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Report: 83273844

Scoping Study for an Information and Knowledge Management System for OKACOM

Project Report **Final**

25 May 2018

OKACOM
The Permanent Okavango River Basin Water Commission
Comissão Permanente das Águas da Bacia Hidrográfica do Rio Okavango

EXECUTIVE SUMMARY

This report reflects on the “Scoping Study for an Information and Knowledge Management System (IKMS) for OKACOM”. The objectives of the study were to identify the needs and priorities of MSs regarding better access to data and information, and to define the objective of a basin-wide IKMS and provide recommendations on IKMS options.

The first chapter provides context to the study, as well as its objectives and reflections on the project’s Terms of Reference (ToR). Chapter two provides a brief description of the methodology that was employed and the resultant task-based outputs. Added to this, the status quo pertaining internal and external information management in OKACOM via OKASEC is explored via desktop investigation, while detailed consideration of OKACOM stakeholder needs are presented in the chapter as well. The bulk of supporting information related to the investigation is included in Appendixes. In closure, Chapter two states key stakeholder needs as it relates to the core data and information requirements of each group. The differences and core similarities between the stakeholder needs are defined in order to clarify the deeper purpose and objectives of an IKMS and its supporting data sharing across the basin. Chapter three presents an analysis of the characteristics of options which OKACOM can pursue to implement an IKMS, with an overview of an appropriate way forward given a realistic foreseeable future. Since financial and human resource capacity remains limited, there is a need to prioritise the important and necessary knowledge management requirements. Chapter 4 concludes the report, providing a brief synthesis of the study findings.

Knowledge support functions in OKASEC are key to supporting effective functioning of OKACOM and in supporting the execution of its mandate. To enable this, the OKASEC Institutional Functional Analysis (2012) provides detailed structural and functional reasoning and requirements for the positions required to ensure the effective execution, maintenance and support that is required. To date, the implementation of many of the positions and functions to enable effective IKMS and data sharing across OKACOM have been slow, with:

- administrative document and contacts management is included in the office administrative support role;
- limited website interaction and ICT technology maintenance being managed via the financial officer role;
- the communications officer position recently being filled (in April 2018), albeit with limited IKMS responsibility.

As a result, knowledge support functions have played a limited role in the functioning of OKASEC.

The scoping study revealed that OKACOM stakeholder information needs and knowledge management requirements vary significantly. These information needs also vary in terms of scale, type, frequency and format. Stakeholder information needs relate directly to their mandate or ‘reason for being’:

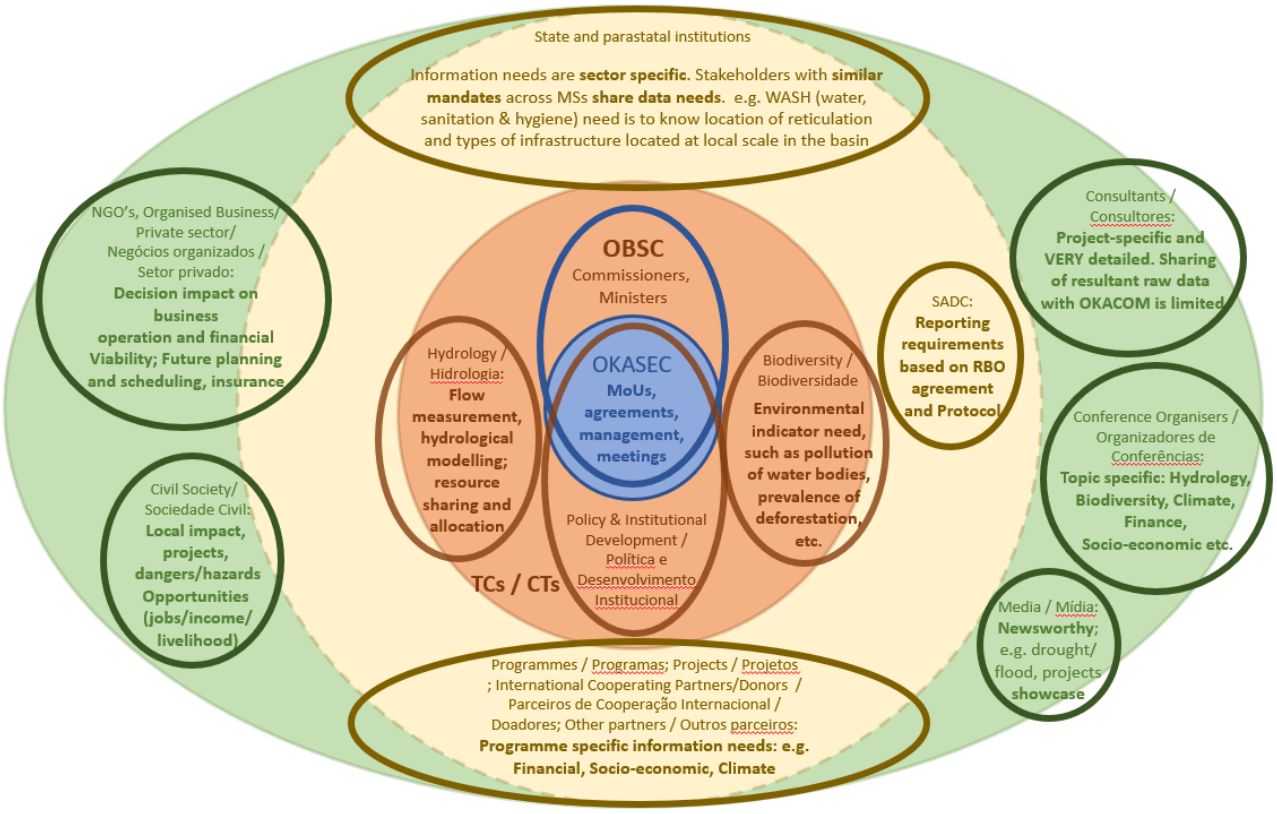

Figure: Stakeholder data needs

A priority information management need with regard to OKASEC internal operations is in support of daily operational and mandate-related data management within the organisation's Gaborone-based office. A priority 'external' stakeholder need (i.e. outside of OKASEC office) and one that cuts across all the sectors is the identification of data custodian(s) where the data or information that relate to stakeholder's specific needs can be found. Thus, metadata is a high priority which, if available in adequate detail, should enhance the efficiencies and achievements of all OKACOM stakeholders regardless of what needs-grouping(s) such stakeholder belongs to. A third priority as identified through the needs analysis is that of developing firm agreements between data holders and data users, in the form of Memorandums of Agreement or Understanding that clearly defines roles, responsibilities and rights as well as operational processes (in the form of Standard Operating Procedures (SOPs) as it pertains data sharing and data access in the basin. Given these three key priorities, an OKACOM IKMS (OIKMS) should fulfil at the very least these functions: i.e. effective operational data management, accurate metadata sharing, and agreement on how to share and access data sets – even if it is not hosted via the OKASEC server.

The challenges that OKASEC face regarding implementation of functions identified in the Institutional Functional Analysis (2012) resulted in the three core needs identified above (i.e. operational, metadata and MoA/MoUs with associated SOPs) not being met. This can be rectified through fairly speedy and largely low-cost intervention from the existing staff contingent in OKASEC.

The internal data and information management (DIM) processes and structures which forms part of OKASEC's day to day operations, as well as the availability of the metadata described earlier, has a direct influence on the potential and possibilities for effective external information and knowledge management options and options sharing of data with MSs and other stakeholders. Therefore the 'clean-up', securing and alignment of internal processes related to OKASEC data management should be addressed speedily, which will, in turn, support other stakeholder information needs. An internal data and folder cleansing process will support the population of a metadatabase (since data can thus be categorised and identified, and data custodian contact details confirmed or updated). The internal data management in OKASEC can be radically improved by improving operational processes, standards and harmonising of system details without incurring significant financial expenditure. Human resource-based interventions, such as implementation of stricter folder and file naming standards, and improvement of file sharing and file saving procedures which ensures that versioning and saving of documents support report and information retrieval is facilitated, as well as improvement of server backup- and internet linkage/speed form a key part of the options towards an effective OIKMS. In support of this process, an improved contact details management approach would support data and information sharing with stakeholder groups that share similar information needs, through the implementation of a customer relationship management (CRM) system. Such a system could be developed and managed in-house (in the form of for example a spreadsheet or relational database) or secured through proprietary CRM software. Either option would support effective engagement with stakeholders and support needs-focussed information and knowledge sharing as well as communication processes between OKASEC and stakeholders.

The options for an IKMS for OKACOM need to be financially sustainable and thus reasonably inexpensive to operate and maintain. This requirement eliminates the possibility of a significantly high-tech system that requires full-time in-house ICT administrative Geographic Information Systems (GIS) and Hydrological modelling expertise. Instead, partnerships with data custodians need to be cultivated and resources already available at custodians should be utilised (thus the importance of MoA/MoUs noted earlier), rather than attempting to create a full suite of IKMS service offerings within OKASEC. Where core data is required to be housed within OKASEC's server, such data should be of a static nature (for example reports, documentation that does not change much over time) and data that has long frequency intervals – for example annual updates and trend analysis that can be shared via OKASEC in addition to sharing via its primary custodian. Collaboration, coordination and close co-operation with data custodians is therefore necessary.

The findings and recommendations sections of the report and appendix include costing details, where information regarding functional and operational partnerships with stakeholders/service providers/custodians were obtained. The service providers seem to consider their engagement as a 'profit-driven business opportunity' opportunity as opposed to a non-profit partnership with OKASOM. Therefore, the costings provided are considered to be significantly inflated. Instead, the approach mentioned earlier – that of establishing MoA and MoU's are significantly more important than merely 'appointing a service provider' in the traditional sense. The MoA and MoU approach would be less costly since it would involve MS commitment

and internal resource allocation within MS departments and/or tertiary institutions, towards supporting OKACOM data and information sharing costs.

It is expected that the OKASEC staff or anybody with the right access will be able to upload data to the OIKMS through user-friendly web-browser screens and the necessary online manuals. The initial population of the OIKMS with all historical dataset will take time and will have to be supported financially after the initial development of each component of the system. Thereafter, it is expected that data and information contributions from member states and ICP consultants can be done by themselves. To drive this process, representatives from MSs could possibly include the updating of the OIKMS on an annual basis as part of their KSAs. TORs and ICP contracts of assigned consultants should also include the prerequisite that at the end of an assignment all document and data should be uploaded to the OIKMS before final payment. These measures will ensure that the system keeps growing over time and that OKASEC staff do not have to maintain the data on the system.

To ensure that the OIKMS is sustainable, implementation options need to have low annual costs to maintain the system. However, some financial commitment is required on an annual basis that should be ring-fenced. Since IT requires ongoing funding and human resources support, the level of expertise and support required for the OIKMS will depend on how user-friendly the system is. Added ti this, the opensource software should always be firstly considered for the different components of the OIKMS to make the annual costs and therefore the sustainability of the system more viable. Initial configuration costs might be slightly more, but all systems (except for online per user services) require initial configuration and setup. The Microsoft Office 365 Enterprise suite seems hard to beat for Knowledge Management tools, especially if the product can be obtained nearly free of charge, if OKACOM can be registered as a non-profit organisation.

In conclusion, the gradual implementation of the OIKMS is possible. However, initially it is recommended that a detailed design of an integrated modular OIKMS be initiated that will include a more detailed needs assessment, software specification, software comparison and detailed design, scheduling and costing of the system. Added to this, regarding the ICT infrastructure, it is critical that OKASEC decides what the long-term plan will be. Based on this report they dan decide whether to:

- keep on investing in their own server infrastructure with associated capital and maintenance costs, or
- contribute towards ORI's infrastructure capital costs for them to host the OIKMS and other services with associated annual costs, or
- fully outsource the IT infrastructure and support to 3rd party VPSs, and only pay annual service fees without further capital layouts.

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ACRONYMS AND ABBREVIATIONS

ACADIR	Association of Conservation for Environment and Integrated Rural Development
ARD	Associates in Rural Development, Inc.
BMZ	German Federal Ministry for Economic Cooperation
BWF	Basin Wide Forum
CORB	Cubango-Okavango River Basin
CSW	Catalogue Web Service
CRIDF	Climate Resilient Infrastructure Development Facility
CRM	Customer Relationship Management
DIM	Data and Information Management
DFID	UK Department for International Development
DIS-WD	Directorate for Infrastructure and Services – Water Division (of SADC)
DMS	Document Management System
DRFN	Desert Research Foundation of Namibia
DSS	Decision Support System
DWA	Department Water Affairs
DWS	Department Water and Sanitation
EPSMO	UNDP-GEF Environmental Protection and Sustainable Management of the Okavango River Basin Project
EPDT	Elephant Pepper Development Trust
EU	European Union
FAO	Food and Agriculture Organisation
FMP	Folder Management Protocol
GEF	Global Environment Facility
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationel Zusammenarbeit
GSOD	Global Surface Summary of the Day
HOORC	Harry Oppenheimer Okavango Research Centre (now the Okavango Research Institute)
KAZA TFCA	Kavango–Zambezi Trans-frontier Conservation Area
KMS	Knowledge Management System
ICT	Information Communication Technology
IKMS	Information and Knowledge Management System
IMS	Information Management Systems
IRBM	Integrated River Basin Management
IRC	International Standards Organisation
MIT	Management Information Tools

MoA	Memorandum of Agreement
MoU	Memorandum of Understanding
MSs	Member States
NAP	National Action Plan
NCDC	National Climate Data Center
NUST	Namibia University of Science and Technology
OBIS	Okavango Basin Information System
OBSC	The Okavango River Basin Steering Committee (OBSC) - OKACOM
OGC	Open Geospatial Consortium
OIKMS	Okavango Information and Knowledge Management System
OKACOM	Permanent Okavango River Basin Water Commission
OKASEC	OKACOM Secretariat
ORI	Okavango Research Institute (University of Botswana) (previously HOORC)
RBIS	River Basin Information System
RBO	River Basin Organisation
RCM	Regional Climate Models
SADC	Southern African Development Community
SAP	Strategic Action Plan
SIDA	Swedish International Development Cooperation Agency
SIWI	Stockholm International Water Institute
SOS	Sensor Observation Service
SOP	Standard Operating Procedure
SWOT	Strengths Weaknesses, Opportunities and Threats
TC	Technical Committees
TDA	Transboundary Diagnostic Analysis
TFO	The Future Okavango
ToR	Terms of Reference
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
WASH	Water, Sanitation, Hygiene
WB	World Bank
WFS	Web Feature Service
WMS	Web Map Service
WWF	World Wildlife Fund
ZAMCOM	The Zambezi Watercourse Commission
ZAMSEC	ZAMCOM Secretariat
ZAMTEC	Zambezi Technical Committee (ZAMCOM)
ZAMWIS	Zambezi Water Resources Information System (ZAMWIS)

1 INTRODUCTION AND BACKGROUND

1.1 PURPOSE AND OBJECTIVES OF THE PROJECT

OKACOM, as a River Basin Organisation (RBO), has played and will continue to play an increasingly important role in coordinating activities between Angola, Namibia and Botswana in the transboundary Cubango-Okavango River Basin (CORB). The implementation of the GIZ-commissioned Transboundary Water Management in Southern African Development Community (SADC) Programme was established by German Federal Ministry for Economic Cooperation (BMZ) with co-financing from the UK Department for International Development (DFID).

Output B.6 of the GIZ programme supports Institutional Strengthening of RBOs, including Information and Knowledge Management Systems (IKMS) support that provide stakeholders with access to relevant water-related data, information, and knowledge products. Significant amounts of data, information and knowledge is available via monitoring initiatives, ongoing studies and projects across OKACOM partnerships, research institutions in MSs and via independent researchers. The question is whether there is a critical need for this data and information to be managed differently than it is done currently, and if so, what stakeholders' priority information needs are. The proliferation of data and information is hypothesised to be useful towards wise decision making; however, this hypothesis is not a universally accepted consensus. This scoping study investigates the stakeholder information needs and determines the priorities for addressing key shared needs

Historically, the need for Knowledge Support Functions in OKASEC have been highlighted as a key need to support effective functioning of OKACOM and in supporting the execution of its mandate. The OKASEC Institutional Functional Analysis (PEMconsult, 2012) provides detailed structural and functional reasoning and requirements for the positions required to ensure the effective execution, maintenance and support that is required. To date, the implementation of the required positions and functions to enable effective Information and Knowledge management and sharing across OKACOM been slow, with:

- administrative document and contacts management being included in the office administrative support role;
- limited website interaction and Information and Communication Technology (ICT) maintenance being managed via the financial officer role; and
- the Communications officer position only being filled in April 2018 – the latter with limited information and knowledge management functions specifically detailed in the job description.

The current limited role that formal knowledge support functions have played in the functioning of OKASEC manifests in data identification and access challenges that operational staff and stakeholders have identified during this scoping study. Difficult exist in especially identification of information that is needed internally as well as externally – when information searches are done much time is often spent on identifying if certain

details exist, finding correct information, latest version(s) or accurate custodian contact details. Since OKACOM's mandate relies on management, maintenance and sharing of information, the day-to-day operation and maintenance of the OKASEC function remaining largely uncoordinated results in less than optimal support to stakeholders – ultimately resulting in less-than-optimal decision making across the basin.

This project support domestication (local integration), institutionalisation (within governing structures) and utilisation (in day-to-day operational and management environments) of information in OKASEC. In this context there are short-term operational needs and longer-term sustainability considerations related to IKMS which have to be incorporated into an IKMS design and implementation.

Given this background, the objectives of this assignment were to:

- define the objective of a basin-wide IKMS;
- identify the needs and priorities of MSs regarding better access to data and information; and
- recommend IKMS options.

There is no organised system that houses the data and information relevant to the basin operation and basin infrastructure in one platform, nor is this information accessible either as metadata or as raw data, especially via an internet-enabled portal or dashboard. Some reports and data available for the basin are accessible on the internet, while others are located in different places and formats. Translation services between the two official languages – English and Portuguese, is not supported other than in the primary web page. There is also no central repository or meta-database available to provide decision support. Although data repositories may exist within MSs, there is variation in hardware, software and design features as well as human resource capacity that limit alignment. An example of the variation is in hydrological data: for example, NUST has an advanced, up to date and detailed hydrology database. Botswana's database of the same kind is not as easily accessible and historically intense as the data available from NUST. In Angola, the availability of hydrological monitoring records is either significantly lacking or very difficult to access.

A well-functioning IKMS will directly support the efficiencies of OKACOM stakeholders and partners. As such, it is important to foster MS ownership of the IKMS – even though the IKMS may have its core at OKASEC, the data that is ultimately required for sharing purposes via custodians, sits within MS departments. Sharing of raw data is not key to OKASEC's function and therefore hosting of such data in OKASEC is not a key need – however the creation of linkage and development of data sharing trust and building of relationships to support improved data sharing can be effected through OKASEC. When scoping the IKMS cognisance was therefore taken of situations and opportunities within MSs that could be harnessed towards enabling system benefits to be realised.

1.2 COMMENTS FROM THE INCEPTION PHASE

There was no change in project team composition based on the original project proposal. Activities presented in the proposal was approved at the inception meeting (15 December 2017). Discussion notes from the inception meeting are included in the minutes (Appendix E). Agreement was reached during the inception meeting that additional translation into Portuguese of selected components of Tasks as well as the interview guide would be completed, in addition to the final presentation and project report. Added to this, based on benefits derived from additional engagement, an additional flight and accommodation as well as a change in venue of one of the meetings from Gaborone to Luanda, was approved as part of the amended project budget. Due to these above-mentioned changes, the contract time frame was extended until June 2018. Comparatively, the changes in the time frame as stated in the ToR and as per the project proposal versus reality were as follows:

Table 1: Original and adjusted project time frame

Task	Deliverable	Original due date	Actual date
Task 1: Inception	Inception Meeting	10 Nov 2017	15 Dec 2017
	Inception Report	20 Nov 2017	15 Jan 2017
Task 2: Desk Research	Brief report on initial data/information/report findings and metadata-base	10 January 2018	12 February 2018
Task 3: Stakeholder engagement	Interview guide (translation to be done after approval)	17 January 2018	2 February 2018
	Brief report for discussion on enhanced findings and initial options for systems	2 February 2018	2 March 2018
Task 4: Identify available options	No specific deliverables	n/a	
Task 5: Draft Report	Draft Study for discussion	2 March 2018	8 May 2018
Task 6: Final report *(incl. Translation)*	Draft report for discussion Draft report for comment Final report for translation Report distribution to MSs	16 March 2018	13 April 2018 8 May 2018 18 May 2018 25 May 2018
	Interim presentation	23 March 2018	12 April 2018
	Presentation to OBSC		4 June 2018

2 SCOPING INVESTIGATION RESULTS

2.1 DESK RESEARCH

This section reports on desk-top investigation into the data needs and project deliverables that was generated in relation to OKACOM and OKACOM over the past decade. The section focuses on areas where information is available in online format, or in reports that are relatively easily accessible. The focus areas include:

- OKACOM strategy and analyses (2009 - 2012);
- research and publications;
- funding agents and partner/consultant projects and reports; and
- general online information sources and search options which could be used by decision-makers and the general public.

2.1.1 OKACOM COMMUNICATION STRATEGY

OKACOM information and communication strategy documents (2009 and 2012) present sound recommendations intended to ensure good information storage, maintenance and dissemination amongst OKACOM itself and its stakeholders. The Institutional Functional Analysis (2012) also provide firm directive for knowledge management support – in the form of ICT as well as Geographic Information Systems (GIS) capacity. These documents indicate the intention for a well-structured, searchable and regularly updated information provision service, with transparent and fair access to relevant information for OKACOM stakeholders. Such an ideal structure and implementation is, however, not possible given the key challenges of financial and resource availability that OKASEC faces. Thus, the scoping study investigated what core information needs can be met via reasonable implementation options.

The 2012 strategy highlights a key stakeholder need, namely OKASEC-based archiving of key selected documents, through creating and maintaining a document storage database. This is highlighted along with dissemination of documents to stakeholders in a timely manner. the strategy also mentions a need for tracking ongoing scientific research to support decision-making – a form of 'updated metadata sharing' with stakeholders. Research outputs and raw data related to such research is generally stored with primary custodians and it is instead the easy identification of data holders and data access protocols that is needed to reduce unnecessary repetition of work, while reducing data collection time. According to the 2012 strategy, these needs should be met to assure well-founded decision making in the basin. These storage and management processes can be executed if either current staff roles and responsibilities are adjusted to accommodate the needs, or specific staff appointment(s) are made to support the function, while in both cases reasonable ICT requirements are to be met (for example frequent backups, reasonable internet speed, and little server downtime).

In addition to holding key OKACOM-related information and making available direct links to externally held data, it is necessary that OKASEC maintains a network of organisations and individuals that can support effective data sharing. Thus, OKASEC would perform the function of 'linkage' to and from stakeholders, as opposed to being the 'keeper' of all data. Currently, information communication is a labour-intensive task on the part of OKASEC, as there is no facility for automated or easy obtaining and sharing of data and metadata. A part of this challenge relates to ineffective contact database management – which, if addressed, could significantly enhance ease of data sharing with stakeholder groups based on their fairly unique needs.

