourcing

Wikipedia defines crowd sourcing "the act of taking a task traditionally performed by an employee or contractor, and outsourcing it to an undefined, generally large group of people" [24]. Examples includes software development - where tools such Linux and Apache, developed by volunteers, have proven themselves against their commercial equivalents, developed by full-tome "specialists" - and information content - where sites such as Wikipedia are built from collective knowledge, rather than by paid experts. The "Wired" magazine, which coined the term, gives examples such as the rise of low-cost stock photography as a challenge to traditional professional photographers [21]. In some cases, commercial companies are actively seeking participation from the "little guy" - for example, the InnoCentive website [22]. Not all crowd sourcing requires human input - the SETI@home Project [30] involves million of PCs donating "free cycles" (unused computing power) to solve the problem of processing vast amounts of signals - while some use it in almost invisible ways - such as the reCaptcha project which uses a security access mechanism to also help "decode" scanned words not recognisable by computer programs, so that books from the Internet Archive can be made available in text form [23]. Yochai Benkler also calls these types of activities "open source economics" [20], and has addressed in detail how they are, and might be, shaping human society [25][26].

Cell-based Access

While much of the Western world is used to accessing data and information through their computers, the high cost of these devices has hindered web access in the developing world. However, the recent massive uptake of low-cost devices, such as mobile/cellular telephones (cellphones) is having an enormous change in people's lives. In India, for example, fishermen can use cellphones to track market prices, locate buyers and share problems and opportunities with other fishermen. One fisherman says "*I can't imagine life without my phone ... we should have had this power a long time ago*" [33].

5. Project Approach

In October 2008, the project team met for a joint workshop to scope and plan the project. The workshop included a "brainstorming" session where the project team identified numerous items that would ideally form part of a web-based "information system" (see Appendix III). It is clear from the outcome of that session that the primary focus of such a system needs to be in two areas: content and communication. Fortunately, the web is an ideal platform to address these needs; it is inherently a communication channel, and numerous types and forms of content can be distributed through it.

At the time of writing, the specific resources and requirements of a SADC Water Institute (referred to here as an "RBO") were not known in detail. Amongst existing RBOs, the organisation model can vary from a few staff to many. Technical resources

– staff and platforms - may be well-established or very limited indeed. In this type of environment, it is desirable to have as low an entry barrier as possible for an organisation to access and make use of an information system. Software used should therefore not be dependant on a specific architecture or operating platform. It needs to have as few restrictions - in terms of cost, usage and deployment - as possible. It needs to be widely and readily accessible. For all these reasons, a web-based solution - which encompasses the option of having it both housed and administered by a sub-contracted third-party - represents the most practicable approach.

6. Developing a RBO Web-based Information System

Software systems, like individuals, do not exist in a vacuum. In particular, the web, by its very nature, strongly drives a paradigm of interconnectivity. The challenge for a project that will develop a web-based information system is to:

- avoid duplication with existing sites;
- make use of the best and most affordable of software and computing services; and
- create a platform that will 'draw in' the crowd that exists in each river basin and also enable them to contribute and build a shared system.

Software Selection Approach

As with any other type of software project, there are always two options: acquire or build. Building a complex software platform "from scratch", within the time and budget of the current project, does not make sense and is simply not possible. Acquiring existing software is thus the only viable approach, even though it may mean some of the identified needs may not yet be met. It needs to be borne in mind, however, that even acquisition is not a straightforward process. Extensive tailoring of "off the shelf", but very general-purpose, tools can be a time-consuming process. Such tailoring, while possible with commercial packages (usually done by the owning company), is usually too costly for many. In this regard it makes the most sense to adopt an appropriate open-source solution, as on-going customisation can be carried out, by contracted developers, or in-house staff, or some suitable combination of both.

It is likely that an RBO Web-based Information System (RBOIS) will grow over time, and that content provision and communication will need to be in the hands of the primary users of the system i.e. the RBO managers (operating in the chosen organisational model) and the river basin community. Therefore, while the RBOIS might be formally housed and administered by a strong, central technical group, it needs to be "operated" by all concerned. For this reason, it makes good sense to adopt a content management solution, which places much of the system functionality in the hands of the people who use it.

Content Management Systems

Content management is a process which encourages one to "categorize and organise information for future retrieval and development" [1]. In simply terms, a content

management system (CMS) is "a computer application used to create, edit, manage, and publish content in a consistently organized fashion" [2]. In more detail, a CMS is "a tool that enables a variety of (centralised) technical and (de-centralised) non-technical staff to create, edit, manage and finally publish (in a number of formats) a variety of content (such as text, graphics, video, documents etc.), whilst being constrained by a centralised set of rules, process and workflows that ensure coherent, validated electronic content." [7]

The field of CMS software is a vast one. The CMS Matrix website [4], lists over 900 different systems, each with differing complexity and capability. Making a selection by evaluating each one in detail is clearly impossible. In addition, nearly all of these are too specific to meet the wider needs identified for the RBOIS. However, there are a few popular systems that have proven themselves through their longevity and widespread adoption.