The 2012 strategy refers to the use of the existing Okavango Basin Information System (OBIS), currently maintained by Okavango Research Institute (ORI) of the University of Botswana, to encourage MSs to make their CORB-related data (both spatial and non-spatial) available to all MSs. OBIS remain operational at ORI, although with limited hardware and staff capacity. Data maintenance is hampered since there is no formal data sharing or maintenance agreements with either OKACOM or any of its MSs. The need for such a centralised information sharing platform, especially from a spatial data perspective, is important to some of the key stakeholder groups – such as the Biodiversity and Hydrology TC's, State and parastatal institutions, Programmes and projects, and Consultancies that support these projects (Figure 3). For a system component such as OBIS to prove effective, it has to be supported by a strong web presence that allow for online information transfer or at the very least enabling detailed metadata content and an operational process that defines conditions of data sharing and use.

An example of a well-developed sector-specific information management system is the Namibian University of Science and Technology (NUST)'s hydrological database for Namibia. This data is not currently readily available as a shared initiative, and similar data types that would be ideal in a basin-wide repository, does not seem to exist in Botswana and Angola. Through the HYDSTRA software, which all riparian states already have licenses or access to, the data could be made available without significant challenges, across the basin (Gaspar, 2018). Although the raw data housed in Namibia is not of specific use for the riparian states of Botswana and Angola, the modelling results could be of particular use. The consideration of a more coordinated approach towards the use of HYDSTRA, in support of data collection in Angola and Botswana and in terms of the information needs of the Hydrology Technical Committee (TC) is included in the Options discussed in Section 3.

The 'Okavango Collections' is another important historical document-data source, theoretically available online via the OKACOM website at *http://www.okacom.org/knowing-the-river/okavango-collections*. The link was not operational at the time that it was tested between early to mid-2018. A well-run online repository such as this, if operational, could facilitate information access which is vital given the geographic scale of the basin and the likely distributed locations of stakeholders.

2.1.2 RESEARCH AND PUBLICATIONS

Questions and concerns related to DIM in CORB have been the topic of conversation for almost a decade. There is no doubt that the existence of a system or network of systems supporting OKACOM and MSs in decision-making processes is well-founded. At the same time, expectations around DIM needs can no longer be delayed.

Various papers with regard to IKMS in CORB have been published. One of the most notable that relate to the manner in which data for CORB could be collated comes from Nkhata (2002). Although dated, the article discusses the setting up of an Information Resource Centre at the then Harry Oppenheimer Okavango Research Centre (HOORC), now ORI. The paper outlines the systematic process involved in the creation of an organised collection of information that has accumulated over the years – although for research purposes, as opposed to OKACOM decision support purposes. The content management process and the activities through which the data collation and ordering was done (which included digital spatial/GIS data and indigenous knowledge), serves as a firm grounding for an OIKMS. Kralish, Zander & Flügel (2014) describe in significant detail the design elements and web features of the OBIS. Key details of OBIS as it pertains to IKMS options are included in Appendix B.6.

2.1.3 RECENT PROJECTS IN CORB

In addition to academic papers and research, a number of projects have been executed in/for OKACOM, providing additional context for the design and set-up of an IKMS. Appendix C lists some of the recent and notable interventions thus supporting OKACOM (COWI, 2018). The outputs of these interventions are critical key inputs from projects, of which the information or at the very least, results and recommendations, should be available to the OKACOM decision making team. This decision-making team comprises of key water resources governance agents and associated sectors in each member country. The inputs of these stakeholders were gained during the stakeholder engagement. Their inputs were gained with regard to the key data needs of the stakeholder groups that they represented, as it pertains to improved information and knowledge management. These needs enable consideration of the hardware, software, processes, data and human resources which enabled a consideration of the options for an OIKMS can be effected on OKACOM's webpage, decision-makers would be able to rather make use of the 'official' links, than having to do a wide online search each time that they look for CORB/OKACOM information. Such a single point-of-contact for online data would in itself improve the sharing of information between OKACOM and stakeholders.

2.2 STAKEHOLDER MAPPING

2.2.1 STAKEHOLDER INFORMATION AND SUBSEQUENT RELATIONSHIP MANAGEMENT

The ‘stakeholder database’ for OKACOM is currently managed via Microsoft Outlooks ‘contact’ facility, individually by OKACOM staff on their computers. Sharing of contact details takes place via e-mailing of these details from one staff member to another. The most complete list is potentially in existence on the OKASEC Records officer’s computer. This information is backed up daily (Ivanov, 2018). Limited categorisation is done, where contact details for selected persons are organised in folders such as OBSC and Technical teams (indicated in red outline in the figure below). The entire database can be searched via typing a name, surname or any applicable identifying information text in the ‘All Contact Items’ box.

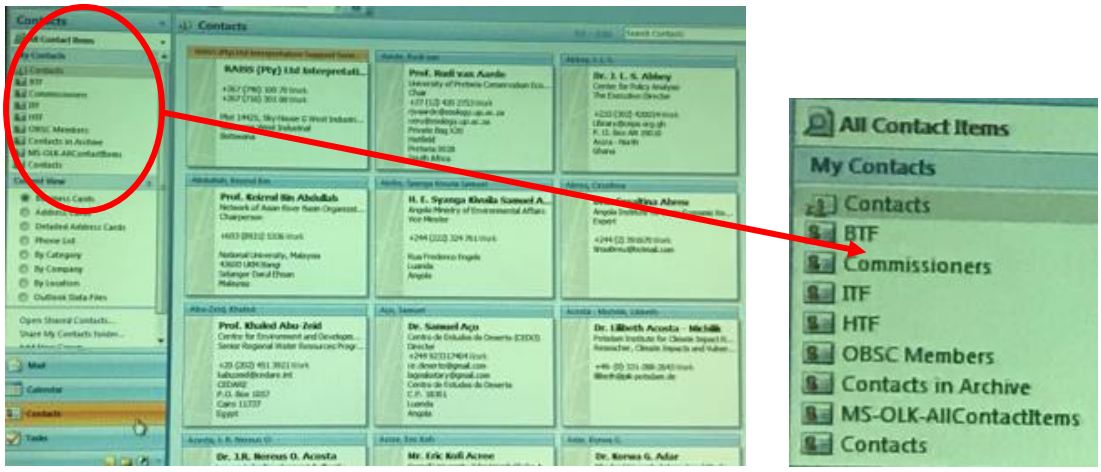


Figure 1: OKASEC contacts database

Challenges exist where duplication of contacts exist either in the primary contacts database, or across folders (for example where a person may be in a selected stakeholder group, but their contact details are also included in another group). It is necessary that the contacts database is cleaned up and categorised, to enable effective search-ability and connection with stakeholders. The implementation of an internal mechanism which OKACOM can use to manage its contacts database will support the general efficiency of connecting with stakeholders that have varying information needs. A CRM or similar tool would support stakeholder contact management, which would support ‘cleaner’ data with less duplication.

OKACOM staff holds individual knowledge as to how organisations and people/individuals are to be contacted, to ensure that protocol related to different stakeholders and especially MSs are followed. There are little details captured in the database that indicate the manner in which contact with any given stakeholder group or individual should be approached (for example, the contacting protocol at ministerial levels are not indicated). It is possible to capture this type of information in the “Notes” section of the contacts database thus supporting the following of specific contacting protocols.

2.2.2 MAPPING STAKEHOLDER GROUPS AND NEEDS

Various stakeholder mapping exercises were done for Information and Communication Strategy purposes (2009; 2012). These mappings provide insight into stakeholder categories and the management of stakeholder interests. The stakeholder mapping could also benefit from assigning corresponding 'levels' of interests. The discussion below enhances the conceptualisation of stakeholder categorisation. Historical stakeholder lists (Appendix F, G, H) are available. These lists and categorisation were used as a basis to map the stakeholders and apply groupings. Figure 2 shows the key stakeholder tiers, with OKASEC, MSs and the TCs being primary stakeholder groups. Figures 3 and 4 show the same diagram template, but with the information needs of stakeholder groups and general data types related to those needs indicated.

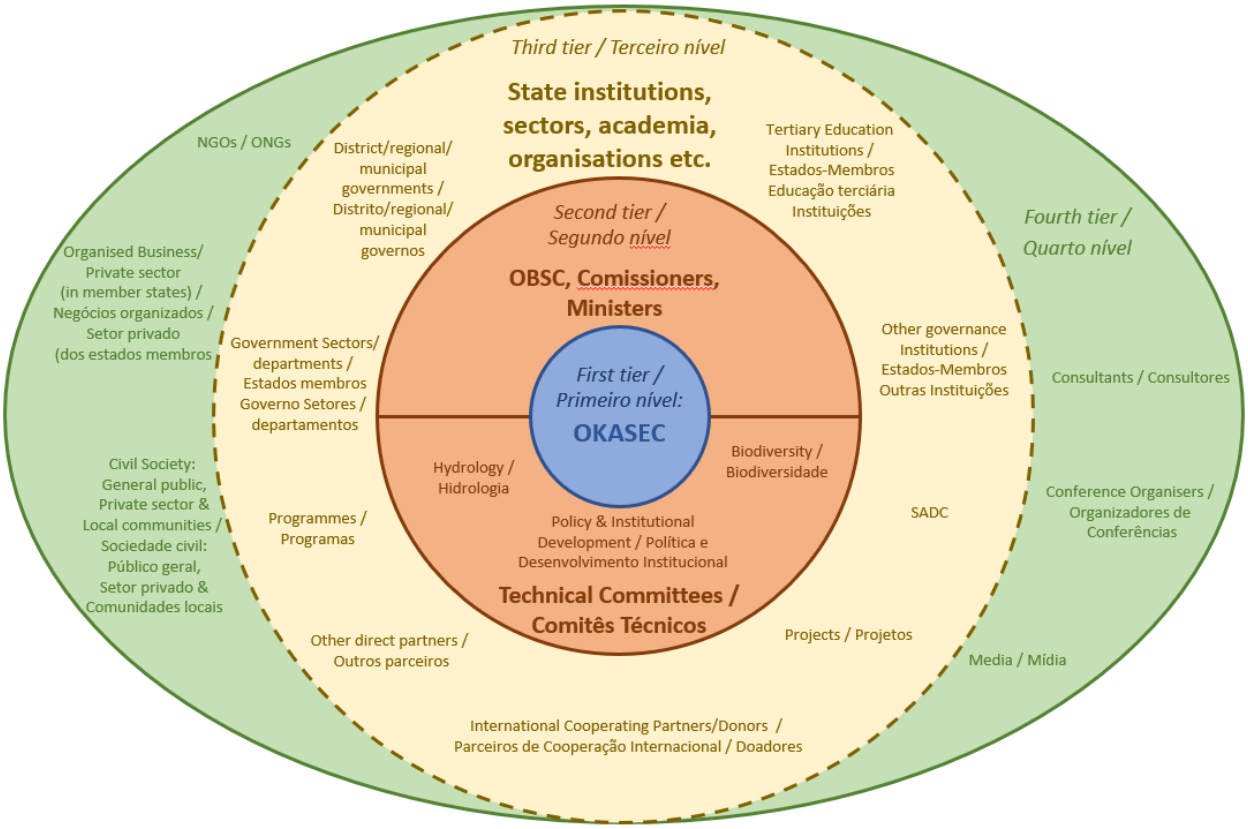


Figure 2: Stakeholder categories and tiers

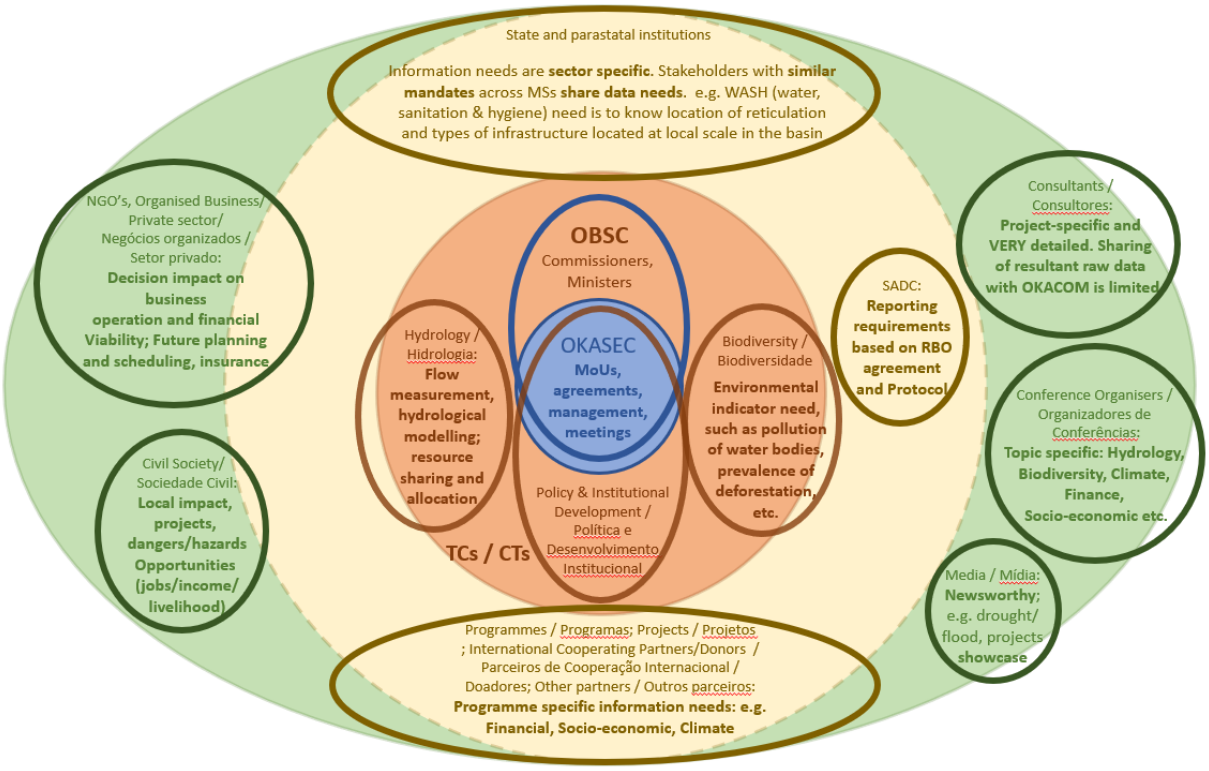


Figure 3: Stakeholder data needs

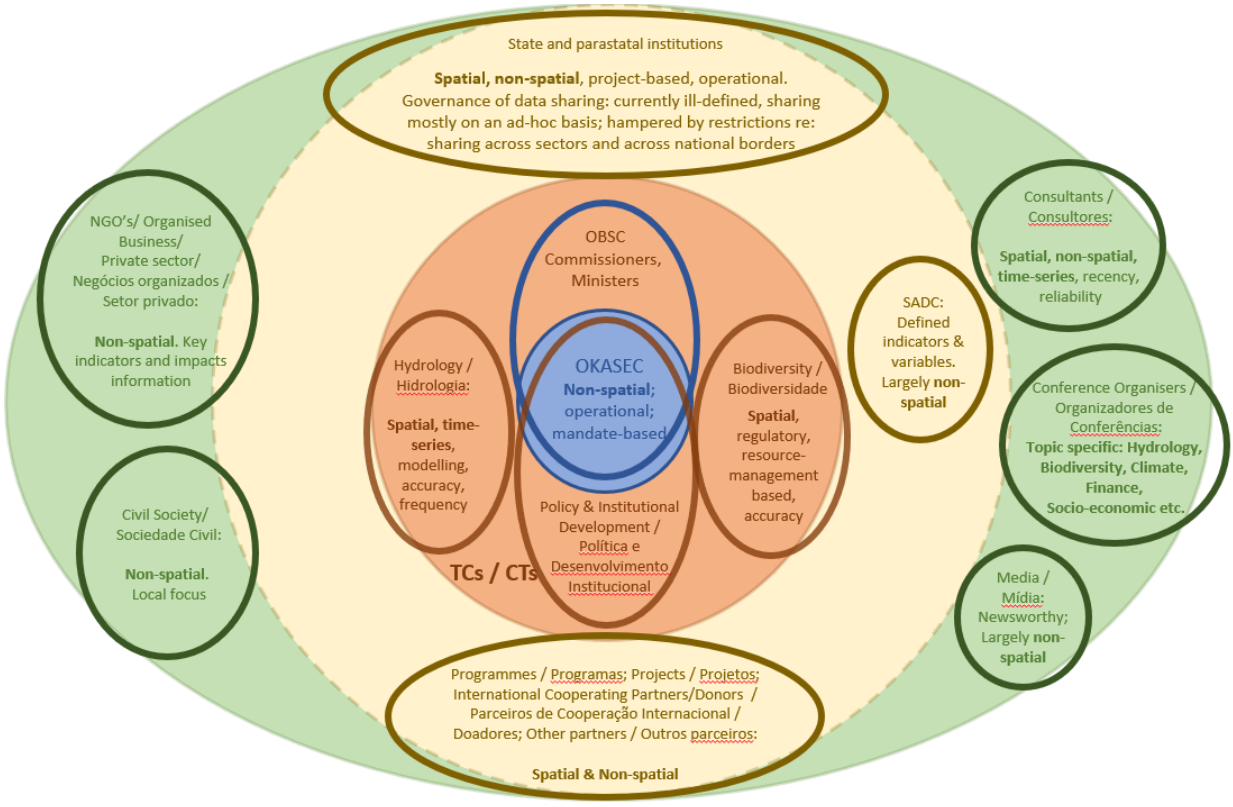


Figure 4: Data type needs for stakeholder categories

2.2.3 STAKEHOLDER SELECTION FOR INTERVIEW PURPOSES

The stakeholder interviews earmarked for the project were ideally held in person where members of OKASEC and stakeholders are located in Gaborone, or where MSs meet in Gaborone during the course of the project. Where stakeholders were not available in person, telephonic or *Skype* interviews were held, and where this was not possible, the interview guideline was sent to the stakeholder for completion. A letter of appointment/authorisation from OKASEC (in English and Portuguese) was provided, as well as introductory communication/e-mails that supported the project team in their quest to collate sometimes sensitive information.

The selection of contacts for purposes of the focussed interviews were guided by OKACOM based on their direct involvement with stakeholders. These persons were interviewed not as individuals in terms of their personal data needs, but rather as representatives of the stakeholder groups, and included for example:

- Five representatives from OKASEC (Executive Secretary, Programme Coordinator, Records officer, and Finance and Administration officer (the latter due to involvement in website and server financial administration)), as well as seconded staff from UNDP. These persons are directly involved in the various projects that support data and information generation and use of data/information for OKACOM, and thus all included;
- ICT support: server and backup administration and maintenance (Ignat Ivanov);
- One representative from two of the TCs per MS: Biodiversity and Hydrological;
- OBSC: One representative from each MS, deemed to play a role in governance and institutional sharing of information from an organisational/legal/regulatory perspective: Angola: Mr Carlos Andrade; Namibia: Ms Cynthia Ortmann; Botswana: Ms Tracy Molefi.
- Representatives from the academic institutions in MSs: ORI, University of Botswana (Representative(s)/user(s)/administrator(s) of the OBIS), Namibia University of Science and Technology (NUST) and *Universidade Agostinho Neto* (in Luanda, Angola);
- A representative from SADC Directorate for Infrastructure and Services (DIS-WD SADC): Mr Phera Ramoeli; and
- Conservation/Community representation from MS's where possible, for example Namibia Nature Conservation, Desert Research Foundation of Namibia (DRFN).

2.3 STAKEHOLDER ENGAGEMENT

2.3.1 ENGAGEMENT OBJECTIVES

The stakeholder engagement process was a combined effort between the project team members and OKASEC, enabling alignment between the teams and establishment of rapport with stakeholders. The transfer of the stakeholder engagement process and questionnaire understanding as it relates to IKMS gap and needs analysis enable OKASEC to pursue similar investigations in future, if required. Additional stakeholder

engagement with MS representatives took place during a meeting on 12 April 2018 in Gaborone. Appendix I presents details of the stakeholder engagements relevant to this report.

Samples of data/information, as it exists in other/relevant databases and designs as well as software platform and hardware requirement details were reviewed. The potential to link/align the different systems were also assessed. Appendix D presents the Guiding Questions that were used in the stakeholder engagement process. The results of the process are reflected on in terms of internal as well as external IKMS requirements. Focus is also placed on internal realities, since this is the basis upon which any future elements of a basin-wide IKMS or Decision Support System (DSS) would be built. The internal system and processes need to be in order before an externally accessible IKMS or DSS can be implemented effectively.

Based on stakeholder engagements and questions the interviewed parties answered relating to the accessibility and availability of information as it pertains to their needs, OKASEC should function as a central hub of OKACOM-related base documentation. This means that the majority of the stakeholders, regardless of their specific needs, identified that they would require direct access to key reports and OKACOM-related project outputs, as well as metadata or links to external data sources, in cases where data that is not directly accessible or hosted on the OKASEC server.

It is thus not necessary for OKASEC to function as a repository of all original raw data (which could be resource intensive to develop and maintain), but rather to gather and synthesise information (in the form of for example project reports) and especially collate and make available metadata that point decision makers to relevant data custodians. Some stakeholders may need the raw data related to field investigations or hydrological modelling – however, this raw data is not what is ultimately used by the OBCS for decision making purposes and thus not needed to be hosted by OKASEC. At most, from a hydrology perspective, collated and assimilated annual monitoring details such as trends and year-on-year changes could be copied from MSs once a year and shared as a copy of the original MS data, on the OKACOM website. The information need from all stakeholder groups is for reasonable and transparent access to relevant current and past available information such as reports, research results and project-based documentation even when the raw data related to these (largely document-based) outputs is not directly hosted on the OKASEC server.

2.3.2 FINDINGS AND RECOMMENDATIONS IN TERMS OF INTERNAL AND EXTERNAL INFORMATION NEEDS

During the stakeholder engagement process, their information needs were explored and existing management information tools in the basin which some of the stakeholders are custodians of were reviewed, along with how it relates to other tools and stakeholders. The review included management information tools (MIT), extending to MIT's elsewhere in SADC, and indicated among others:

- Positive considerations (strengths);

- Challenges (where known/available/shared, both past and present) (internal weaknesses and external threats); and
- Lessons learnt that can be applied to OKACOM as well as opportunities which exist towards e.g. collaboration, which could counter some of the challenges.

The internal and external information needs influence each other directly: internal information and knowledge management processes in OKASEC that relate to for example efficiencies in contacts database management and the file naming, folder structuring, version control, backup and hosting processes and general management of reports and documentation related to OKACOM activities and initiatives, have to be made managed effectively for it in order to be made available effectively to external stakeholders to support the stakeholder grouping needs.

Internal needs that affect meeting of external stakeholder needs

Details of IKMS related needs that were identified via OKASEC staff interviews are detailed in Appendix K. This include, in no particular order, the following:

- OKACOM website maintenance/updates:
  - Updating the website since it has not been much maintained for some years;
  - Adding key OKACOM documents such as project reports that are available for public consumption, to the website;
  - Adding hyperlinks to external stakeholder websites and to specific reports that relate to CORB and OKACOM, if it is not hosted on the OKASEC server;
  - Consider addressing online keyword searches to prioritise OKACOM search words and return more appropriate search results;
  - Re-instate the Okavango Collections site;
- Contacts data management improvement or CRM software and contacts data capture into such a system;
- Resurrecting the ‘library space’ where external stakeholders can access hard copy or digital records and data related to CORB and OKACOM – this was available in Maun, but since the office moved to Gaborone is has not been available – the option was identified by OKASEC based on requests from external stakeholders including for example researchers and consultants that are involved in OKACOM projects, to have such a function accessible;
- Implementing stricter saving of OKACOM key documents from personal computers onto the Server;
- Frequent and secure backup of the OKASEC server;
- Staff training in OKASEC related to Server room safety and security (e.g. fire safety);
- Folder structure streamlining: the folder structure should be considered in line with stakeholder group needs, so that information related to different stakeholder groups can easily be accessed. This is also necessary since staff reported to have difficulty in finding documents. This will require some training

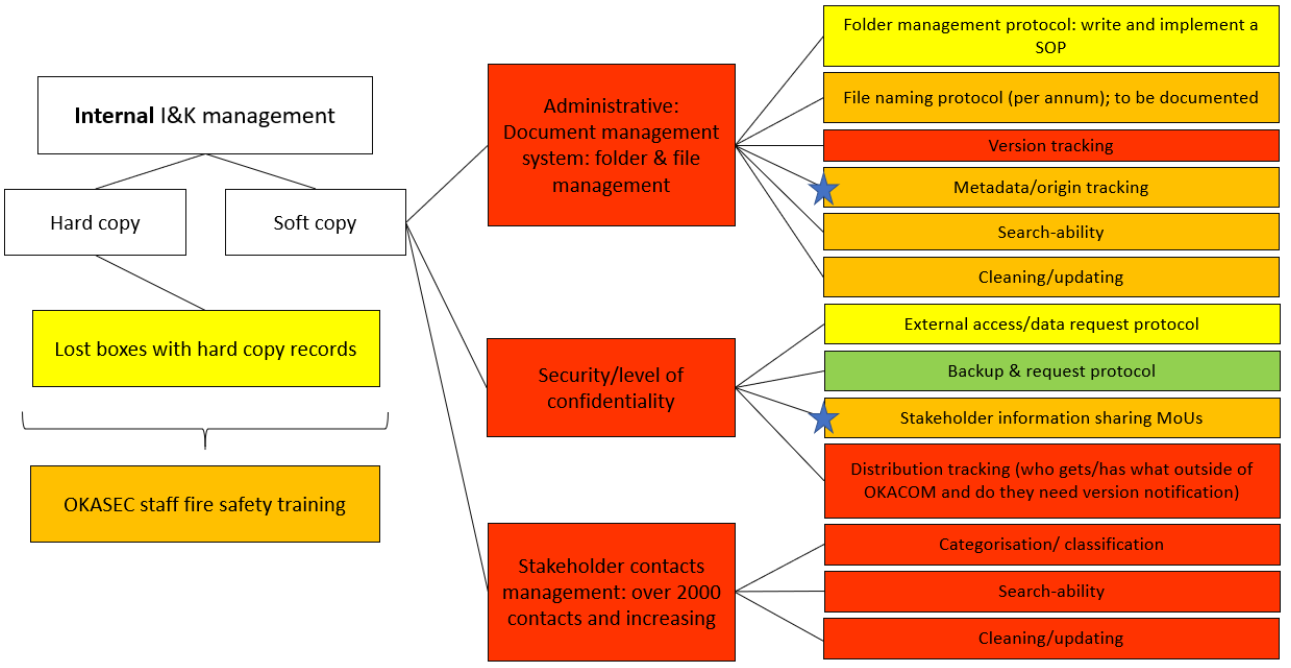
to ensure that staff follow the same protocols (sharing a document relating to standard folder and file naming is not deemed to be effective);

- Related to folder structure: file naming standardisation: some level of metadata (i.e. origin of documents) should be contained in the file names. This was identified by OKASEC staff as a key need, along with version control – to ensure that the latest version of any given document can immediately be identified;
- Sharing of folders and files and enabling secure access to certain folders e.g. financial records;
- General clean-up of folders and files;
- Collation of metadata (which is currently managed randomly on the OKASEC server) into a single metadata document (for example a spreadsheet); and
- Commencing a tracking process to identify the distribution of documents and document versions to stakeholders, since there is currently no mechanism by which to identify who received what communication, as well as who might need to receive version updates or other related communication.

The combined results of 'internal OKASEC' needs identification is presented in Figure 5. It shows the needs and priorities as identified by the OKASEC staff during one-on-one interviews as well as by some of the external stakeholders, related to internal OKASEC information and knowledge management processes, as follows:

Red: Critical need for information management improvement	**Yellow:** Fairly acceptable as it currently stands
Orange: Fairly important but can wait a while	**Green:** Acceptable/low need prioritisation within OKASEC

The two items indicated with a 'blue star' correlate with external stakeholder information needs.



Key finding: Get 'Back to Basics': Quick wins to manage documents and contact details lies in standard operating procedures

Figure 5: OKASEC operational information needs mapping

Although the 'internal OKASEC' operational information needs form the basis of much of the information needs of other stakeholders such as MSs and TCs in particular, the 'external stakeholder' interviews identified only two similarities with these abovementioned challenges:

- Metadata/data origin details to be available, making it possible to identify custodians of raw data in order to gain access to required information; and
- Stakeholder information sharing MoU needs, that goes beyond high-level data sharing protocol policy, towards practical data sharing SOPs.

External stakeholder core needs

As noted in the 'internal needs' discussion above, the key needs across stakeholder groups in OKACOM relate to availability and access to OKACOM project reports, memorandums and key documents that relate to OKACOM's mandate in CORB. These documents are currently not readily available and the time and effort it takes for stakeholders (regardless of their categorisation) to request and obtain such information is challenging. Similarly, the availability of metadata that could point stakeholders to where external reports or raw data might be held or who the custodians are, is a key need.

The figure below shows needs that were identified by the external stakeholders that has a cross-cutting impact across stakeholder engagement as it pertains to options for data hosting and sharing via existing systems at academic/tertiary institutions in particular (right-hand side of the figure). The existing external databases present an option for utilisation towards enabling many of the stakeholder needs to be met – however such information sharing can only be effected through establishment of MoU.

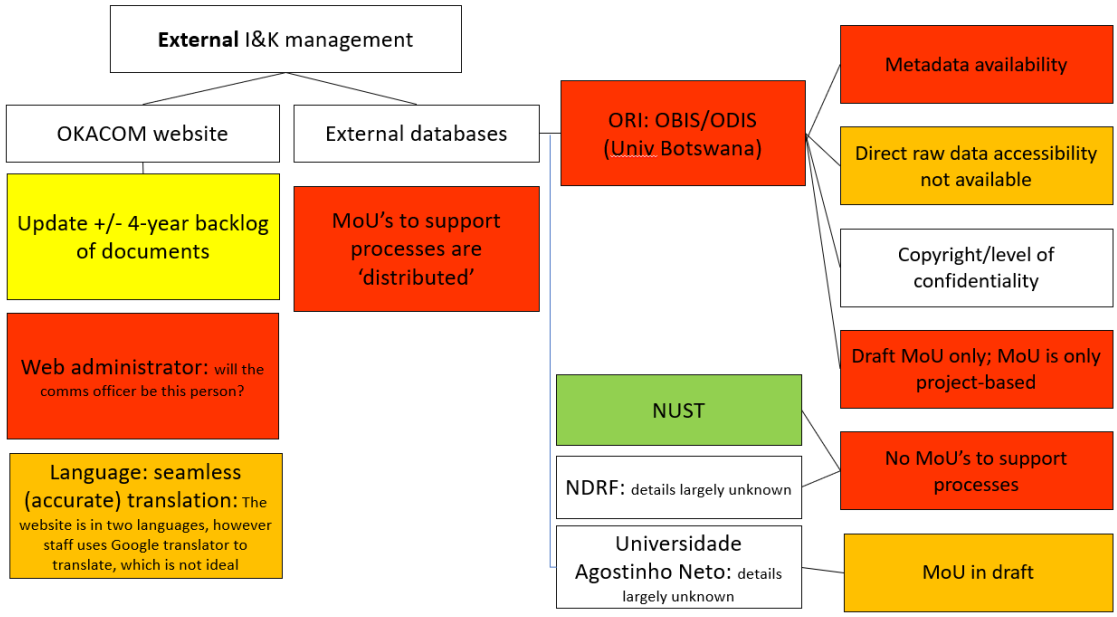


Figure 6: External OKACOM IKMS needs mapping

The left-hand side of the figure present the focus on the needs for stakeholders to be able to obtain core OKACOM-related information directly from the OKACOM website as opposed to via individual requests to OKASEC. The ability of OKASEC to thus ensure updating of the website needs to be done through the role of a ‘website administrator’ – a person whose function could either be secured externally from OKASEC, or via adding to or adjustments of roles and responsibilities within the current OKASEC staff contingent.

The need for accurate online translation services of content and documents that would be contained as per the above stakeholder needs description was also identified as important – although it was not identified by all interviewed stakeholders as cross-cutting and thus not a critical priority.

3 DISCUSSION OF OKIMS OPTIONS

Based on the needs identified and reported on in Section 2, this final section of the report marks the identification of reasonable available options for an OKACOM IKMS to be implemented. Cost-effectiveness and 'quick-wins', as well as the utilisation of existing available opportunities for implementation were taken into account when the suitability of options were compiled.

3.1 KEY ELEMENTS OF AN OKACOM IKMS

The key elements of an IKMS, in no particular order, are: Hardware, Software, Process, Data and Human resources. Each of these five elements are necessary to exist in a particular level of efficiency to ensure an overall efficient and effective IKMS. The brief discussion below in terms of each of the IKMS elements reflect the strengths, weaknesses, opportunities and threats in each sector in relation to the needs identification reflected on in Section 2. Thereafter, the options are considered in more technical detail, towards achieving a technical outcome that will support the internal and external OKACOM needs.

1. HARDWARE
Strengths: The OKASEC server has sufficient space to store existing documents and information for purposes of serving the key needs identified in Section 2 **Weaknesses:** "Direct sharing" of files not taking place – manual only. Backups and general server maintenance is lacking **Opportunities:** By utilising the current server, laptops and related hardware, costs do not have to be significant to secure hardware integrity. Wi-Fi availability *must* be improved to achieve additional effectiveness **Threats:** No specific identified specific threat unless a very much improved system, which will require much budget, is implemented
2. SOFTWARE
Strengths: MSOffice is well used and well understood by staff. Stakeholders have significant exiting resources e.g. HYDSTRA **Weaknesses:** No GIS-based integration within OKASEC is available, and opportunity for OKASEC hosting is limited **Opportunities:** CRM software will support contacts database management. GIS software at ORI could be used for spatial data sharing/serving **Threats:** Financial costs of software maintenance – especially GIS, is very high and minimise chance of OKASEC hosting GIS data directly
3. PROCESS (OPERATING PROCEDURES, GOVERNANCE AND MS RELATIONS)
Strengths: Small staff contingent makes manual sharing possible. **Weaknesses:** No standard operating procures, standardised data and information handling. Sharing of data is done manually **Opportunities:** Current human resources can be applied to radically change the operating processes and improve information and knowledge management. A keen interest from supporting parties (e.g. TNC) to support OKASEC ito staff. **Threats:** Time-pressures and KPI's focussing on elements other than process improvements internally.
4. DATA
Strengths: Long history of records being kept. Keen interest from OKASEC and all stakeholders that were interviewed, to have an effective OIKMS **Weaknesses:** Little to no metadata existing. **Opportunities:** Utilising existing structures and organisations that are stakeholders to OKACOM, to provide data management services and only maintain core raw data at OKASEC. Skills and abilities at these stakeholder entities are sufficient and willingness exist

Threats: Relationships need to be built to promote partnership and thus avoid financial implications to OKASEC – if the data management is approach from a 'service provider' perspective, stakeholders may end up requiring high-cost hosting options
5. HUMAN RESOURCES
Strengths: Committed staff contingent. Committed and eager stakeholders **Weaknesses:** Users and maintenance staff/administrators of the system have KPI's in their job descriptions that does not ideally match OIKMS objectives **Opportunities:** Ensure that the users and maintenance staff/administrators of the system has clear key performance areas in their job descriptions. Foster stakeholder relationships especially with data custodians **Threats:** Financial implications of relatively short-term contracts – challenging to develop a long-term strategic staffing vision ito IKMS services

3.2 CONCEPTS UNDERLYING THE OPTIONS

Based on the IKMS assessment, the options that are available to OKACOM and its partners to implement efficient data, information and knowledge management in OKACOM are detailed herewith. The options include consideration of scoping and implementation options of supporting ICT Systems to facilitate the identification, capturing and sharing of OKACOMs knowledge assets – both internal and external. The objective of this section of this report is to:

- Discuss the potential scope of an IKMS for OKACOM (preliminary referred to as IKMS in the rest of the document);
- Describe the functions and the structure of the proposed **Okavango IKMS** (OIKMS);
- Discuss the options for building the OIKMS in a phased approach; and
- Discuss supporting structures and environment that would contribute towards the development of a sustainable IKMS.

3.2.1 KNOWLEDGE MANAGEMENT CONCEPTS

Knowledge Management is primarily about managing what your organisation knows versus what it needs to know. It aims at sharing knowledge with the right people in the organisation in the most effective and efficient manner, and thereby facilitating the transfer of knowledge as well as the creation of new knowledge through collaborative innovation. The prime reason for knowledge management is to support the organisation's decision makers with up to date information and knowledge so to reach the organisation's mandate and goals.

Knowledge management is often misinterpreted as being merely 'information management'. Knowledge is rather about know-how and understanding of people on how to perform tasks through experience, contextualisation of information and intuition. Knowledge is not only embodied in the minds of OKACOM staff or stakeholders, but is also captured in the organisational reports, policies and processes which are statements of current and previous employees' collective knowledge.

The way in which data, information and knowledge relate is illustrated in the figure hereafter. Effective and efficient knowledge management is hard to achieve if it is not based on sound DIM. Although some knowledge creation can be achieved without having access to proper data and information, the only way for an organisation to find out what it knows is to effectively store and share its data and information. Data is

unstructured information and is usually not organised in any way, although often quality controlled through metadata. Examples of datasets are measured river flows, water levels and rainfall. Combining, condensing, summarising and contextualising of datasets is the creation of information. Examples of that might be using the river flows and rainfall data to make summaries of long term trends of the data to identify outliers. Another example would be the hydrological modelling of a system where different datasets are applied to make future projections of floods and droughts. Knowledge however is more about understanding of the facts of diverse types of information. Wisdom is a state of being wise, where knowledge can be applied intelligently to make wise decision on the way forward and to act on the knowledge. It is this latter state where OKACOM would enable true cross-boundary water resources management to support the entire CORB.

Figure 7: Utilising Data, Information, Knowledge towards gaining and implementing Wisdom

There are basically three types of knowledge to consider when it comes to knowledge management, of which the relationship of the first two types are illustrated in the figure hereafter:

- Explicit Knowledge: This type of knowledge is captured when experience and know-how is captured in the form of reports, decision support or expert systems as well as in organisational processes. The codification of knowledge is often imperfect and dated, for example writing of a report at the end of a project can never capture all the know-how generated during the project and as soon as the report is completed the knowledge already becomes dated. Explicit knowledge capturing can be equated to

information management, and often IT Systems are promoted as Knowledge Management systems while they are only storing and sharing reports.

- Tacit knowledge: Tacit knowledge is the know-how in people gained through experience. This is the freshest knowledge that still resides in people's minds. This knowledge leads to breakthroughs in organisations and is a source of innovation. IT's plays mostly a supporting function during the facilitation of creating knowledge, through socialisation.
- Embedded knowledge: This type of knowledge is captured in software, routines, manuals etc. It is different from explicit knowledge due to it not being immediately apparent why, for example, an organisational process is required. Reverse engineering is often necessary to figure out what the knowledge is behind the organisational process.

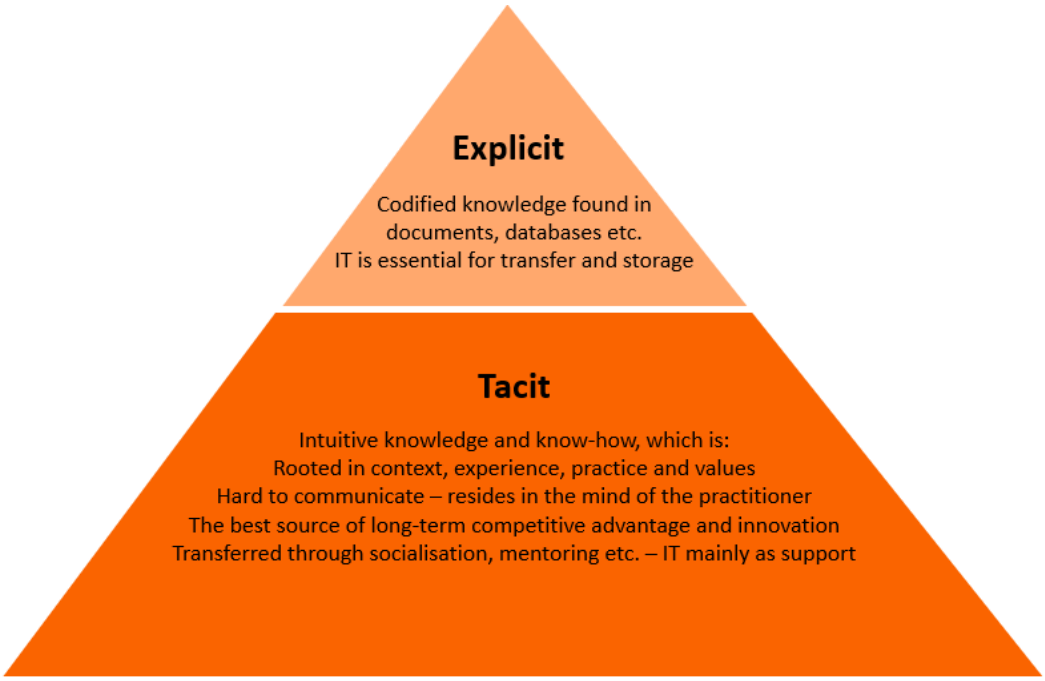


Figure 8: Tacit versus Explicit knowledge

3.2.2 KNOWLEDGE CREATION

Too often information management is done for the sake of building an ICT System. Knowledge Management (that includes effective Information Management) ensures that in the design and selection of ICT the focus should stay on 'creating (and sharing) knowledge'. Organisational goals and decisions are not made storing or even sharing reports. Decisions and innovations are made through the creation of new tacit knowledge, i.e. through socialization. It is only when people interact with each other (in person or through technology) that decisions are made, and innovation happens. Knowledge is created in diverse ways as illustrated in the figure hereafter. This is very important to take cognisance of to ensure an effective OIKMS.

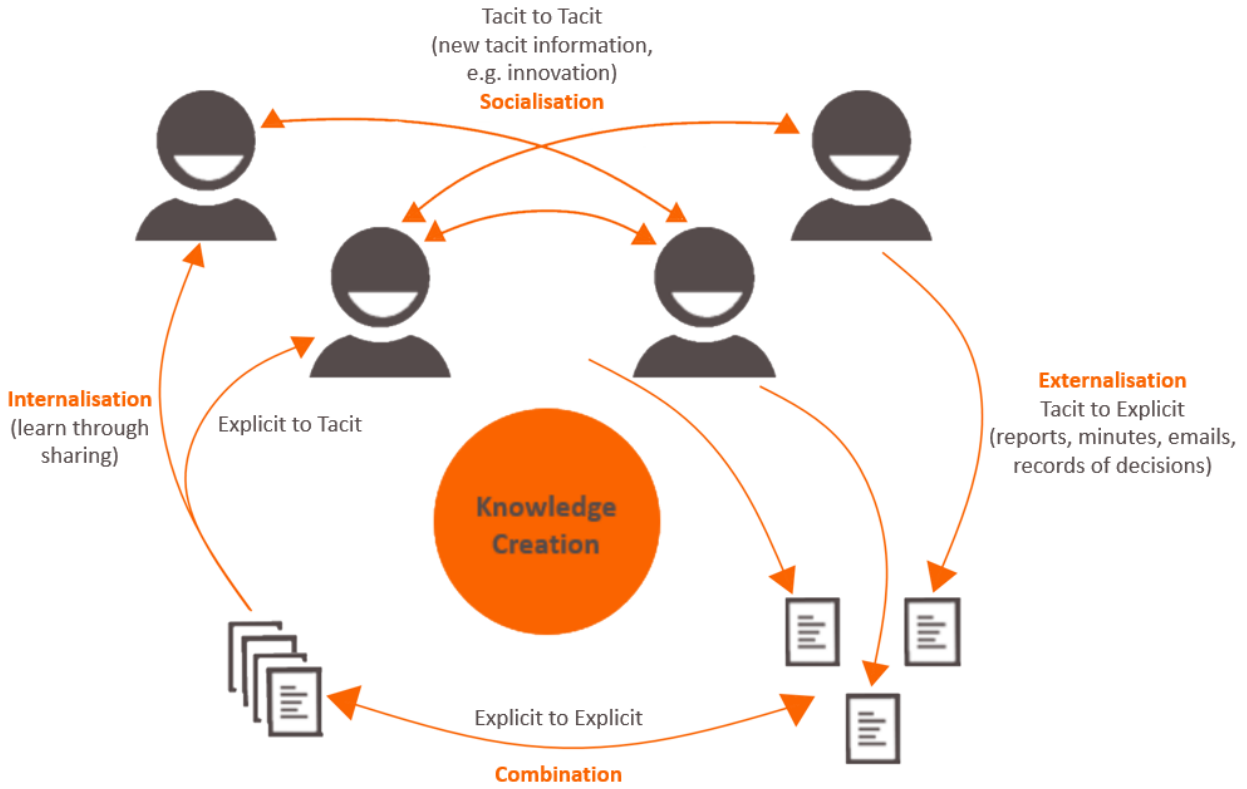


Figure 9: Knowledge creation as it pertains to OKACOM

Capturing tacit knowledge in the minds of experts is the most common way of (explicit) knowledge creation. This is typically writing detailed subject matter reports or capturing decisions from meetings etc. This is called Externalisation and involves tacit to explicit knowledge creation. Although this is very common, care must be taken to capture all forms of explicit knowledge and not just reports. Interactions of people is often not captured good enough and this is where innovation and new tacit knowledge is created. Recording of meetings and video-conferencing often have many benefits to people whom could not attend or for identifying gaps in reporting. A Combination knowledge generation process, as it relates to OKACOM, refers to knowledge integrators making use of other (possibly types of) explicit knowledge to create new explicit knowledge. This is for example combining multiple thematic reports into a larger integrated plan. Internalization refers to the process of sharing all available explicit knowledge to the right people at the right time to create new tacit knowledge. That means learning through sharing or explicit to tacit knowledge creation.

Tacit knowledge creation is also done through socialisation where people interact with each other through different methods such as in meetings, through social media, via internships and other means of collaboration. This is creating tacit knowledge from other people's tacit knowledge. This is the most beneficial form of knowledge creation but is often difficult to make explicit effectively. This concept also supports the need that was identified earlier in this report, relating to stronger development of stakeholder relationships as well as formalisation of agreements through MoA's. Expanding on the aforementioned figure, the one below illustrates typical technologies and how they should play a part in capturing and creation of technologies, as it pertains to OKACOM.