Plone

Many of the currently popular content management systems are based on PHP and MySQL, two widely-used web technologies. A few are based on Java, either linked to MySQL or using XML. The particular system that, as of time of writing, was most attractive to the project team, is the Plone system [19]. The main reasons for recommending Plone are because it is:

- a **well established** product - with the core technology dating back to 1996
- an **open source** platform - with a strong development team and on-line community, and widespread backing from commercial support
- based on a solid web application server (ZOPE) - which itself has a multitude of related products linked to it [27]
- written in **Python** - an object-oriented language, with strong support in the science community (and beyond)

Plone has won a number of awards from the on-line community, most recently one from Packt Publishing [9]. A quick overview of both Plone and CMS is provided by IntoWeb [15].

In terms of its potential use for an RBO web-based information system, it is significant that the European Environment Agency (EEA) uses Plone on their website (http://www.eea.europa.eu/), particularly if future co-operation between SADC and the EEA can be pursued in future. This agency has also mandated the use of open source software and open standards wherever possible, as part of their European Environment Information and Observation Network (EIOnet) [17].

A more detailed look at some of the details and potential usefulness of Plone are provided in Appendix IV.

7. Conclusion

Each river basin organisation can, based on its needs (in terms of mandate, business model and related business processes) select its own suite of software tools and approaches. However, in order to take best advantage of often limited resources, it is recommended that SADC investigate the development and deployment of a common web-based infrastructure, using an open-source tool such as Plone, which can be "rolled out" to a river basin organisation. Each organisation can then customise this further, according to their specific needs. It is also recommended that river basin organisations ensure that they make the most effective and appropriate use of widespread and readily available information and communication tools and knowledge to better fulfill their mandates.

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Appendix I: Design Objectives for a web-based CMS

- Offer effective information
- Have improved quality of content
- Make it possible for more people to easily publish content
- Give the whole website a common look-and-feel
- Build a technically sound and platform independent website
- Adhere to web standards and use Open Source applications
- Accessible by a multi-lingual audience
- Follows the guidelines in "Vägledningen 24-timmarswebben 2.0" i.e. "*Swedish National Guidelines for Public Sector Websites*" (http://www.verva.se/english/publications/swedish-national-guidelines-for-public-sector-websites/)

Manages video and other multi-media content

Appendix II: Content Structure for a web-based CMS

At the top/bottom of each main page, there should be a site navigation menu with the following options:

- Home
- Contact
- Sitemap
- Login
- Help

A typical menu "sidebar" could include:

- About Us
    - Mandate
    - Organisation
        - Secretariat
        - Task Teams
        - Funding
        - Agreements
    - History
- Our Basin
    - Overview
    - Maps
    - Data
    - Sectors / Issues
- Resources
    - Projects/Programmes
    - Publications
        - Basic
        - Technical
        - Annual Reports
    - Images
    - Links
- Work Opportunities
    - Jobs
    - Tenders
    - Procurement
- News
    - Current
    - Press
    - Archive
- Events/Meetings
- Forums

Appendix III: Workshop “brainstorm” - RBO User Needs

Vision

The web-based system should help strengthen the role of culture & values in RBO processes

Interface & General Operations

- web-based
- road-map of site
- be able to link information topics into chains of related content
- allow for the same content to be provided **and** presented in multiple languages (link to the identity of user) - suggest English; Portuguese; French for SADC (but allow for others)
- generic interface can customised for each RBO - taking into account their context - typically through images/sights/sounds
- allow for different types of technology to access the site in different ways
- allow users to identify themselves by language; background; interest (education level?)

Information/Data Sets

- Glossary of key terms
- List of functions/responsibilities of the specific SWI (not daily tasks)
- Projects on-the-go in a basin; and their expected outcomes/benefits; stakeholders
- involved
- Type of information topics include:
    - "how tos" (practical guidance for running projects and processes)
    - protocols (e.g. policies; guidelines; legislation; action plans)
    - background/descriptive information (e.g. “River Awareness Kit”)
    - links to resources outside of the RBO primary website; for example:
        - water-related data sets (e.g. hydrometrology; water demands)
        - available, down-loadable tools
        - available on-line tools
        - benchmark values for RB performance (relative to others)

Information/Data Characteristics

- Flag with expiry date

- Categorise by topic
- Flag as “generic” vs. “specific” to the RBO
- Assign Weight
- Track no. of times accessed
- Assign levels (by complexity) to information topics
- Assign key words; also linked to individual's likely level of understanding
- Rate usefulness of information topics and data sets
- Package information into "digestible" chunks (step-by-step items where possible and applicable)
- Easy to monitor by system administrator
- Search/retrieve/query for different aspects
- Be able to sort/weight information