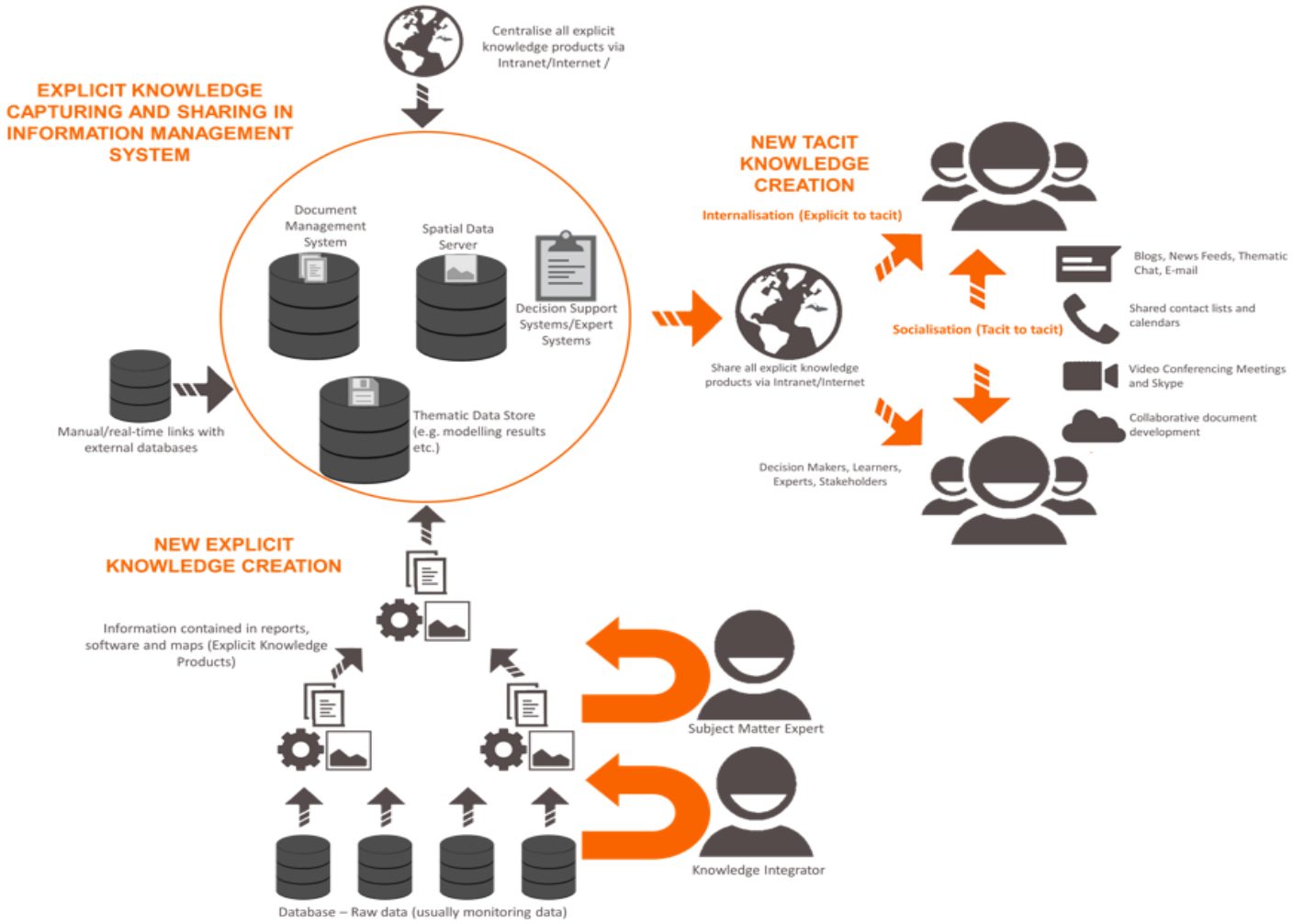


Figure 10: Knowledge creation and typical supporting technologies as it relates to OKACOM

OKASEC should ensure that their human resources contingent capture some of their knowledge in different forms, like reports, maps and e-mails. An intranet and e-mail server are the bare basics required for externalisation and combination. This is also the basics for information management. What organisations however lack most for proper information management is the sharing of the captured information with appropriate people so that the knowledge can be reused. Too often, as is the case with OKASEC, the intranet is used even to a limited extent to store backup copies of work related information – often in a very unstructured way which make the internalisation of knowledge (learning through sharing) nearly impossible.

It is only once all explicit knowledge can be shared intelligently with all the appropriate people that duplication of efforts is avoided, and new knowledge is created effectively. Historically sharing of data and information was thought to be only effectively shared once categorisation of the reports and other information was done. These days, however, the advent of extremely powerful search engines it is often not necessary to first categorise and index all your documents. Metadata is still however required for numeric and spatial datasets, which are often not searchable by these engines.

Internalisation of information by people is not only achieved by having access to information and reports but also by having access to decisions support or expert systems and workflow type application that captures organisational knowledge in a define process. Technology only plays a supporting role in tacit to tacit knowledge transfers such as internships, mentoring, meetings, stakeholder engagements. Tacit to tacit interaction is much more than what is said or shared but also about what is not said such as norms and values and demeanour. All obstacles for human interaction and sharing of knowledge should be removed by facilitative technologies and encouraged through organisation culture. A whole host of facilitative technologies exist from meeting video conferencing, shared contact list/calendars to collaborative document development. All these knowledge management technologies provide an opportunity to record these interactions between people which in turn externalises the knowledge for reuse through sharing.

3.2.3 FUNCTION AND STRUCTURE OF A REALISIC OKACOM IKMS

The figure hereafter provides a simplistic view of knowledge flows in OKACOM. Most of the knowledge is created by members of the TCs. MS representatives play a crucial role in the TCs and supporting these groups with knowledge and information management should be one of the focus areas for the IKMS. MS Representatives plays a facilitating role between MS information and knowledge and eventual decisions and actions made by OKACOM. ICP consultants also influence decision by undertaking studies with data supplied mainly from the TC MS Representatives while results are mainly communicated at the TC and the OBSC meetings.

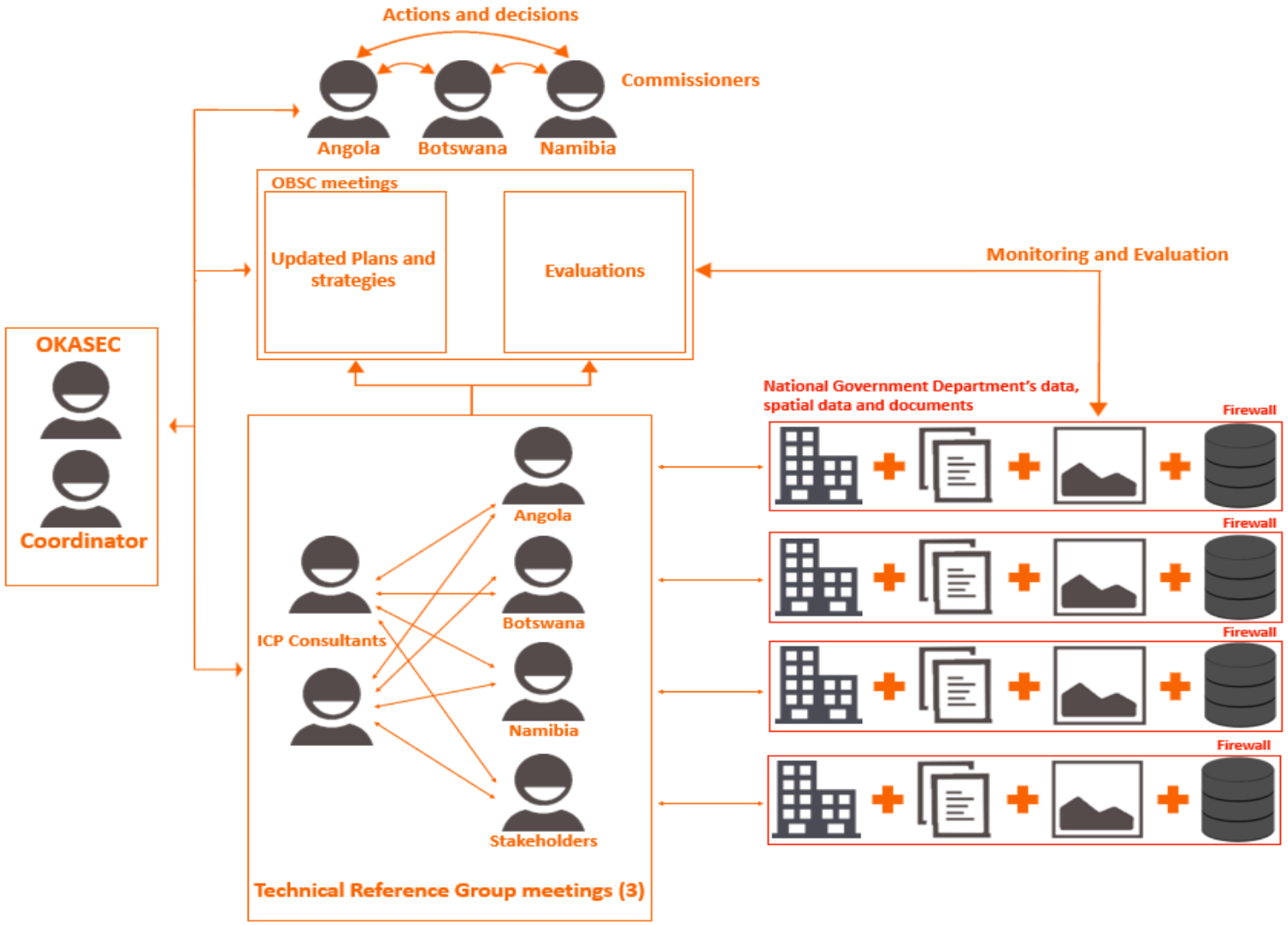


Figure 11: OKACOM basic knowledge flows

Deliverables are fed back to OKASEC for storage and redistribution. OKASEC plays a very important coordination and facilitation role to all the meetings and could possibly be the most important role-player when it comes to tacit knowledge management by getting people to socialise (meetings) and capturing the created knowledge through various supporting technologies. Where required, legal and administrative processes should be captured through business process analyses (UML Analysis) for the OKACOM Commissioners and OKASEC so to retain important organisational memory. This could be translated into decision support systems or workflow programs to help future Commissioners with their mandates.

The Scoping study revealed that currently the three main technologies used to facilitate the flow of information are e-mail (and related communications and document sharing), the OKACOM Website (which is currently mainly only updated with latest tender documentation) and the OKASEC intranet file structure (the server folder details as discussed earlier in this report). The data and information not residing on the website are sent around mainly by e-mail or physically through electronic media when e-mailing limits are reached. This is partly unavoidable due to all member Governments having very restrictive firewall policies when it comes to direct access to data to avoid security breaches. There also seems to be very few web-interfaces to Governmental databases. This lead to the situation that ICP consultants must request data via the MS Representatives each time there is a new study or an update to a study or plan. Although electronic copies of the ICP deliverables are stored on the OKASEC intranet, it is not downloadable or context searchable. Although pragmatic, storage of hard copies does not contribute towards knowledge management and is another form of on-site backup.

To manage OKACOM's knowledge and information it is important to have a vision of a knowledge management system that can progressively be developed according to the needs of the organisation. The Scoping study also revealed that OIKMS should be designed and developed for a relatively small multi-national organisation. A web-enabled user controlled and extendable knowledge and information management platform (structure illustrated in the figure hereafter) is therefore required with the following functionality that can be progressively added:

- Context searchable document management system: the system should allow for the controlled upload and download of documents through a centralised interface with metadata about the documents. Version control, collaborative development and strong contextual search should be minimum.
- Geospatial server: there are many different web-enabled spatial databases that are available to include in the platform, of which there are quite a few that are open-source. Spatial datasets should be up-loadable controlled.
- Thematic databases: many web-based database technologies are available. Unfortunately, all database software needs to be configured to meet the needs of the specific data types to be stored.
- Collaborative contacts (stakeholder information), calendars, news events, discussion forums.
- Apps development for web publishing of all or part of the data and information.
- Workflow and decision support development functionality to capture business processes.

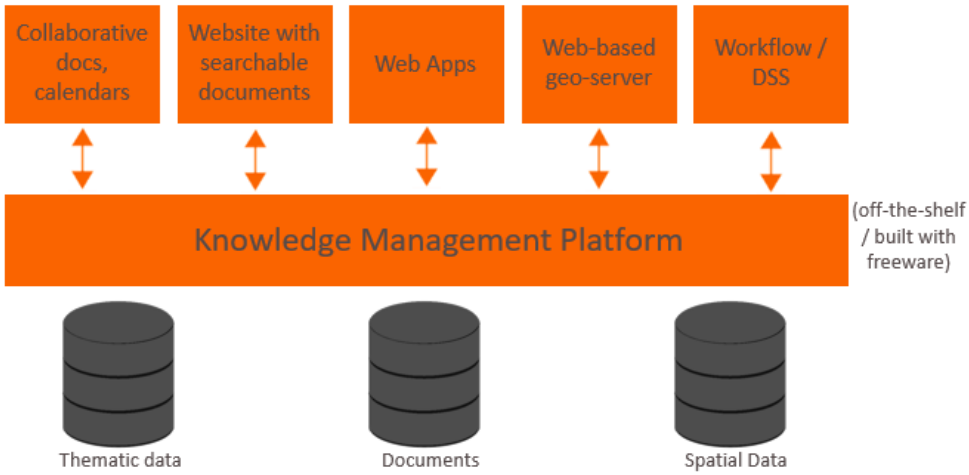


Figure 12: Proposed OKACOM IKMS platform structure

3.3 IMPLEMENTATION OPTIONS

Six implementation options were defined during this analysis, which combines platform and software options that could be systematically implemented. There are 3 types of options:

- **Current improvement** – This includes **Option A** where the hardware and software stay the same but proper DIM is done to improve the current data. This option would be implemented (immediately), to activate effective management of and access to core documents, data and functions that are key to OKASEC, TC, and OBSC roles.
- **Progressive implementation** – This includes **Options B and C** where different elements of the OIKMS are implemented through some upgrades of hardware, installation and setting up of software. Both these options require longer term strategies with a clear ringfencing of finances, to ensure an effective OIKMS operation. These are only to be pursued once the current internal operating environment have been cleaned, cleared and organised effectively.
- **Full implementation** – This includes **Option D, E and F** where the full OIKMS is realised but on different platforms and software solutions.

The vision of each of the implementation options are discussed below:

OPTION A: "DATA STRUCTURING" – CURRENT IMPROVEMENT
For this option the hardware and software configuration stay the same, but focus is placed on the cleaning up of the Intranet Project Folders as well as the stakeholder database. All other issues related to server storage etc. is also dealt with by OKASEC staff. As part of this options the Personal Folders for OKASEC staff should be created on the server so that all work-related data for each staff member is stored on the server and backed-up with the server. This will avoid on data loss when desktops or PCs are lost or fails, even if the computers are separately backed-up.
OPTION B: "LITE UPGRADE" – PROGRESSIVE IMPLEMENTATION
This option allows for minimal hardware upgrades to the selected platform such as additional memory to load extra VMs. During this option the website is migrated to the OKASEC Server for ease of access, a DMS is implemented and all the reports migrated to the DMS and the rest of the intranet project folders data is moved to Read-Only Online Project Folders.

The OBIS stay as it is with the thematic data – documents are migrated to the DMS. This makes the Intranet Project Folder Redundant. Some KM functionality will be enabled through the existing Exchange Server by enabling online calendar sharing as well as shared contacts for an access restricted online stakeholder database.
OPTION C: "UPGRADE + ORI – PROGRESSIVE IMPLEMENTATION
This option allows for further hardware upgrade to the selected platform including additional processors in accordance to the software requirements. This option is the same as Option B with the following additions: • Thematic data is migrated from the Online Project Folders to a customised OBIS installed on the preferred platform or to a purchased and installed copy of HYDSTRA. • Spatial data is migrated from the Online Project Folders and the OBIS to an Online Spatial Server at ORI with the associated annual maintenance contract.
OPTION D: "UPGRADE + ORI + MS" – FULL IMPLEMENTATION
This option allows for significant upgrade to the preferred platform according to all the required software for the OIKMS, but which is less than the cost of replacing the server. This option is the same as Option C plus the full realisation of MS Office 365 Enterprise for all OKASEC and OKACOM members by moving Exchange to online MS servers and implementation of Sharepoint for ICP consultants and technical committee members. This also include the setting up of video conferencing facilities at OKASEC through Skype for Business.
OPTION E: "REPLACE + MS" – FULL IMPLEMENTATION
This option is for the full implementation of the OIKMS on the selected platform such as the OKASEC Server. No functionality is hosted by 3rd party service providers, except for the Microsoft Office 365 Enterprise solution. This means that a spatial data server will have to be installed and configured on the OKASEC Server and all spatial data migrated from the OBIS and initially from the project folders to this server. This option allows full control to the OIKMS by OKASEC with minimal reliance on 3rd parties, except for a server maintenance contract for their server.
OPTION F: "VIRTUAL OFFICE WITH OKASEC BACKUP – FULL IMPLEMENTATION
This option is for the full virtualisation of all the general server and OIKMS functionality to 3rd party VPSs. This option does not require any significant capital costs although the initial start-up and configuration costs will be the same as for all the other options. The functions are the same as for Option F, however no investment in IT infrastructure will ever be required again since the total cost of ownership of server infrastructure is built in to the annual VPS agreement. The OKASEC server can be maintained on the ad hoc basis as currently and all VPS data can be backed-up to the OKASEC server from the VPS as an off-site backup.

Appendix L present detailed hardware and software considerations which relate to technical implementation.

Appendix M provides extensive details of each implementation option, including cost implications.

4 CONCLUSION

The status quo of internal DIM in OKASEC can be radically improved by improving operational processes, standards and harmonising of system details, without significant financial expenditure being incurred. For the Intranet Project Folders, human resource-based interventions such as implementation of stricter folder and file naming standards, and improvement of file sharing and file saving procedures which ensures that versioning and saving of documents support report and information retrieval is facilitated forms a key part of the options towards an effective OIKMS. The management of stakeholder information can similarly be addressed in a reasonably cost-effective manner, which will provide improved operational efficiency and management of stakeholder contact details and engagements. Improved contact details management through the implementation of a CRM system would support effective engagements with stakeholders and support information and knowledge sharing as well as communication processes between OKASEC and OKACOM stakeholders. Existing Exchange Server functionality could be used to publish the stakeholder information online, which can be maintained by OKASEC.

To make the OIKMS sustainable, any implementation option need to have very low annual costs to maintain the system. However, some financial commitment is required on an annual basis that should be ring-fenced. If it is expected that the OIKMS will not have any cost, then it should not be even attempted. Any IT required ongoing funding and human resources support, Regarding the latter, the level of technical expertise of maintaining the OIKMS will depend on how user-friendly the eventual full OIKMS will be implemented. It is expected that the OKASEC staff or anybody with the right access will be able to upload data to the OIKMS through user friendly web-browser screens and the necessary online manuals. Initial population of the OIKMS with all historical dataset will take time and will have to be supported financially after the initial development of each component of the system.

Thereafter it is expected that data and information contributions from member states and ICP consultants can be done by themselves. To drive this process, representatives from member states could possibly include the updating of the OIKMS on an annual basis as part of their KSAs. TORs and ICP contracts of assigned consultants should also include the prerequisite that at the end of an assignment all document and data should be uploaded to the OIKMS before final payment. These measures will ensure that the system keep growing over time and that OKASEC staff do not have to maintain the data on the system.

Regarding the ICT infrastructure, OKASEC needs to decide what their long-term plan will be. Will they:

- keep on investing in their own server infrastructure with associated capital and maintenance costs, or
- contribute towards ORI's infrastructure capital costs for them to host the OIKMS and other services with associated annual costs, or
- fully outsource the IT infrastructure and support to 3rd party VPSs, and only pay annual service fees without further capital layouts?

The opensource software should always be firstly considered for the different components of the OIKMS to make the annual costs and therefore the sustainability of the system more viable. Initial configuration costs might be slightly more, but all systems (except for online per user services) require initial configuration and setup. The Microsoft Office 365 Enterprise suite seems hard to beat for Knowledge Management tools, especially if the product can be obtained nearly free of charge, if OKACOM can be registered as a non-profit organisation.

The gradual implementation of the OIKMS is possible however initially it is recommended that a detailed design of an integrated modular OIKMS be initiated that will include a more detailed needs assessment, software specification, software comparison and detailed design, scheduling and costing of the system.

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Personal Communication cited in the document:

Note: stakeholders engaged with during the Member State workshop on 12 April 2018 are not listed separately. The attendance lists for the workshop of 12 April is included in Appendix J.

Andrade, Carlos (March 2018). OBSC and Biodiversity Task Force Member. GABHIC, Angola State Secretariat for Water.

Chonguica, Dr Ebenizario (March 2018). OKASEC Executive Secretary,

Dhliwayo, Masego (March and April 2018). GIS Chief Technician (OBIS).

Gaspar, Gina (April 2018). Hydrological engineer; Kisters/Hydstra support: SADC.

Ivanov, Ignat (Feb 2018). IT support specialist to OKASEC. Gaborone, Botswana.

Makati, Anastchia (March 2018). Namibia University of Science and Technology (NUST).

Moleele, Dr Nkobi (March 2018). UNDP Secondment to OKACOM.

Motsumi, Sekgowa (March 2018). OKASEC Programme Coordinator.

Mufeti, Pauline (March 2018). Hydrological Technical Committee / Deputy Director of Hydrology, Ministry of Agriculture, Water and Fisheries for Namibia.

Murray-Hudson, Mike (March 2018). Senior Research Scholar, Okavango Research Institute (ORI).

Ramodimo, Olerato (March 2018). OKASEC Administration/Records Officer.

Selolwane, Shirley (March 2018). OKASEC Finance Officer.

APPENDIX A: Key project team and associated contact details

Group/ involvement	Title	Surname	Names	Known as	Organi-sation	Position	e-mail	Other details	Comments
Contract funding/ Steering Committee	Mr	Fritzen	Victor Emmanuel	Victor	GIZ	GIS Project Manager	Victor.fritzen@giz.de www.giz.de	Transboundary Water Management in SADC, Dalale House, Plot 27, Main Mall, Private Bag X12, Village Gaborone, Botswana T +267 310 2520; M +267 72 79 74 81	GIZ project manager
Client/ Steering Committee	Mr	Motsumi	Sekgowa	Sekgowa	OKACOM Secretariat	Programmes Coordinator	sekgowa@okacom.org or ssmotsumi@gmail.com	P.O. Box 25741 Plot 25019, Old Lobatse road Gaborone, Botswana W: +2673161593 M: +26771326549	OKACOM programme coordinator
Steering Committee	Dr	Moleele	Nkobi	Nkobi	UNDP	UNDP secondment	nkobi.moleele@undp.org nkobi.moleele@gmail.com	As above	
Client/ Steering Committee	Dr	Chonguica	Ebenizário	Eben	OKACOM Secretariat	Executive Secretary	ebenc@okacom.org ebenizarioc@gmail.com	As above	
Assisting with stakeholder contact details	Ms	Ramodimo	Olerato	Olerato	OKACOM Secretariat	Records officer	olerato@okacom.org	As above	Internal records management and contact establishment with key stakeholders
	Ms	Selolwane	Shirley	Shirley	OKACOM Secretariat	Finance and administration officer	shirley@okacom.org	As above	Internal records management
Consultant/ Steering Committee	Mr	Weston	Derek	Derek	Pegasys	Director	derek@pegasys.co.za	1st Floor Block G, Hatfield Gardens 333 Grosvenor Street, Pretoria, South Africa	Pegasys project director
Consultant/ Steering Committee	Dr	Storie	Judith Maryna	Maryna	Pegasys	Principal	maryna@pegasys.co.za	As above	Consultant
Consultant/ Steering Committee	Mr	Haasbroek	Bennie	Bennie	Pegasys	Specialist	Bennie.Haasbroek@ hydrosolconsulting.com	Not available	Consultant

Consultant/ Backstopping, GIS & graphics support	Ms	Kathleen	Godfrey	Kathleen	Pegasys	Technician	kathleen@pegasys.co.za	As above	Consultant
GIZ	Ms	Keitseng	Dimpho	Dimpho	GIZ	Procurement Manager	dimpho.keitseng@giz.de www.giz.de	GIZ Botswana and SADC Private Bag X12 1st Floor, Morula House Plot 54358, New CBD Gaborone, Botswana T: +267 3959615 / 3957400 F: +267 3959750 M: +267 73012411 / 72113109	
OBSC	Mr	Andrade	Carlos				carlosandrade@gabhic.gv.ao	OBSC - Angola	Key stakeholder
OBSC	Ms	Ortmann	Cynthia				cynthia.ortmann@mawf.gov.na	OBSC – Namibia	Key stakeholder
OBSC	Ms	Molefi	Tracy				trsmolefi@gov.bw tsmolefi@gmail.com	OBSC - Botswana	Key stakeholder
DIS-WD SADC	Mr	Ramoeli	Phera				pramoeli@sadc.int		Key stakeholder
	Mr	Ivanov	Ignat				ignat@maintenancerus.co.bw	OKACOM – IT support contractor	IT backup and security
	Ms	Mufeti	Pauline				paulina.mufeti@mawf.gov.na pmufeti@yahoo.com	Namibia	Key stakeholder
	Mr	Modiakgotla	Pako				pkmodiakgotla@gov.bw pakomodiakg@gmail.com	Botswana	Key stakeholder
ORI	Dr	Murray-Hudson	Mike				mmurray-hudson@ori.ub.bw / mike@murray-hudson.com	ORI (University Botswana)	Data / system custodian
ORI	Mr	Dhliwayo	Masego				mdhliwayo@ori.ub.bw	As above	GIS Specialist

APPENDIX B: Notable online data/information sources

List of existing reports/data/documentation relevant to OKACOM information system (note – some of these are also included in Appendix C, which reflect recent and notable OKACOM initiatives).

B.1 CORB-specific url's for accessing existing reports

Author	Date	Title/ Heading	URL	Comments
OKACOM	2011	Transboundary Diagnostic Analysis	http://www.okacom.org/okacom-resources/key-documents/documents/copy_of_feffcubango-okavango-river-basin-transboundary-diagnostic-analysis/at_download/file	
OKACOM	2010	National Action Plan (NAP) Botswana	http://www.okacom.org/site-documents/key-documents/okavango-cubango-river-basin-botswana-national-action-plan-2011-2016/view	
OKACOM	2010	NAP Angola	http://www.okacom.org/site-documents/key-documents/national-action-plan-nap-for-the-sustainable-management-of-the-cubango-okavango-river-basin-angola/view	
OKACOM	2010	NAP Namibia	http://www.okacom.org/site-documents/key-documents/national-action-plan-2010-nap-for-the-sustainable-use-of-the-resources-in-the-okavango-river-basin-namibia/view	
IEA	2007	OKAVANGO River water commission	https://iea.uoregon.edu/treaty-text/2007-okavangoriverwatercommissionentxt	
GEF		Environmental Protection and sustainable development of the Okavango River Basin Global Environment Facility	https://www.thegef.org/project/environmental-protection-and-sustainable-management-okavango-river-basin	
OKACOM		Environmental Protection and sustainable management of the of the OKAVANGO River Basin Projects	http://www.okacom.org/okacoms-work/partners-and-projects/projects/okacom-projects/epsmo-1	EPSMO data is largely included in OBIS. As a side-note: The Future Okavango data is also to some extent included in OBIS – although not all
OKACOM		Okavango Delta Management Plan	http://www.okacom.org/okacoms-work/partners-and-projects/partners/public-service-partners/okavango-delta-management-plan-odmp	
International Waters Governance		Okavango River Basin International Waters Governance	http://www.internationalwatersgovernance.com/okavango-river-basin.html	

SIDA		Regional Co-operation	http://www.sida.se/English/where-we-work/Africa/Regional-co-operation-in-Africa/example-of-results/Fran-konflikt-till-dialog--Okavangofloden-forenar-grannlander/	
SDG IISD, FAO		Cubango- Okavango River Audit	http://sdg.iisd.org/news/cubango-okavango-river-audit-released-by-fao-okacom/	
		Handbook of Catchment Management	https://books.google.co.za/books?id=B98ub4Ykh6gC&pg=PA471&lpg=PA471&dq=Okakom+Management&source=bl&ots=nWnZ0i7iOv&sig=WItSDKLjY8fHw4Y2xPooq1k4COg&hl=en&sa=X&ved=0ahUKEwin-vuj9bjYAhWHA8AKHacqAdQQ6AEIUTAI#v=onepage&q=Okakom%20Management&f=false	Book
OKACOM		Integrated river basin management Project	http://www.okacom.org/okacoms-work/partners-and-projects/projects/partner-projects/irbm	
		Hydro-political Vulnerability and Resilience along international waters Africa	https://books.google.co.za/books?id=NPXKoHilf8kC&pg=PA37&lpg=PA37&dq=Okakom+Management&source=bl&ots=-rganQ0CrS&sig=NjsXrk5Bu7V7s8Bf6YH9UqKx-r8&hl=en&sa=X&ved=0ahUKEwin-vuj9bjYAhWHA8AKHacqAdQQ6AEIUzAJ#v=onepage&q=Okakom%20Management&f=false	Book
		Management of transboundary rivers and lakes	https://books.google.co.za/books?id=Z3ilzosWx4wC&pg=PA96&lpg=PA96&dq=Okakom+Management&source=bl&ots=5NPzyNfreZ&sig=E-62bTo6EO_fFmWVhhAkLBdymt0&hl=en&sa=X&ved=0ahUKEwin-vuj9bjYAhWHA8AKHacqAdQQ6AEIRTAF#v=onepage&q=Okakom%20Management&f=false	Book
Namibian		OKACOM at the helm of management of the river basin	https://www.namibian.com.na/index.php?id=80560&page=archive-read	
Namibian		Okavango delta management plan	https://www.namibian.com.na/index.php?id=80560&page=archive-read	
OKACOM		Angola Monitoring Reports	http://www.okacom.org/observing-the-river/environmental-monitoring-reports/monitoring-reports/angola-monitoring-reports and http://okavangodata.ub.bw/ori/	
		Angola Basin SPE	https://search.spe.org/i2kweb/SPE/class/Oilfield%20Places/Africa/Angola/Angola%20Offshore/South%20Atlantic%20Ocean/Angola%20Basin	
FAO			https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=11&ved=0ahUKEwj4_abBr77YAhUBLsAKHRUuCC04ChAWCCUwAA&url=http%3A%2F%2Fwww.fao.org%2F3%2Fa-i3743e.pdf&usg=AOvVaw3o3cTGA1flFe9OwBohBOVi	

Journal: Ecology Society		Resilience in transboundary water Governance: The Okavango River Basin	https://www.ecologyandsociety.org/vol18/iss2/art23/	Published article
FAO		FAO data map OKAVANGO Basin e.g. base maps, remote sense and toponomy -Geology and Hydrology map of Angola, contributing area Geology-geologic units	http://ref.data.fao.org/es/web/guest/map?entryId=d0075341-e920-4da8-934b-924588b9da6a&tab=metadata and http://ref.data.fao.org/map?entryId=8de5e437-c8a6-42f7-bac7-cffab897341e and http://ref.data.fao.org/map?entryId=233493e2-185c-4e7f-bfca-715dcf0af2d6&tab=about	Metadata – a valuable resource to be harnessed if possible, from within the OKACOM website
One World Group		Discussion paper on the permanent Okavango river agreement	http://oneworldgroup.co.za/projects/discussion-paper-permanent-okavango-river-basin-agreement/	Paper
OBIS		Okavango Basin Information System	http://leutra.geogr.uni-jena.de/obis/metadata/start.php	OBIS is the data and information management platform of the research project The Future Okavango (TFO). Based on open-source software and open standards, OBIS offer access to various types of environmentally related information (e.g. time series data, spatial data, documents). Also see Appendix B.6
NUST hydrological database			http://fnrss.nust.na/?q=department/geo-spatial-technology/reseach	Database does not seem to be available online

B.2 ZAMCOM

General comments: When a user searches for “ZAMWIS” on the internet, there are multiple options to gain access to information. A general user will be uncertain as to which is more important, most up to date or where to find the exact information they may be looking for. The ZAMCOM website and ZAMWIS database, as well as design features were investigated at ZAMCOM offices in April 2018.

Author	Title/Heading	URL
DHI	ZAMWIS WRIS	http://zamwis.wris.info/
DHI	ZAMWIS	http://www.zamwis.org/Main/index.php and http://www.zamwis.org/CountriesData/filelist.php
ZAMCOM	The Zambezi Watercourse Commission ZAMCOM	http://zambezicommission.org/newsite/
SADC		https://www.sadc.int/opportunities/procurement/procurement-archive/zambezi-water-resources-information-system-zamwis-enhancemen/
WARMA		http://www.warma.org.zm/index.php/information-centre/zamwis

DEVEX	Zambezi River Basin Management Project Zambezi Water ... – Devex	https://www.devex.com/funding/r?report=tender-183590&filter%5Bstatuses%5D%5B%5D=forecast&filter%5Bstatuses%5D%5B%5D=open
World Bank	Procurement notices -ZAMBEZI Water resources information systems	http://projects.worldbank.org/procurement/noticeoverview?id=OP00034385
Infrastructure News	ZAMWIS is set for modernisation	http://www.infrastructurene.ws/2014/04/22/zamwis-set-for-modernisation/

B.3 ORASECOM

General comments: Potentially better integration than the sites accessed for ZAMCOM / ZAMWIS, with sites in general being linked. Linkage of OKACOM to partners (bordering basins) are indicated, (e.g. http://www.okacom.org/okacoms-work/partners-and-projects/partners/river-basin-organisations/orasecom) however, the linkage is not quite clear – the link only states what the partner does but not really how the link is established and executed.

Author	Title/ Heading	URL	Comments
ORASECOM		http://orasecom.org/	This page has a link that launch into the site listed below
		http://www.orangesenqurak.org/river.aspx (this is one of 4 “tabs” available)	
ORASECOM		https://www.govpage.co.za/orange-sengu-river-commission-orasecom.html	
Water Action Hub		https://wateractionhub.org/organizations/view/63/	
		http://orangesenqurak.org/governance/water+resource+management+southern+africa/sadc+water+protocol.aspx	
	Orange Senqu	https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwjxl_De78fYAhXrJcAKHdyVDr8QFggrMAA&url=http%3A%2F%2Fwww.orangesenqurak.org%2Fgovernance%2Fintegrated%2Bwater%2Bresource%2Bmanagement%2Fintergrated%2Briver%2Bbasin%2Bmanagement.aspx&usg=AOvVaw2B8Vn8b-qThr5p_cBQwpQa	As beautiful as the images on the site (i.e. making it attractive to use) is the ease of use. It mentions that in basins shared by multiple countries the number of stakeholders increases which further increases the complexity of river basin management. This enlightens the general user as to the complexities that can arise when transboundary waters are being managed. There are introductions to what is on the site, for example steps for IWRM, River Basin Management, stakeholder Involvement etc. The user can click on one of these and it gives information about that particular subject. The site is informative and supports river basin governance understanding.

B.4 Other

Author	Title/ Heading	Country/ area	URL	Comments
SAMSA	SADC Protocol on shared watercourses	SADC	https://www.samsa.org.za/legislation/sadc-protocol-shared-watercourses	
World Bank	World Bank Projects		http://projects.worldbank.org/procurement/noticeoverview?id=OP00034385	
	Current Projects, Legal Policy and strategy analysis and development		http://www.acwr.co.za/legal_current.htm	
WWF	About our Earth: Freshwater > Rivers	Global	http://wwf.panda.org/about_our_earth/about_freshwater/rivers/irbm/	Easy on the eye, giving the public/general user an opportunity to have easy access to what they were initially looking for: once on the site after searching e.g. 'basin management', all the information about basin management appears. This site explains in very simple English what a river basin is. For example: it gives the key elements on how to run and operate a basin successfully. The necessary requirements that should be put in place with regards to sustaining the lifespan of the basin. The need to have all stakeholders on board and keeping them well informed on what decisions are being made with regards to the long- term sustainability of the basin. It mentions the need for transboundary cooperation amongst countries breaking boundaries around cultural, political and economic divides, realising the importance of conserving this important resource. An easy to operate site for users with limited skills and experience/water resources knowledge.
International River Organisation (IRO)			https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=18&ved=0ahUKEwjIy4S8irvYAhXBLsAKHcUjAGwQFgiEATAR&url=http%3A%2F%2Friverfoundation.org.au%2Four-programs%2Fintegrated-river-basin-management%2F&usg=AOvVaw0SiCkB60AkLaLta4avqFPi	Once a user is on the site they are met with what the Organisation offers. The IRO Story, Work, Contributions, News and Contacts. It has a Blog so one can see recent conversations on river basin management keeping you updated with what goes on in that field. Great images throughout the site, keeping users interested – however not technically detailed. World Rivers Day is promoted – useful for the public to consider. It highlights the values of rivers and strives to increase public awareness, encourages improved stewardship of rivers around the world. There is a Women and Water programme as well which is an important perspective and inclusion of marginalised groups in advancing river basin management- particularly given that women in the developing world play decisive roles in managing water in the family level. When a user visits a website, they want to leave having captured information and having better understanding on what they were looking for and this site mentions the challenges for basin management. This is a good example of one where the general public could access information re: e.g. the Twinning programme which pairs River prize winners with communities who

				can benefit from their knowledge and good expertise in sustainable river management.
	Kunene River awareness kit		https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=12&ved=0ahUKEwiB_seX3MDYAhVrDcAKHb6RAs84ChAWCCswAQ&url=http%3A%2F%2Fwww.kunene.riverawarenesskit.com%2FKUNENERAK_COM%2FEN%2FGOVERNANCE%2FINTEGRATED_MANAGEMENT%2FINTEGRATED_RIVER_BASIN_MANAGEME.HTM&usg=AOvVaw2qUJDLGCMK_RqF466W6k1I	This site is more of a tool kit as it offers the user a guide to Integrated Basin Management, which are engagement and ownership by decision makers. Clear definition of the role and structure of the river basin organisation. Strong river basin advocacy, local government partnerships. The user with no prior knowledge may find it challenging to understand clearly. The *People and River* theme provide an exploration of the diverse culture, economic activities, livelihoods and the dependencies of the urban and rural population of Angola, Namibia and the Kunene basin. *People* presents the people in the particular 2 Riparian States and the basin and the basin, their history, cultural diversity, traditional way of life. A user will leave the site not just with knowledge about basin management system but also having been exposed to other cultural aspects of the people that are within the Riparian States. This site is not difficult to use because it gives headings on what is on the site, for example Water quality, Ecology and Biodiversity so when a user is on the site they can just click on Water Quality, and see an explanation of this, which would be the concentration of different chemicals in the water, what determines e.g. “good” or “bad” water. Such information is very insightful and makes a user more informed with what is needed to sustain our basins – however it is not technically detailed for decision making purposes at e.g. RBO and member state level.
Global Waters	Southern African Regional Environmental Programme	SADC	https://www.globalwaters.org/content/southern-africa-regional-environmental-program	

B.5 General internet search review

When a general search is executed using commonly available internet browsers, some of the databases that may contain needed data for CORB decision makers, such as OBIS, do not appear first on the list when online searches are done. For example: when OBIS is searched, a ‘fight club’ appears first. Similarly, with ‘OBSC’ is searched, the ‘Oak Brook Soccer Club” appears at the top of the list.

Examples of Google search engine returns are presented below.

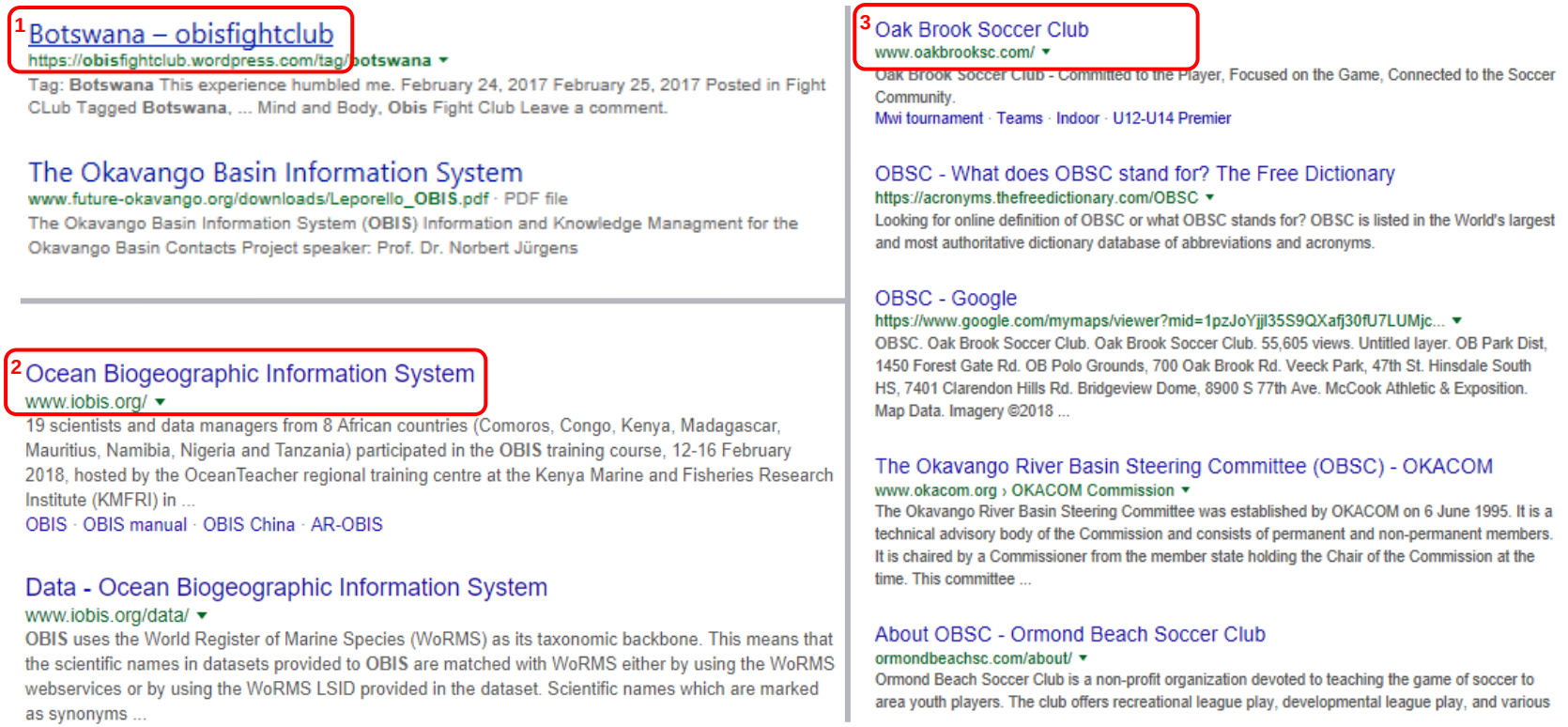


Figure: Online search return examples: OBIS (1,2) and OBSC (3)
Source: www.google.com

B.6 Brief OBIS review

The OBIS design as well as its current operational and administration environment provide valuable insight towards establishment of an IKMS. OBIS incorporates among others time-series data (visualised as linear graphs), GIS-based visualisations, monthly location (point-) based information for climate/weather stations, precipitation and discharge. It also houses a large collection of GIS files (shapefiles), thus presenting mapped, observation and scenario data. Metadata for data contained in OBIS is based on considerations of for example such as ISO 19115 standard for Geographic Information-Metadata (ISO, 2005) and the Catalogue

Services Specification (OGC, 2007), both of which are widely applied in geodata infrastructures on national and international levels (INSPIRE, EU, 2007). A review conducted between March and April 2018 showed that some metadata maintenance is required, and that standards and structures related to digital spatial data could be improved. Although OBIS still runs, the staffing and hardware maintenance constraints that ORI face retracts from the potential effectiveness of OBIS to serve in its current state as the OIKMS.

OBIS (located at *leutra.geogr.uni-jena.de/obis/metadata/start.php*) does give access to guest users to view metadata of available datasets, however the metadata list is also not frequently or regularly updated. New users of the site may have to wait for maximum three days to receive access to data, however once registered, data downloads are easy to do. Most data categories seem to have files uploaded/available for download, however the recency and frequency of the data is unknown. The internet availability of OBIS, as depicted in the Figure below, seem to not be a reality presently, with only *some* data being extractable over the internet – a significant amount of raw data, is only accessible directly via ORI.