Communication Facilities

"to allow inputs and views of a broad range of stakeholders and 'basin citizens' "

- Opinion polls for gathering comments/ratings on key issues
- Discussion forum with Q&A between experts/stakeholders
- Share experiences of the RB occupant with others (text/images/sounds)
- Allow for input via different technology devices
- "Crowd sourcing" tool (to help with solving complex RBO problems, with the aid of stakeholders)
- Basin-specific wiki to allow users to add content

Modules

"to support effective management of the basin through the use of on-line tools"

- SIWI Business Model Selector
- Transboundary Opportunity Analysis
- Data Storage & Display Module
    - shows which data sets are available
    - depicts data visually (e.g. plot of rainfall; spatial changes)
    - is able to visualize statistical changes
- Database Modules
- CRM (customer relationship)
- Business Opportunities (e.g. tenders; projects; TOR)
- Scenario Planning Module/s (based on verified data)
- Development Game Module/s (e.g. the "be a water droplet" game developed in Spain) to strengthen management skills

- Flood Warning System ((e.g. EU-WISE)
- Monitoring & Evaluation Module (to help assess performance of projects against targets)
- SensorWeb Modules (for close-to-real-time monitoring)
- Google Earth Module (overlay basin information and data)

Appendix IV: The Plone Content Management System (CMS)

Overview

The following description of Plone comes from the Open Advantage website [8]:

> "Plone is a flexible, full-featured and enterprise-ready CMS. It is built on top of the ZOPE platform, a powerful, generic framework for building content management systems. It is a good choice for an organisation looking for an extremely flexible, scalable CMS. It rewards good design principles, simplifying the task of creating an easy-to-maintain website infrastructure. Plone stores all content in the ZOPE Object Database (ZODB) which means there is no need for a separate database to be installed. Almost all of Plone's functionality can be managed through a web interface, including starting and stopping the server, viewing logs, setting permissions, and creating and editing content."

Plone also offers such functionality as:

- Epoz editor: a WYSIWYG editor for all content
- News and Events: are linked to calendars and news feeds
- Member areas: personal areas, where users they can create their own set of pages, including news items, events, and discussion topics.
- Workflow: allowing creation, editing, submission, approval (and revisions, along with a complete history)

A "one pager" describing CMS and Plone is available from Intoweb, a South African Plone consultancy [16].

Relevant Features for the RBOIS

In addition to the features that are common to other CMS, Plone has very useful functionality that makes it especially relevant for use as the RBOIS [6], (based on the features identified by the project team; see Appendix III):

- Full-text **indexing** of Word and PDF documents; Plone automatically indexes the full text of Word and PDF files, making it easy for users to quickly find content across the web site.
- Archetypes; allow for the creation of new types of **structured information**
- Collections; allow users to easily to construct **dynamic searche**s, reports and queries and track these
- Wiki-enhancements; often wiki sites are seen to have weak access control and bad site structure but Plone enables **wiki-features** inside the normal CMS to take advantage of the best of both systems
- **Multilingual** content management; makes it possible to maintain the interface and the content in multiple languages
- **Time-based publishing**; set the date/time when items will become visible and/or expire
- Automatic **site map** generation; allows for a single point of navigation
- Cross-platform; Plone **runs on any platform**: Windows, Linux, Mac OS X, Solaris, FreeBSD and any other UNIX-based system.
- Comment capabilities on any content; provides an **easy way to leave feedback** on documents, images and other content

Finally, because it based on ZOPE, Plone is readily extensible through the use of add-on "products" i.e. if functionality is needed that isn't included in Plone by default, its possible to install an existing add-on module to add more capabilities (e.g. for blogging) or write new one, with full access to the Plone API.

Case Studies and Usage Examples

A number of case studies, describing Plone implementation in the "real world" are available:

1. "*Case Study: Discovering Plone Content Management System*" [10, 11] - a website for the DISCOVER magazine (USA)
2. "*Building a university website*" [12] – from the Faculty of Arts, Göteborg University (Sweden)
3. "*Migrating a website to Plone*" [13] – from four different United States universities
4. "*Using Plone to build an OpenCourseWare system at MIT*" [14]

Further case studies are linked from the Plone site [15], reflecting widespread Plone usage in a number of countries. In terms of local (South African) support, some Plone-based websites include:

- Durban Local Government - http://www.durban.gov.za/
- National Department of Labour - http://www.labour.gov.za/
- Metro FM radio station - http://www.metrofm.co.za/
- Forestry Information (ForestInfoNet) - http://www.forestinfonet.co.za/ (with project background at http://www.forestinfonet.co.za/theproject/)