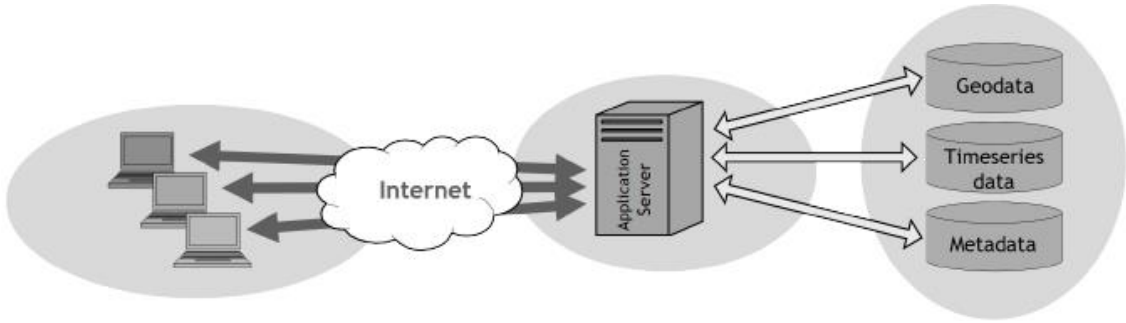


Figure: OBIS common system architecture
Source: Kralish, Zander & Flügel (2014)

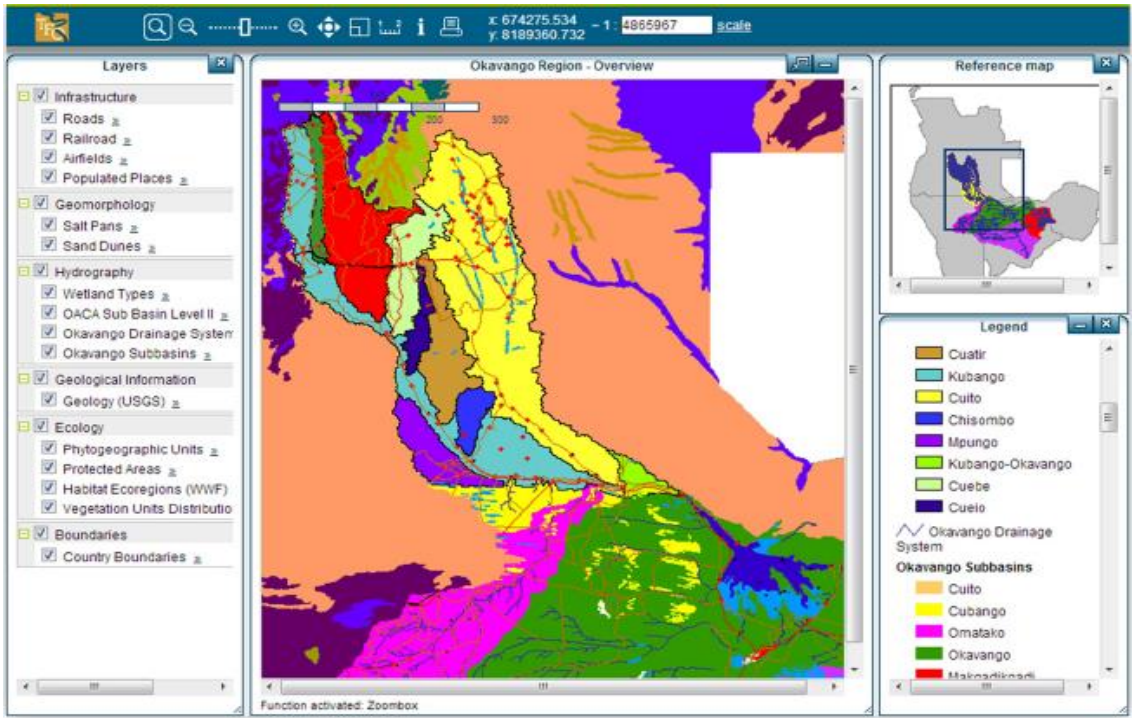


Figure: Visualisation of maps in OBIS
Source: Kralish, Zander & Flügel (2014)

APPENDIX C: Recent notable OKACOM projects

OKACOM - who is helping current and upcoming international partner projects in the basin	http://www.okacom.org/site-documents/who-is-helping-current-and-upcoming-international-partner-projects-in-the-okavango-river-basin	Dated 2010, 2 page summary of international partner projects at that time
Okavango Transboundary Diagnostic Analysis (TDA)/ Environmental Protection and Sustainable Management of the Okavango (EPSMO)	http://www.okacom.org/site-documents/tda-final-reports/feffcubango-okavango-river-basin-transboundary-diagnostic-analysis http://www.okacom.org/site-documents/tda-background-reports/cubango-okavango-basin-studies-tda/okavango-river-basin-environmental-flow-assessment-project-final-report-report-no-08-2009 http://www.okacom.org/site-documents/tda-background-reports/gis-data-base-for-the-environment-protection-and-sustainable-management-of-the-okavango-river-basin-project-epsmo	1. Transboundary Diagnostic Analysis 2011 219 pp, (including low, medium and high development scenarios) 2. Environmental Flow Assessment 3. GIS database for the EPSMO (2009)
World Bank (CIWA) Multi-Sector Investment Opportunity Analysis (2017)	http://www.worldbank.org/en/region/afr/brief/okavango-multi-sector-investment-opportunity-analysis http://documents.worldbank.org/curated/en/520141503551327823/pdf/119059-BRI-P150383-PUBLIC-23-8-2017-6-19-35-CIWAPolicyBriefOkavangohigh.pdf	
GEF/UNDP C.O.R.B. SAP	https://www.thegef.org/project/support-cubango-okavango-river-basin-strategic-action-programme-implementation	UNDP Strategic Plan Environment and Sustainable Development Primary Outcome: Outcome 2.5 Legal and regulatory frameworks, policies, and institutions enabled to ensure the conservation, sustainable use, and access and benefit sharing of natural resources, biodiversity and ecosystems, in line with international conventions and national legislation UNDP Strategic Plan Secondary Outcome: Outcome 1.3 Solutions developed at national and sub-national levels for sustainable management of natural resources, ecosystem services, chemicals, and waste
	https://www.thegef.org/sites/default/files/project_documents/2028_BD_Botswana_TE_0.pdf	Building Local Capacity for Conservation and Sustainable Use of Biodiversity in the Okavango Delta. Completed - Terminal Evaluation
Corbwa Cubango Okavango River Basin Audit (2012 & 2014)	http://www.okacom.org/okacoms-work/partners-and-projects/projects/okacom-projects/corbwa/corbwa-documents/land-water-data-review-including-options-for-database-organization-c-o-r-b-july-2012/view	2012 Land and water data review, including options for database organization. 82 page report that addresses two specific objectives of the CORBWA project: Component 1: Information Protocols and Component 5: Decision Support Tool. The document provides recommendations on technical specifications, selection of hardware and software for the project. It also reviews the availability of land and water data.
	http://www.okacom.org/okacoms-work/partners-and-projects/projects/okacom-projects/corbwa/corbwa-documents/synthesis-report-cubango-okavango-river-basin-water-audit-corbwa-2014/view	2014 Synthesis Report. This report presents a synthesis of studies conducted in the framework of the Cubango-Okavango River Basin Water Audit (CORBWA). This water audit is part of a larger FAO project 'Coping with water scarcity: the role of agriculture – Developing national water audits in Africa'.
USAID SAREP (Southern Africa Regional Environment Programme)	http://www.innovativehydrology.com/ImprovingHydrometricSystems-2005.pdf http://pdf.usaid.gov/pdf_docs/Pnadg284.pdf http://www.okacom.org/site-documents/project-reports/sarep-	Initially under USAID/OKACOM Okavango River Basin Project, a four-year initiative Improving Hydrometric Systems - Institutional and Training Assessment for Hydrological Monitoring describes the results of an assessment of approaches to conduct hydrological

	documents/sarep-technical-series-2014-anthropogenic-climate-change-and-hydro-climatic-conditions-in-the-c-o.r.b	monitoring, use and manage information at responsible institutions in Angola, Botswana and Namibia. Enhancing Data Management for OKACOM identifies data and information needs for OKACOM and other users of information on the Okavango River Basin. The primary result of this consultancy was a data and information management strategy for the proposed OKACOM Secretariat. 1. Improving Hydrometric Systems. 2. Enhancing Data Management 3. Anthropocentric climate change and hydro-climatic conditions Prepared by Chemonics International Inc. and Piotr Wolski, Climate System Analysis Group, University of Cape Town.
The Future Okavango. Funding: BMBF. Sept 2010 – Aug 2015 Leading institution: University of Hamburg, Germany	http://www.future-okavango.org/downloads/TFO_Report_engl_compiled_small_version.pdf http://www.future-okavango.org/downloads/TFO_Data_sharing_protocol_20130125.pdf http://www.future-okavango.org/downloads/Leporello_OBIS.pdf http://www.future-okavango.org/downloads/TFO_Conceptual_Framework_Final.pdf http://www.future-okavango.org/downloads/TFO__PB_Water_engl_small.pdf	Synthesis Report - Findings, Scenarios and Recommendations for Action Data Sharing Protocol Okavango Basin Information System Ecosystem Services Conceptual Framework Hydrological importance of wetlands
SWEDEN (SIDA) Cubango Okavango - 10 year institutional support	http://www.internationalwatersgovernance.com/okavango-river-basin.html	10 year institutional support to OKACOM Secretariat
OKACOM Protocol on Hydrological Data Sharing (2010)	http://www.okacom.org/site-documents/key-documents/2010-okacom-protocol-on-hydrological-data-sharing-for-the-okavango-river-basin/view	
Groundwater needs assessment in the Okavango	http://splash.lboro.ac.uk/downloads/groundwater/3_OKACOM_final_report.pdf	
Water balance estimation in Angola part of Okavango	http://www.sciencedirect.com/science/article/pii/S0022169406002514 http://sro.sussex.ac.uk/1696/	Pitman model calibration for Angola sub-catchments - by Denis Hughes Rainfall estimation by satellite
Addressing poverty through multi-sector investments in the Cubango-Okavango River Basin	http://documents.worldbank.org/curated/en/520141503551327823/pdf/119059-BRI-P150383-PUBLIC-23-8-2017-6-19-35-CIWAPolicyBriefOkavangohigh.pdf	The Multi-Sector Investment Opportunities Analysis (MSIOA) is part of a systematic strategy by OKACOM to assist the member states in achieving socially just, economically prosperous, and environmentally healthy development of the Cubango-Okavango River Basin (CORB). This is part of an effort to define a Sustainable and Equitable Climate Resilient Investment Program among the member states to address development challenges within the basin.

APPENDIX D: Interview guide

English Version:

To support the Interview process, this Interview Guide is set up to indicate some broad areas of consideration as to what the status pertaining data, information and ultimately knowledge management as it relates to OKACOM **and its MSs**. Some of the activities related to the purpose of this Guide include: a **Gaps identification and Needs Analysis** - OKACOM is governed by the SADC Protocol on information sharing. However, there may be national regulations, systems and processes which could influence the workings of an information and knowledge management system for OKACOM. We are aiming to interrogate these influences to determine possible challenges or opportunities.

- Legal framework (considering existing member country laws, governance policies, strategies and guidelines; current impacts and linkages (or lack thereof) or regulations that have an impact on the way data is handled/stored and information is shared; such legal frameworks are interwoven with institutional frameworks that guide data alignment in terms of collection/surveys/capture, management, sharing/distribution, custodianship etc., in its interaction with other sectors' data and information sets
- Institutional framework review, with three sub-focus areas:
    - How the organisation structure works, what the key role is of each structure is and what the flow of information is between member states and between structures in OKACOM. For example, information flow between Political > Commissioner > Secretariat > Country representatives.
    - How donor funded projects are managed, especially in relation to the information products produced and the maintenance of these products.
    - Sectoral information management influences for example data sharing between land planning and environmental, and linkages or impacts that influence transboundary water resource management).
    - Processes (for example Standard Operating Procedures, forums/meetings that may positively impact alignment across sectors and borders, KPI's/KPA's related to data management/handling/custodianship)
- Data (data sets, custodianship, duplication or absence of data, feature types) and, where possible, database design elements and system considerations (custodians, etc) that are key to the function and role of OKACOM basin states and internal structures.
- System (including for example: platform, hardware, software, and application considerations that is key to handle/manage/share the data, especially server configurations and ICT)

The discussions guided by this document aim to obtain insight into the above in as far as it may promote or hinder collaboration and alignment between member states. An optimal understanding of the situation that currently exist will allow us to:

- Assist in understanding the key functions and consider options to improve internal as well as data, information and knowledge management processes;
- Ensure that we understand priorities regarding functions and processes within your governance role/department as well as where you may be relying on other sources of information than what you have direct control over; and

Begin to assist with options on how best to address the situation.
(A) Information to be collected if possible, before the interview is held:
Name and formal designation of person/position being interviewed: Which member state, organisation/unit/department do you represent? Is an institutional structure diagram available and if so please could you share it? If the structure mentioned above does not indicate this information, approximately how many permanent staff members are there within your unit/department who has direct need of data, information and knowledge related to transboundary water management? Please break these numbers down by broad functional categorization (e.g. Managers, GIS staff, Officers, Trainers, Engineers, Hydrological modellers, Spatial Planners, Other support staff).
(B) Institutional framework, Functions and Processes
What are the **main functions/business/operational processes** that fall within the unit/department responsibilities, which directly impact or are impacted by data collection, data management and data quality and the ability to share this with member state stakeholders? Please note: This is a critical question; please complete accurately and in detail as possible.
Are you aware of re-structuring of any business process within your unit/department? If **Yes,** • Who is executing this? • How far has this progressed? How may it impact transboundary water resource information and knowledge sharing?
Do you have any current or legacy business process documentation, including items and can it be shared, such as: • mapped business processes in the form of flow charts and diagrams; • policies that guide information and knowledge management; • formal Business Requirement Reports; • Standard Operating Procedures; • KPI/KPA descriptions related to managing data/information as it pertains to transboundary water management; • File naming and file management protocols; • Electronic library guidelines • or any other such documents? For <u>each</u> of the main functions/business/operational processes: Are there any current issues with the information in any of the systems that assist with the function? If **Yes**, please provide details. Are you aware of information overlaps or duplications within your unit/department, or between units/departments – either at inter-nation level or transboundary / member state level? If **Yes**, please provide details. Who is mainly responsible for the quality of information within systems that assist with the function (quality assurance)? Are there security concerns or confidentiality/privacy challenges relating to any information within systems that assist with the function? If **Yes**, please provide details.
(C) Stakeholders
For <u>each</u> of the **main functions/business/operational processes** listed above, please answer the following: • Who mainly **gives/provide input** to the function/process (originators of data/information)? • Who mainly **receives the output** from the processes and for what purposes (primary end users)? • Who is mainly responsible for ensuring the process is fulfilled (process custodians/quality control)? • Who is mainly responsible for the day to day **inputting** of information into systems that assist with the function (data generators), if applicable? Who else **uses** the data to make strategic and planning decisions (apart from primary users – i.e. 'where does the resultant information end up, to make a transboundary impact'? Public? Government Departments, NGOs, etc?
(D) The existing OKACOM website (http://www.okacom.org/)
What do you believe the purpose of the website is? Who do you think (or know) are the primary users of the website?

Do you believe that the website fulfils this purpose, and please explain why you say so?

If you could improve the current website, what would you have done and why?

(E) Data, Information and Knowledge Management Systems

For each of the **main functions/business/operational processes** listed in Section B, are there information systems currently in place to assist with the function? (In this context spreadsheets are not considered systems.)

If Yes,

- What is the name of the system?
- What is the purpose of the system and is there documentation for the system?
- Who owns the system?
- Who administrates the system
- Is the system internal only or is there a public interface to the system?
- What, if any, are the major challenges with the system?
- Is the system properly assisting with fulfilling the requirement of the function?
- What, if any, improvements would you like to the system?
- If known, describe the technology that is being utilised for the system?
- Are there any processes under way to address challenges in/change the system?
- What is the urgency of any fixes required?
- Who is paying for the maintenance of the system, how is it funded and what is the costs?

If **No**,

- Would it benefit you to have a formal system in place?
- How would you describe the main functionality required from such a system?
- What is the urgency of addressing this new system required?
- Who should be involved – both in your unit/department and outside of it, to discuss the requirements/development details?
- Who should be the custodian/own the system?
- How should the system be maintained?

Is your unit/department considering or currently implementing new data or information management protocols, or Information and Communication Technology (ICT) including for example PBAX System, Video Conferencing, etc?

If **Yes**, please answer the following questions for each new system:

- If known, describe the technology that is being utilised for the system?
- Is it a new system or a replacement system? What system will it replace?
- What problem(s) does it solve?
- What are the risks?
- How much will it cost/or is it costing?
- Who is intended to maintain it (staff/capacity)?
- Who is intended to operate it (staff/capacity)?
- Who may it serve outside of your unit/department?

(F) Towards an OKACOM IKMS

A Centralized Hub/Clearing house that operates across member states can assist with planning, identification of data needs, operational management, cross-boundary cooperation/sharing, and support liaison between departments not directly linked to water resource management.

What would you consider the most important datasets **needed** (i.e. what you cannot operate without) in your unit/department to perform your given function(s)?

For each of the above please indicate whether it is available (yes/no/partly) and what may be the challenges with it, if there are any challenges.

What would you consider the most important datasets outside of your unit/department, that you would like access to? Please indicate in order of priority where 1 is highest priority. Please feel free to add additional data sets to the list: __ Hydrological modelling information __ Water licensing/permit/use allocations information __ Departmental operational information __ Rainfall gauges Information __ Monitoring station information __ Early Flood warning __ Drought monitoring __ Spatial development Planning data such as land use/land planning, zoning, nodal development areas and spatial development framework details __ Safety & Security __ Metadata requirement only (i.e. who holds what data – actual data not needed to be held directly) __ Base data such as topographic, urban, transport etc. __ Special areas/locations of importance such as protected areas __ Environmental data such as no-go areas in terms of heritage areas, wetlands, endangered species/protection zones for project or expansion purposes
What would you consider the most important datasets **wanted** (i.e. wish list/if you could have this data in an ideal world, but which you could operate without) to be made available/accessible by your unit/department to perform your given function(s) better? For the wanted datasets, do you know where it is available from – please state where from if you do know.
If you could change one major thing in terms of data management in terms of transboundary water management in OKACOM, what would it be?
(G) Additional
Please provide any additional comments that you think are relevant for us to know or consider, or is there anything critical that we may have overlooked, related to information and management in terms of a needs and gaps assessment for OKACOM information and knowledge management?

Portuguese Version:

Estudo de Definição de Escopo para um Sistema de Informação e Gestão do Conhecimento (IKMS - *Information and Knowledge Management System*) para a OKACOM:

Para apoiar o processo de Entrevista, este Guia de Entrevista está configurado para indicar algumas áreas gerais a se considerar sobre qual o status dos dados, das informações e da gestão do conhecimento pertinentes à OKACOM e seus Estados-membros. Algumas das atividades relacionadas ao propósito deste guia incluem: **A Identificação de Lacunas e a Análise de Necessidades** - a OKACOM é regulada pelo Protocolo da SADC no que diz respeito ao compartilhamento da informação. No entanto, podem haver normas, sistemas e processos nacionais capazes de influenciar o funcionamento de um sistema de informação e gestão do conhecimento para a OKACOM. Objetivamos investigar essas influências para determinar possíveis desafios ou oportunidades.

- O quadro legal, considerando as leis existentes no país membro, as políticas de governança, as estratégias e diretrizes; os impactos e as ligações atuais (ou a falta deles) ou os regulamentos que impactem como os dados são tratados/armazenados e como a informação é compartilhada; tais regimes jurídicos se entrelaçam com as estruturas institucionais que orientam o alinhamento de dados no que diz respeito à coleta/pesquisas/captura, gerenciamento, partilha/distribuição, custódia, etc., na interação com os conjuntos de dados e informações de outros setores.
- A revisão do quadro institucional, com três áreas de foco secundário:
    - Como a estrutura da organização funciona, qual o papel fundamental de cada estrutura e qual o fluxo de informações entre os Estados-membros e entre as estruturas na OKACOM. Por exemplo, o fluxo de informações entre o Político > o Comissário > o Secretariado > os Representantes do país.
    - Como os projetos financiados por doadores são gerenciados, especialmente em relação aos produtos da informação produzidos e à manutenção destes produtos.
    - A gestão da informação setorial influencia, por exemplo, o compartilhamento de dados entre o planejamento territorial e o ambiental e as ligações ou impactos que influenciam o gerenciamento dos recursos de água transfronteiriços.
    - Processos (por exemplo os Procedimentos Operacionais Padrão, fóruns e reuniões que possam impactar positivamente o alinhamento entre os setores e as fronteiras, Indicadores-Chave de Performance (KPI´s - Key Performance Indicators) /Áreas-Chave de Performance (KPA´s - Key Performance Areas) relacionados ao gerenciamento/manipulação/custódia de dados).
- Os dados (os conjuntos de informações, a custódia, a duplicação ou a ausência de dados, os tipos de recurso e, sempre que possível, os elementos de design do banco de dados e as considerações sobre o sistema (os guardiões, etc.) que são chave para a função e o papel dos Estados-membros da bacia e para as estruturas internas da OKAKOM.
- O sistema (incluindo por exemplo: a plataforma, o hardware, o software e as considerações de aplicação que são chave para tratar/gerenciar/compartilhar os dados, especialmente as configurações do servidor e a TIC).

As discussões guiadas por este documento visam obter insights sobre o que foi descrito acima até onde se possa promover ou impedir a colaboração e o alinhamento entre os Estados-membros. Uma compreensão ideal da situação existente atualmente nos permitirá:

- Compreender melhor as principais funções e considerar opções para melhorar os dados, as informações e os processos da gestão do conhecimento internos e externos;
- Certificar-se de que entendemos as prioridades no que diz respeito às funções e aos processos dentro dos cargos/departamentos de governança, assim como onde você pode contar com outras fontes de informação além daquelas sobre as quais tenha controle direto; e
- Começar a oferecer opções sobre qual a melhor forma de abordar a situação.

(A) Informações a serem coletadas, se possível, antes que a entrevista seja realizada:

Nome e designação formal da pessoa/cargo sendo entrevistada:

Que Estado-membro, organização/unidade/departamento representa?

Há um diagrama da estrutura institucional disponível e, se sim, por favor, pode compartilhá-lo?

Se a estrutura mencionada acima não indicar esta informação, existem aproximadamente quantos membros do quadro permanente da sua unidade/departamento que necessitam diretamente de dados, informações e conhecimento relacionados à gestão dos recursos hídricos transfronteiriços? Por favor, quebre estes números por categorias funcionais gerais (por exemplo, gerentes, funcionários dos Sistemas de Informações Geográficas (GIS - *Geographic Information Systems*), oficiais, instrutores, engenheiros, modeladores hidrológicos, urbanistas, outro pessoal de apoio).

(B) Estrutura, funções e processos institucionais

Quais são as **principais funções ou processos de negócio/operacionais** que estão sob responsabilidade da unidade/departamento, quais afetam ou são afetados diretamente pela coleta de dados, pelo gerenciamento de dados e pela qualidade dos dados, e qual a habilidade para compartilhar isto com as partes interessadas no Estado-membro?
Atenção: esta é uma questão crítica; por favor, complete com precisão e tão detalhadamente quanto possível.

Você está ciente de reestruturações de qualquer processo de negócio dentro da sua unidade/departamento? Se **Sim,**

- Quem a(s) está(estão) executando?
- Em que ponto está o processo?
- Como elas podem afetar as informações sobre os recursos de água transfronteiriços e o compartilhamento do conhecimento?

Você tem alguma documentação de processos de negócio atuais ou antigos (e ela pode ser compartilhada?), tais como:

- Processos de negócios mapeados na forma de fluxogramas e diagramas;
- Políticas que guiem a gestão da informação e do conhecimento;
- Relatórios formais de requerimentos de negócio;
- Procedimentos de funcionamento padrão;
- Descrição de indicadores padrão e áreas padrão de performance (KPI's/KPA's) relacionados ao gerenciamento de dados/informações referentes à gestão das águas transfronteiras;
- Protocolos de nomeação e gerenciamento de arquivos;
- Diretrizes para a biblioteca eletrônica;
- Ou quaisquer outros documentos?

Para cada uma das principais funções ou processos de negócio/operacionais:

- Há atualmente algum problema relativo à informação em qualquer um dos sistemas que auxiliam esta função? Se **Sim**, por favor, forneça detalhes.
- Você está ciente de sobreposições ou duplicações de informações dentro da sua unidade/departamento ou entre unidades/departamentos – seja em termos transfronteiriços ou entre nações, ou em termos de Estados-membros? Se **Sim**, por favor, forneça detalhes.
- Quem é o principal responsável pela qualidade da informação nos sistemas que dão suporte a esta função (garantia da qualidade)?
- Existem preocupações relacionadas à segurança ou desafios concernentes à confidencialidade/privacidade de qualquer informação nos sistemas que que dão suporte a esta função? Se **Sim**, por favor, forneça detalhes.

(C) As partes interessadas

Para cada uma das **principais funções ou processos de negócio/operacionais** listados acima, por favor, responda:

- Essencialmente quem **faz a entrada/fornece os dados** para a função/processo (os originadores de dados/informações)?
- Essencialmente quem **recebe o produto** dos processos e para que fins (usuários finais primários)?
- Quem é o principal responsável por garantir que o processo seja cumprido (guardiões do processo/controle da qualidade)?
- Quem é o principal responsável no dia-a-dia por **introduzir as** informações nos sistemas que dão suporte a esta função (geradores de dados), se aplicável?
- Quem mais **usa** os dados para tomar decisões estratégicas e de planejamento (além dos usuários principais – ou seja, 'aonde a informação resultante chega para realizar um impacto transfronteiriço'? Ao público? Aos departamentos governamentais, a ONGs, etc.?

(D) Site atual da OKACOM (http://www.okacom.org/)

Qual você acredita seja o propósito do site?

Quem você pensa que sejam (ou sabe que são) os principais usuários do site?

Você acredita que o site cumpra esta finalidade e, por favor, explique seu raciocínio?

Se você pudesse melhorar o site atual, o que você faria e por quê?

(E) Dados, Informações e Sistemas de Gestão do Conhecimento

Para cada uma das **principais funções ou processos de negócio/operacionais** enumerados na seção B, há atualmente sistemas de informações estabelecidos para auxiliar esta função? (Neste contexto, planilhas não são consideradas sistemas.)

Se Sim,

- Qual é o nome do sistema?
- Qual é a finalidade do sistema e existe documentação sobre o sistema?
- Quem é o dono do sistema?
- Quem administra o sistema?
- O sistema é apenas interno ou ele tem uma interface pública?
- Quais são os maiores desafios, se houver, em relação ao sistema?
- O sistema tem auxiliado apropriadamente a cumprir a exigência desta função?
- Quais melhorias, se houver, você gostaria de sugerir para o sistema?
- Descreva a tecnologia utilizada pelo sistema se ela for conhecida.
- Existem quaisquer processos em curso para enfrentar os desafios/mudar o sistema?
- Qual a urgência de todas as correções necessárias?
- Quem está pagando pela manutenção do sistema, como ele é financiado e quais os custos?

Se **Não**,

- A implementação de um sistema formal traria benefícios para você?
- Como você descreveria a principal funcionalidade necessária para um sistema desse tipo?
- Qual a urgência de se providenciar este novo sistema exigido?
- Quem deve ser envolvido – tanto no seu departamento/unidade quanto fora dele/dela para discutir os requisitos/detalhes do desenvolvimento?
- Quem deve ser o guardião/possuir o sistema?
- Como o sistema deve ser mantido?

A sua unidade/departamento está atualmente considerando ou implementando novos protocolos de gerenciamento de dados ou da informação ou Tecnologia da Informação e Comunicação (TIC) incluindo, por exemplo, o sistema PBAX, videoconferências, etc.?

Se **Sim**, por favor, responda às seguintes perguntas para cada novo sistema:

- Descreva a tecnologia que está sendo utilizada pelo sistema se ela for conhecida.
- É um sistema novo ou um sistema de substituição? Qual sistema ele substituirá?
- Que problema(s) ele resolve?
- Quais são os riscos?

- Quanto ele vai custar ou está custando?
- Planejou-se que quem irá mantê-lo (funcionários/capacidade)?
- Planejou-se que quem irá operá-lo (funcionários/capacidade)?
- Quem ele poderá servir fora da sua unidade/departamento?

(F) Rumo a um Sistema de Informação e Gestão do Conhecimento (IKMS) para a OKACOM

Um hub central que opere para todos os Estados-membros pode ajudar com o planejamento, a identificação das necessidades de dados, a gestão operacional, a cooperação/compartilhamento fronteiriço, e dar suporte na articulação entre os departamentos que não estejam diretamente ligados à gestão dos recursos de água.

Quais você considera são os conjuntos de dados mais importantes **necessários** (ou seja, o que você não pode operar sem) no seu departamento/unidade para executar a(s) sua(s) determinada(s) função(funções)?

Para cada um dos conjuntos acima, por favor indique se ele está disponível (sim/não/parcialmente) e quais podem ser os desafios relacionados a ele, se existirem quaisquer desafios.

Quais você considera são os conjuntos de dados mais importantes fora da sua unidade/departamento aos quais você gostaria de ter acesso? Por favor indique em ordem de prioridade, onde 1 é a prioridade mais alta. Por favor, sinta-se livre para adicionar conjuntos de dados à lista:

_ Informações de modelagem hidrológica
_ Informações de licenciamento/autorização/alocação do uso da água
_ Informações operacionais departamentais
_ Informações dos medidores de precipitação
_ Informações da estação de monitoramento
_ Alerta rápido de inundações
_ Monitoramento de secas
_ Dados de planejamento de desenvolvimento espacial, como o uso/planejamento da terra, zoneamento, áreas de desenvolvimento nodal e detalhes do quadro de desenvolvimento espacial
_ Segurança
_ Requerimentos exclusivos para metadados
_ Dados de base, como topográficos, urbanos, de transportes, etc.
_ Locais/áreas de importância especial, como áreas protegidas
_ Dados ambientais tais como áreas interditadas ou por serem áreas de patrimônio histórico, pântanos, zonas de proteção/espécies ameaçadas de extinção ou para fins de projeto ou expansão

Quais você consideraria são os conjuntos de dados mais importantes **desejados** (ou seja, uma lista de desejos/dados aos quais você poderia ter acesso em um mundo ideal, mas que poderia operar sem) para disponibilizar ao seu departamento/unidade para que este/esta execute sua(s) determinada(s) função(funções) de maneira melhor?

Para os conjuntos de dados desejados, você sabe onde estão disponíveis – por favor indique onde, se souber.

Se você pudesse mudar algo relevante em termos da gestão de dados relacionados à gestão das águas transfronteiras na OKACOM, o que seria?

(G) Pontos adicionais

Por favor inclua qualquer comentário adicional que você considere relevante sabermos ou considerarmos, ou indique se há algo crítico que possamos ter negligenciado, relacionado às informações e à gestão, em termos da avaliação das necessidades e lacunas para a gestão da informação e do conhecimento para a OKACOM.

APPENDIX E: Minutes of project inception meeting

Meeting / Project	**Scoping Study for an Information and Knowledge Management System for OKACOM: Inception Meeting**
Date	15 December 2017
Time	08h30
Venue	OKASEC Offices, Gaborone
Attendees	In no particular order: Dr Ebenizário Chonguiça (Eben) (EC) Dr Nkobi Moleele (NM) Mr Sekgowa Motsumi (SM) Mr Victor Fritzen (VF) Dr Maryna Storie (MS)
Not in attendance	Mr Bennie Haasbroek (BH); Mr Derek Weston (DW)

Description	Discussion	Responsible	Due Date
Agenda item 1: Welcome and attendance			
	Introduction of team members		
Agenda item 2: Protocol			
	Confirmation of meeting chairperson: MS was confirmed as chairperson for the meeting Administrative matters/protocol during meetings: Names may be used to address team members – titles not needed during discussions. The client is OKACOM. GIZ is the funding agent. SM is the Programme coordinator for this programme. SM will send MS the OKACOM logo, and slide template for future use. NM is involved in the strategy implementation plan (UNDP) and focused on ensuring harmonization and reconciliation between this and the UNDP programme. SM and NM will provide copies of the job descriptions for the information systems related positions (Decision Support Systems person; Scientific officer/Policy analyst (UNDP position); Communications specialist) Contact channels: All team members to be cc'd in communication, with SM as primary contact. No communication with member states unless via OKASEC. ACTION: MS compile minutes of meeting SM provide slide deck and logo	SM SM/NM MS SM	End Jan 2018 End Jan 2018 End Jan 2018
Agenda item 3: Inception discussion			

	Contractual items: The “Inception report” would rather be delivered as a “Framework” document, which already is in the structure and format of the final report. Thus, indicating headings and sub-headings that would be relevant to the final report, but where not all the content is included yet. Reference to ‘short reports’ (Tasks 2, 3) mean 3 to 5-page write-ups only – no longer requested from OKASEC. Task due dates move on with approx. 15 to 20 days due to later inception date. New date schedule proposed in Framework. Key deliverable is the Member states meeting in 1st week in March, for which Tasks 2 and 3 short reports and the Interview guide would have to be translated into Portuguese to facilitate engagement. At the above week in March, OKASEC will arrange an additional workshop day during the course of the March meeting while the member state representatives are in Botswana, for the above outputs to be presented. This visit was not costed for in the proposal budget and would be discussed for possible approval as an additional allowable expense. There are RBO workshops the last week in April/in early May in Namibia, where options can be endorsed. Another meeting is envisaged potentially in May 2018, for presentation to OBSC. If this presentation is the place where additional comments are to be received, additional professional days would be confirmed to incorporate these OBSC comments into the final report. Overlap between the UNDP project and this GIZ project is good, and the delayed time frame is therefore suitable. (The UNDP project inception is expected to be End Feb 2018). Based on the above there would be a move of the project finalization from mid April to mid/end May. The final report should have little text and most of the technical content/as much as possible in annexures; also, infographics are agreed to be made use of to support decision makers, rather than lengthy text. Invoicing confirmation: Invoices to be delivered as per contract, with the first one due submitted to GIZ by end Nov 2017. Invoicing delivery dates will have to be adjusted to conform with the extended time frame. Additional expenses related to additional meetings/workshops included would be confirmed before the meeting/workshop take place and invoicing adjusted accordingly.	MS – draft Framework MS MS MS/translator OKASEC /GIZ OKASEC decision MS	End Jan 2018 First week in March First week in March April, for May 2018 Final report

	Method and activities discussion: MS presented the method and time frame. The method was approved, with some items and focus areas being highlighted – see below. The time frame is adjusted to for with the delayed start of the project. VF noted that the deadline for the project may me moved to later – e.g. May, to accommodate the needed member state meeting attendance, discussions at the meeting, and subsequent later than originally anticipated finalization of the project deliverables. General discussion: It is noted that OKACOM has amplified its position beyond technical advisory purposes in the basin, towards increasingly considering transboundary implications wider than water resource management. This is a positive 'push on the envelope of transboundary cooperation and investment application. None of the above can be done effectively without information that can fill the gap: evidence-based decision making is a key need. This requires different levels of engagements with different ministries across political boundaries, and collaboration with other sectors where data originates from, e.g. economics and planning related. Recognition is given that there are limits to data sharing across sectors. Therefore, protocols are needed, and States have to remain sovereign. Where water resource data may be at a mature stage for sharing across state boundaries, even the limits of these sharing options has to be considered. The limits of what can be shared and how it can be shared would have to be explored. Different sectors and different levels of handling/using data have to be considered. NM noted the PURPOSE of data collection and sharing is what is important to consider – answering to 'what does the member states really want'. EC supported this and added that it need to be considered ito Transboundary water management. Narratives for each member state has to be created from the interview process. Information sharing and data sovereignty challenges may exist and current agreements in terms of data sharing is important to note. The key for OKACOM would be to address challenges that cannot be addressed at a national level in the member states themselves. In addition to the above, water allocation decision making processes and investment programmes/projects need access to relevant information. Therefore it is necessary to consider: ➢ What information, ➢ What type of data, ➢ How to share it and		

	➢ For what purpose the sharing of the information would be. Also: demand vs supply of data: data managers vs data users. These may have different needs. Considering what is 'data' and 'information': e.g. Hydrologic and Flow, but this is not ALL that is necessary to consider: Other data is as important, e.g. 'Vertical' models, and 'Horizontal" data e.g. spatial and land use data. Reports also require a proper repository – it is not only the raw data that needs to be housed. It would be necessary to interrogate the UNDP and EU projects and how these projects may link/collaborate and work together to support information and knowledge management. SM noted that hard-core modelling is already included under the EU decision support design so not to be duplicated here. VF posed the question whether this is just a data repository or whether the system will be more 'lively'. – this IKMS assessment will determine the need. There may not only be one recommendation – there may be more that are suitable and a hybrid of options are also possible. Capacity would have to be considered. Staff functions are envisaged to be filled for the next 4 years in OKACOM to support institutional functions & to institutionalize the programme. The functions would ideally support as follows: DSS role for "Data" Management, Communications person managing the 'Information' component, and the Policy analyst working at the "Knowledge" level of the IKMS pyramid. EC noted that synthesis of data is necessary in supporting users of the data to reach a decision – attempting to package it in a 'simple' format – not requiring decision makers to have to know raw data details and methods of analysis (e.g. hydrology) to make a decision on transboundary water management policy/practice. This assessment should find out how far technology can go to achieve this. It is recognized that there may be researchers and individuals involved as well as departments and custodians of data. Each group have different information needs. For example researchers would require rainfall and flood level data, whereas decision makers require synthesized data. Researchers may also require different data depending on their discipline/topic of research. It is never easy to cater for all. Other audiences include e.g. tourism, farming/agriculture, residents in urban areas, planners, water managers etc. These will all craft the information into something usable within their context. Thus the use of the data is also depending on who is crafting the resultant message/narrative. The question remains as to how much can be done		

	by ICT versus by humans, to generate each narrative. In the end the most important is that there is a system that can support multi-level administrative decisions, which will then filter through to a political level. Data custodian contact details and metadata would be identified as far as possible. VF noted that SEARCH functions would be most important, since that would assist different types of users to obtain the best possible information for their given purpose. The search facility should return applicable and accurate data, including metadata and 'where to find additional information' that may not be directly accessible from the search facility; it should also allow for a spatial/geographical extent- and content search. The system would potentially be a "Data clearing house" to ensure that data provided by the system is independent of external persons or capacities and the need for external persons/data administrator to manage the process – because after 4 years the future of staff capacity is unknown. The system should be robust and resilient, with strong elements of domestication and ownership in member states. Within member states there should be an institutional focal point, and NOT an individual person as focal point. Universities could be engaged e.g. the ORI Director Information Systems may be able to provide insight into what may or may not work. Also the Namibian Polytechnic / University of Science; as well as the University of Technology – Angola. Department Water Affairs (Botswana), and DWS South Africa can comment on the Ramotswa information management system process and efficiencies as example, which is considered to run institutionally well while being owned by multiple departments. A memorandum of understanding (MOU) already exists in Draft – this would be shared with MS. VF noted that the MOU / hydrological data sharing protocol, is being revised under the EU project – details to be shared. EC commented that data sovereignty issues have to be agreed in the form of a basic route of access to data, while at the same time transparency is needed and no hidden agendas can exist – the principles of engagement has to be clearly defined for mutual trust and honesty for genuine transboundary cooperation to be effective. The vision and demand for the system need to be clearly defined. Learn from LIMS where difficulties can be avoided. Pursue partnerships ito data sharing.	SM	End Jan 2018

	VF proposed the term IKMS for this 'system' to be referred to, at this time. ACTION: MS to incorporate the new time frame and noted focus areas in the Framework document. SM proposed to 'repeat' the desk survey items in the interview guide to provide effective background to interviewees. The guide will be informed by the literature review, and terminology definitions are nb.	MS MS	End Jan 2018
Agenda item 4: Reporting framework review			
	Review of framework: MS presented the framework, and it was accepted to be the format for the inception report. **Additional considerations** discussed in addition to the earlier general discussion include: There are 2 groups of stakeholders to be considered: those who GENERATE the information and those who use it to manage. Also to note: decisions are taken at a given scale, which may have to adjust based on the status quo 'on the ground' – basin-wide information may not be directly applicable to local conditions. This IKMS should cater specifically for basin management structures. NM noted that Needs and Gaps should be considered holding in mind other systems such as LIMCOM and the challenges and lessons learnt from those systems. A key result from this study should be a reason as to WHY a transboundary system is needed and why this project is being done. There is currently no Integrated water resource management plan for the basin, and some models need to still be domesticated. There is also data that is known to exist but not always known where it is housed/who the custodians are – e.g. ito climate or hydrological studies. In these cases it is necessary to know the need – whether the data is really needed, or whether it may remain as and where it is. The UNDP project will develop the IWRMP / SAP (Strategic Action Plan) – it may sometimes be called different names, but is essentially the same vision. It is the method that is important, as opposed to the terminology. Some comments on Data, Hardware, Software and Tools: OBIS is hosted in Hamburg – may have to be migrated locally. Proprietary data systems/software need to be identified and considered since it may impact the hosting of data/systems.		

	Contact detail sharing of stakeholders to be involved would be done closer to stakeholder engagement time, and protocols for contacting different stakeholders finalized. In the resultant output, infographics would be used as best possible to display status and recommendations, rather than using significant text content.		
Agenda item 5: Immediate next steps and dates			
	ACTION: Framework to be drafted and shared. Additional contacts details to be shared. Letters of introduction from ministries to be provided, for purposes of stakeholder connection/engagement – e.g. Ministry of Energy and Water in Angola: These letters would be for sectors as well as member states overall.	MS SM OKACOM	End Jan 2018
Agenda item 6: Next meeting date			
	Proposed date: Mid Feb 2018 – To commence initial stakeholder engagements	Date to be finalized between MS, BH and OKACOM	
	Early March: member state meeting date to be finalized and attendance of MS/BH to be considered. Work on a 30 min discussion with persons from each member state, on an additional day to be added to the overall meeting, for discussion of this project and its purpose & outputs and details involved in the needs and gaps assessment. Interpreters and equipment will be available already at this meeting but may need to be extended for the additional day. This approach would gain more value than using e.g. online survey processes.	OKACOM	Confirm in Feb, for March
Agenda item 7: Meeting closure			
	EC thanked everyone in attendance for a productive meeting and truthful discussions from a technical point of view. He thanked GIZ for being supportive and flexible in their approach and putting OKACOM in the driving seat of the project and providing the space for engagement.		
	SM thanked GIZ for investing in this scoping process and not investing 'straight away' in the system, thus ensuring that it may create ownership right from the start.		
	NM confirmed that this inception meeting was a good foundation to build the project on.		
END			

Approved by:

_____
Name Surname
OKASEC
Date: ____ February 2018

APPENDIX F: Historical stakeholder contact details

Table 2 - IRBM Partners and Roles

PARTNER	ROLE
	INTERNATIONAL
SIWI – World Water Week	Assisted OKACOM organize a symposium on transboundary river basin management and organized local tours for OKACOM commissioners at World Water Week – 2006.
Uhl and Associates	With EPMSO consultants, conducted initial assessment of hydrological monitoring in Kuando Kubango and Huambo provinces for design of OKACOM—Angola hydromet program.
US Forestry Service – International Programs; Department of Agriculture	Partnered on Forestry Assessment of Kuando Kubango Province, training of regional technical staff for vegetation and forest inventory, and training of Namibian foresters in fire management.
World Wildlife Foundation – USA and Namibia	Collaborated with IRBM to design a complementary project to disseminate lessons learned from Namibia LIFE program to a regional platform. Project funded by USAID Washington.
	REGIONAL/BASIN LEVEL
Elephant Pepper Development Trust (EPDT)	Provided training in cultivation and care of elephant chili peppers for Mucusso and Dirico communities. Provided follow-up monitoring and training for locally-identified extension staff.
EU—SADC Foot and Mouth Project	Partnered on the development, preparation and implementation of a workshop aimed at integrating TFCA programs with animal health issues. FMD Project designed and hosted workshop in Kasane, while IRBM provided facilitation and logistical support.
Every River Has Its People Project (ERP), financed by Sida	Collaborated on the design and implementation of a socio-ecological survey of Kuando Kubango province in 2005. Assisted IRBM with exchange visit of Angolan NGOs and community members to community conservation trusts in the Kavango Region.
GTZ – Transboundary Water Management in SADC Program	Collaborated closely on organizing and funding three regional workshops to strengthen capacity of transboundary river basin organizations. Co-developed and co-financed consultancies aiming to prepare RBO guidelines for technical aspects related to managing river basins.
KAZA TFCA Secretariat	Facilitated the establishment of a KAZA Working Group for Communities to institutionalize advances made through an IRBM-supported process to develop a consultation approach for KAZA. Participated in IRBM facilitated workshops on consultation, and coordination of TFCAs and animal health with the SADC region.
OKACOM	Major IRBM partner – provided programmatic guidance, participated in all activities and contributed technical advisors and in-kind contributions to all aspects of IRBM programming.
SADC Directorate for Infrastructure and Services – Water Division	Recipient of IRBM funds and support for RBO capacity-building program consistent with Protocol on Shared Watercourses. Supervised the organization of three regional RBO workshops, designed and supervised consultancies to prepare guidelines aimed at strengthening RBO capacities, and designed and uploaded website and information management program.
Sida Regional Transboundary Water Programme	Collaborated on establishment of the OKACOM Secretariat. IRBM provided interim secretariat services to OKACOM, facilitated legal framework for establishment of Secretariat, and financed part of its start-up phase, while Sida financing first three years of the Secretariat's operations. Sida consultants and Interim Secretariat collaborated closely on development of financial management and procurement guidelines and preparation of grant documents for Sida financing.
UNDP – FAO GEF Environmental Protection and Sustainable Management of the Okavango River Basin (EPSMO)	Co-funded several initiatives within the basin, including partnering on design and rehabilitation of 12 hydromet stations in Angola. Assisted OKACOM with preparation of data sharing protocols and closely coordinated with IRBM and OKACOM on key aspects of the biodiversity, hydrology and institutional task forces.
	NATIONAL
ANGOLA	
ACADIR – Angola	Local NGO operating in Kuando Kubango. ACADIR was the main local partner for implementation of community-based program in Menongue. IRBM provided both technical and administrative/financial training to strengthen ACADIR's capacity.
Bairro Azul Community Development Group	Provided staff, managed financial accounts, supervised logistics and labor for construction of demonstration improved pit latrines.
Direcção Nacional de Agua (DNA) – Angola	Served as main implementation partner in Angola. Implemented rehabilitation program for hydromet stations and partnered with IRBM, provincial government and Pandera community on key technical support needs.
Dirico Municipality – Angola	Provided oversight and logistical support to the biodiversity program in Mucusso. Assisted in implementation of land tenure and land access assessment conducted in 2009.
Governo Provincia do Kuando Kubango – Angola	Through the Departemento Provincia de Agua (DPA), provided technical assistance and equipment for Pandera and Kangamba/Lumeta, and through the Departemento do Ambiente, monitored process & results of Mucusso field inventories.
Instituto Desenvolvimento do Florestal (IDF) – Angola	Assisted with implementation of Kuando Kubango forest assessment and training programs for field forest inventory within the Mucusso coutada.
Kangamba – Lumeta Community Development Group	Provided staff, managed financial accounts, supervised logistics and labor for construction of tourism infrastructure, such as craft stalls, car wash, and garbage collection.
Menongue Municipality	Contributed technical and commercial resources to support solid waste management activities in Kangamba Lumeta and Bairro Azul. Also provided oversight to the entire community-based environmental management program, through a local reference group.
Ministério do Urbanismo e Ambiente (MINUA)	Through an MOU with IRBM and the Provincial Government of Kuando Kubango, provided guidance on the processes of conducting biological, land use and socio-ecological assessments of Mucusso coutada, and preparing a proposal to enhance the protected area status of southeastern Angola.
Mucusso Communa – Angola	Administration provided extensive administrative support and logistical backstopping to IRBM field-team in Mucusso. Monitored IRBM community-based activities, facilitated necessary approvals to work in southeastern Angola, and arranged community meetings.
National Biodiversity Strategy and Action Plan (NBSAP) Project	Partnered with IRBM on a biodiversity consultation meeting for Kuando Kubango province, and assisted in getting approval from the Government of Angola for IRBM activities within Mucusso; consistent with NBSAP objectives.
Ndumbo Community Development Group	Provided staff, managed financial accounts, supervised logistics and labor for forestry and agriculture projects.
Pandera Community Development Group	Provided staff, managed financial accounts, supervised logistics and labor for public works rehabilitation.
Shamue Community Association	Main community partner in Mucusso, representing communities along the Kubango River in Mucusso. Responsible for managing chili pepper human-elephant conflict (HEC) program and constructing the Mucusso community center. Members of the association participated extensively in trainings and field inventories for mammals and vegetation, and in socio-ecological assessments.

World Vision International – Angola Program	Grant partner for implementation of community-based environmental management program in Menongue Municipality. Developed and implemented IRBM program in four communities in Menongue. Mentored local NGO and liaised with local government. Provided complementary technical and financial assistance in small-scale
	sustainable agriculture projects in the same communities. Leveraged additional resources – both physical equipment and finances for community development groups.
BOTSWANA	
Attorney General's Chambers	Worked with the Ministry of Finance and Development Planning towards registration of the Tropical Forestry Conservation Fund as a limited company under the Companies Act.
BIOKAVANGO Project	Assisted as member of OKACOM OBSC and Biodiversity Task Force.
Centre for Applied Research	Prepared guidelines for Water Allocations and Benefits Sharing and Funding of River Basin Organizations.
Department of Environmental Affairs – Ministry of Environment, Wildlife and Tourism (MEWT)	Participated on OBSC and Biodiversity Task Force. Provided guidance in linking biodiversity developments to the Botswana situation, and integrating with ODMP. MEWT was one of main ministries involved in development of the Botswana Tropical Forestry Conservation Fund (Forest Conservation Botswana), and IRBM assisted with registration of the fund as a non-profit company in Botswana.
Department of Water Affairs – Botswana	Participated on the OKACOM OBSC and Hydrology Task Force. Also, participated in training and demonstration activities related to water resources monitoring.
HOORC – University of Botswana	Through MOU with IRBM, provided senior-level research staff in support of the development of a vegetation map of Mucusso, and assisted in training inventory staff at a regional training course in March 2007.
IUCN – Botswana	Using Botswana Trust Funds, through IRBM, organized and conducted a CBNRM Workshop to identify and highlight issues, opportunities, and constraints for community-based natural resources management in Botswana.
Ministry of Finance and Development Planning	Served as lead agency for introduction and development of Botswana Tropical Forestry Conservation Fund. IRBM provided legal assistance with registration of the fund as a limited company under the Companies Act.
Okavango Delta Management Plan (ODMP) Implementation Program – DEA Regional Office – Maun	Provided technical guidance as member of OKACOM OBSC and Biodiversity Task Force, particularly with respect to bringing the experiences of ODMP to-scale in the larger basin-wide context.
Solahart – Botswana	Contractor installing solar systems for the Sankuyu Community Trust and the Mucusso Community Center.
Somaraleng Tikologo	Installed solar systems for the Sankuyu Community Trust and the Mucusso Community Center under contract with IRBM.
NAMIBIA	
CONSERV – Namibia	Installed solar systems in 5 community campgrounds, forestry centers, or environmental clubs at local schools in the Kavango Region.
Integrated Rural Development and Nature Conservation (IRDNC) – Namibia	Assisted with exchange visits between conservancies and indigenous groups in Namibia with counterparts in Angola.
Kavango Regional Council – Namibia	Expressed interest in demonstrating participatory land use planning exercise in the Kavango Region. Coordinated results of land use planning with Ministry of Lands (MOL) in Windhoek and MOL representatives in Rundu.
Ministry of Agriculture, Forestry, and Water; Department of Water Affairs – Namibia	Served as the lead agency on OKACOM—Namibia. Hosted IRBM Country Coordinator, who acted as lead focal point for OKACOM—Namibia. Established office in the Ministry and provided administrative support for Country Coordinator and several interns from Polytechnic of Namibia. Through the Department of Forestry, co-facilitated regional Fire Management training with IRBM and the USFS.
Ministry of Environment and Tourism (MET)	Served as the main environment agency on OKACOM. Representatives from MET participated on OKACOM Biodiversity Task Force and OBSC. Coordinated in training and exchange visits between Angola and Namibia under the IRBM project.
Ministry of Lands and Resettlement (MLR)	Actively participated and monitored consultative land use planning pilot in Kavango Region.
Namibia Nature Foundation (NNF)	Provided and supported Country Coordinator for Namibia. Organized, developed and implemented consultative land use planning exercise in Kavango Region. Assisted in installation of solar systems at five sites in Kavango Region.
Polytechnic of Namibia	Provided interns who conducted research on forestry, community use of natural resources and tourism potential of eastern Kavango Region with IRBM support and mentorship.

APPENDIX G: Stakeholder details from OKACOM Stakeholder Integration Strategy (2009)

Selected features of the document, relevant to this report, is included below:

TABLE 1 CUBANGO-OKAVANGO RIVER BASIN STAKEHOLDERS - THE TABLE DEPICTS THE CLUSTERS THAT WERE ADOPTED BY PARTICIPANTS AT THE CONSULTATION WORKSHOP:

Business	Civil Society	Government	Media	Academic	Donor	Regional and international stakeholders
Power Utility*	NGO	Regional Governments	Press/Media	Scientists	International Funding Institutions	e.g. UN, SADC
Tourism	CBO/VDC	District Water Management		Educator/Teacher		
Mining	Youth Groups	Municipal/ Council Government		Student		
Construction		Municipal/ Council Waste Dept.				
Agro-Industry	Conservationists	(national and local government)				
Factory Farmer	Basin wide forum	Water management parastatal				
Irrigation Farmer		Conservationists				
Health care provider	Health care provider	Health care provider				
	General community	OKACOM				

Lessons learned from KAZA:

1.04.1.2 Stakeholder Classification

Similar to the OKACOM process, KAZA classified their stakeholders. However, instead of using levels of importance, a matrix (Figure 1) that helped identify the degree to which stakeholders were affected and their of impact was applied using the following criteria:

- Key Players;
- Those that need to be actively consulted;
- Those whose interest should be maintained; and
- Those who only need to be kept informed.

Figure 1 KAZA Stakeholder classification matrix.

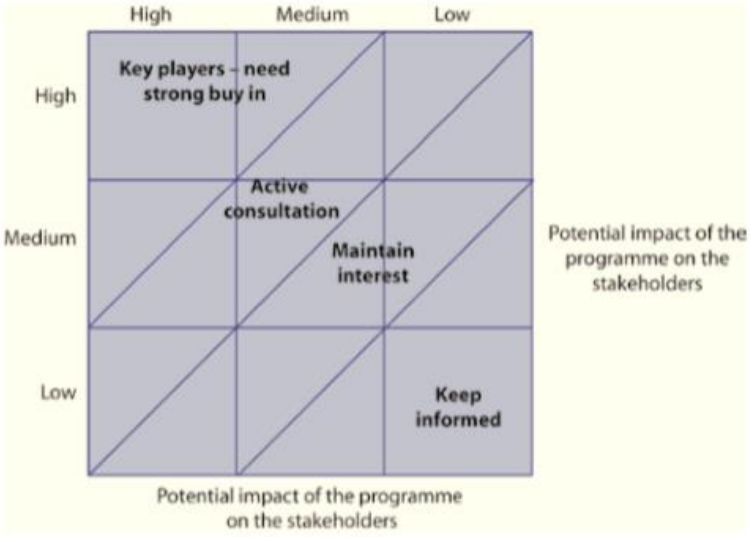


TABLE 2 CUBANGO-OKAVANGO RIVER BASIN STAKEHOLDERS AS ADOPTED BY PARTICIPANTS AT THE CONSULTATION WORKSHOP.

1. Private Sector	2. Civil Society	3. Government	4. Media	5. Academic	6. Donor	7. Regional and international stakeholders
Power Utility*	NGO	Regional Governments	Press/Media	Scientists	International Funding Institutions	e.g. UN, SADC
Tourism	CBO/VDC	District Water Management		Educator/Teacher		
Mining	Youth Groups	Municipal/ Council Government		Student		
Construction		Municipal/ Council Waste Dept.				
Agro-Industry	Conservationists	(national and local government)				
Factory Farmer	Basin wide forum	Water management parastatal				
Irrigation Farmer		Conservationists				
Health care provider	Health care provider	Health care provider				
	General community	OKACOM				

Figure 2 Matrix used to cluster stakeholder roles in the OKACOM.

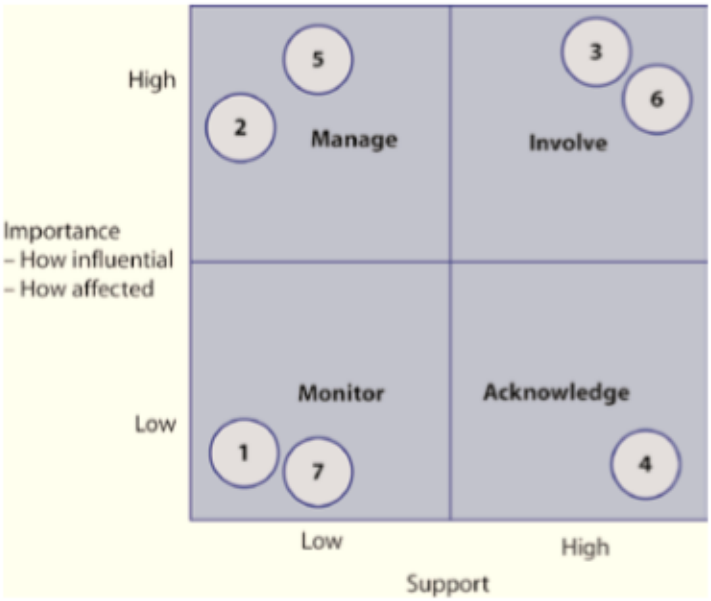
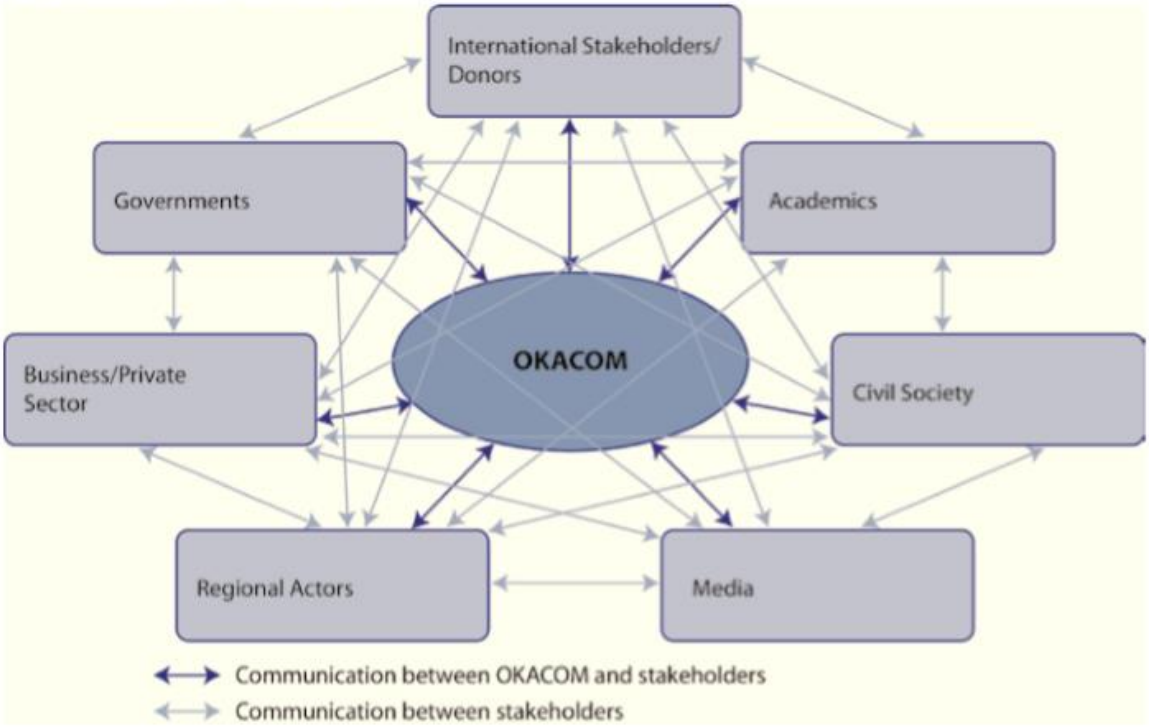


Figure 3 Stakeholder Integration Network.



APPENDIX H: Stakeholder details from OKACOM Stakeholder Integration Strategy (2012)

Selected features of the document, relevant to this report, is included below:

1 Private Sector	2 Civil Society	3 Government	4 Media	5 Academia	6 Donor	7 Regional and International Bodies
Power Utility	NGO	Regional Governments		Scientists	International Funding Institutions	SADC
Tourism	CBO	District Water Management		Teachers		UN
Mining	Youth Groups	Municipal Government		Students		
Construction	Conservationists	National Government				
Agro-Industry	Basin Wide Forum	Parastatals				
Factory Farmer	Communities	OKACOM				
Irrigation Farmer						
Health Care Provider						

OKACOM Stakeholder Integration Strategy Final Draft, 2011

5.1.1 Access to Relevant Distributed Information Sources

Information sources relevant to OKACOM's work are widely distributed:. They include:

- Internal knowledge assets
- Research results
- Monitoring data
- Community consultation
- Global best practice.

5.1.1.1 Internal knowledge assets

The first best source of knowledge for OKACOM is in OKACOM. The Commission's members are chosen for their experience and expertise in natural resources management – together they represent a formidable source of knowledge valuable in managing the Basin. But like many organizations, OKACOM does not really know what it knows. Capturing the tacit knowledge of Commission members is a key element of OKACOM's knowledge strategy. A first step has been collection of biographical information that shows that wealth of experience of Commission members. The strategy will also include production of accessible issue papers based on interviews with Commission members. Testimonials from credible sources like Commissioners and OBSC members can go far in enhancing acceptance of a management approach, or research results. Speaking engagements and media interviews for the Executive Secretary and Commissioners should allow for question and answer sessions and for some degree of debate. On OKACOM's web site, three minute videos of Commissioners talking about current issues will allow this first-hand experience to be more widely shared.

OKACOM's retired Commissioners are also a key element in its information and communications strategy. A living source of institutional memory and experience, these elders will be invited and encouraged to take part in OKACOM activities and events.

5.1.1.2 Research results and monitoring data

OKACOM develops research partnerships to fill needed gaps and take advantage of new knowledge. A recent example is the cooperation with the University of Botswana's Okavango Research Institute in relationship to flood monitoring. While research exposes pockets of usually very narrowly defined data, government shoulders the burden of ongoing collection of environmental and social data year after year – data that OKACOM needs for big picture planning. Under-resourcing and lack of good communications tools often isolate and discourage the collectors of this data, and often breed mistrust and reluctance to share it. OKACOM's strategy is to encourage and facilitate quality in data collection and monitoring

APPENDIX I: Tracking inputs received

Title	Name	Surname	Email Address	Phone Number	Geography	Context	OKACOM introduction made	Questions sent	Response	Contact format	Inputs Received
Dr	Ebenizario (Eben)	Chonguica	ebenc@okacom.org	+267 6800023	OKACOM	OKASEC (Executive Secretary)	Yes	Yes	Yes	In person	Yes
Mr	Sekgowa	Motsumi	sekgowa@okacom.org	+267 680 0023	OKACOM	OKASEC (Programme Coordinator)	Yes	Yes	Yes	In person	Yes
Ms	Shirley	Selolwane	shirley@okacom.org	+267 6800023	OKACOM	OKASEC (Records officer)	Yes	Yes	Yes	In person	Yes
Ms	Olerato	Ramodimo	olerato@okacom.org	+267 6800024	OKACOM	OKASEC (Finance and Administration officer)	Yes	Yes	Yes	In person	Yes
Mr	Ignat	Ivanov	ignat@maintenancerus.co.bw	+267 72 222 171 / +267 74 774 090	Botswana	OKASEC (IT Support) -- MaintenanceRUS	Yes	Yes	Yes	In person	Yes
Dr	Nkobi	Moleele	nkobi.moleele@undp.org / nkobi.moleele@gmail.com / nmoleele@resilim.com	+267 3181750	OKACOM	UNDP secondment to OKACOM	Yes	Yes	Yes	In person	Yes
Ms	Pauline	Mufeti	pmufeti@yahoo.com / paulina.mufeti@mawf.gov.na	+264612087191 / +264 812500094	Namibia	Hydrological Technical Committee / Deputy Director of Hydrology, Ministry of Agriculture, Water and Fisheries	Yes	Yes	Yes	Skype Call	Yes
Mr	Carlos	Andrade	calucarlos@yahoo.com.br	+244 222 010447 / +244 92 3308210	Angola	OBSC and Biodiversity Task Force Member. GABHIC, Angola State Secretariat for Water	Yes	Yes	Yes	Completed Questionnaire	Yes
Mr	Pako	Modiakgotla	pkmodiakgotla@gov.bw	+267 3607158 / +267 72531796	Botswana	Hydrological Technical Committee / Water Resources Engineer/Hydrologist,Dept. of Water Affairs	Yes	Yes	Engaged during workshop 12 April		
Mr	Mike	Murray-Hudson	mmurray-hudson@ori.ub.bw / mmurray-hudson@ub.ac.bw		Botswana	Senior Research Sholar, Okavango Research Institute (ORI)	Yes	Yes	Yes	Via E-mail	Yes
Mr	Masego	Dhliwayo	MDhliwayo@UB.AC.BW	+2676817243 (ORI office)	Botswana	GIS Chief Technician (OBIS)	Yes	Yes	Yes	In person	Yes
Mr	Phera	Ramoeli	pramoeli@sadc.int		SADC	Acting Director for the Directorate for	Yes	Yes	Engaged during workshop 12 April		

						Infrastructure and Services at the SADC Secretariat					
Ms	Tracy	Molefi	tsmolefi@gmail.com / trsmolefi@gov.bw	+267 397 2274	Botswana	National Coordinator for River Basin Organizations	Yes	Yes	Yes	electronic	Yes
Ms	Cynthia	Ortmann	cynthia.ortmann@mawf.gov.na / cortmann.co@gmail.com	+264 61 208 7158	Namibia	Deputy Director of Water Environment	Yes	Yes	Engaged during workshop 12 April		
Ms	Anastchia	Makati	Makatia@UB.AC.BW		Botswana	Namibia University of Science and Technology (NUST)	n/a	Yes	Yes	In person	Yes
					Angola	Universidade Agostinho Neto	Attempts resulted in no connection established				
					Angola	University of Quito-Cuanavale	Attempts resulted in no connection established				
					Namibia	Namibia Nature Conservation	Attempts resulted in no connection established				
					Namibia	Desert Research Foundation of Namibia (DRFN)	Attempts resulted in no connection established				

APPENDIX J: Attendance register: 12 April 2018

OKACOM
Assistance to Implement the SADC Protocol on Shared Watercourses by the Permanent Okavango River Basin Water Commission's Member States'

Participants list
Regional Consultation Workshop
12th April 2018
Fairgrounds, Gaborone

giz
RBMsolutions
Vienna-Austria

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Name	Institution	Phone	Email address	Signature
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APPENDIX K: Internal needs identification

The details presented below reflect on the internal needs identification:

Data storage and the OKASEC server

1. HARD COPY DATA STORAGE

Historical records of varying nature (reports, memorandums, financial records) are kept in the Server room, in a file cabinet with cabinet contents identifiable via a well organised document management system. The document management system is organised via a .xls spreadsheet where every box and its contents are recorded in the spreadsheet, and each box is numbered according to its position in the cabinet/on the rack (Figure on the right). Unfortunately, a number of boxes have gotten misplaced during the OKASEC office move from Maun to Gaborone. For example, two boxes can be seen missing from the bottom of the cabinet in the figure hereafter.

Figure: Hard copy records storage cabinet

Figure: Additional hard copy documents in OKASEC offices

In a room alongside the Server room, another set of documents are housed. These documents include popular magazines, reports and generally non-confidential materials (left hand side, Figure on the left), as well as copies of project reports, books and other similar documents (right hand side, Figure on the left). The document management of this section seems to be less structured than that of the cabinet that is kept in the server room, with room for improvement in providing visitors the ability to easily find information that they may want to access.

In Maun, the office used to have a research section where users/visitors were able to access data, records and information about CORB. This option does not exist and it would be beneficial for the facility to be resurrected. Such facility would then provide access to digital data and information in addition to these hard copies – especially digital data that is not available online or in the public domain.

2. OKASEC SERVER

The OKASEC server room contains a purpose-built cabinet that houses the server. There seem to be a number of additional drives connected to the network – not in a particularly neat fashion – as can be seen in the figure on the right. Access to the server room is not particularly secure (with a window to the outside potentially providing external access to the room), although the computer that runs the server requires an administrators' password for access.

Figure: Server and external hard drives

3. SERVER ROOM SAFETY AND SECURITY

The server room has a fire alarm installed, with serviceable powder-based fire-fighting equipment easily accessible to the left-hand side of the door (centre image). To the far right of the server room is the water-based fire-fighting equipment for the office.

Figure: Fire alarm and fire-fighting equipment

None of the staff have to date been trained in the use of the equipment and they are not aware that the equipment to the left of the server room door is specifically to be used in/for the server room in case of a fire. This means that a mistake may be made where the water-based equipment could be used in the server room by uninformed persons. To this end, it is proposed that selected, or even all staff, are provided basic fire-fighting training that is specific to the OKASEC office.

Folder structure, management and security issues[1]

1. FOLDER STRUCTURE AND FOLDER MANAGEMENT

Server backups

An unaccounted-for number of documents are saved on the staff's personal computers and are either not backed up at all, or backed up on an ad-hoc basis by staff individually. The server had not been backed up for a significant amount of time at the time that the first site visit and stakeholder engagements for this project were conducted. However, after discussion with the IT service staff, backups have been made. The need for saving of files from personal computers onto the server, as well as continued backup of the server must be prioritised as a matter of urgency.

Folder naming/structure and Folder Management Protocol

The figure below shows the primary folder structure for OKASEC as it exists on the server. The folders that do not conform to the standard naming convention and structure (indicated in the red circle) present a challenge in that is the file structure is not well organised and thus difficult to search and assess in terms of relevancy to OKASEC and its stakeholders. After the entire server is backed up and the backup kept in safe storage (i.e. not over-written), these folders should be analysed, and moved/deleted/merged into the standard folders structure.

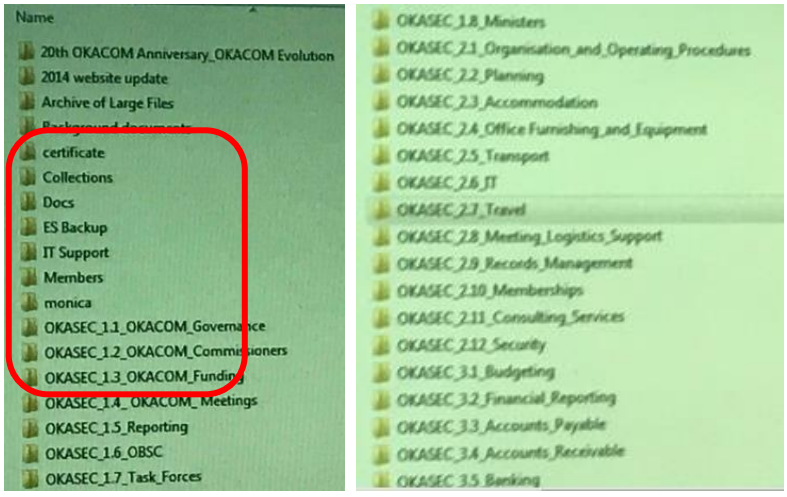


Figure: Primary folder structure – to be cleaned up

The folder naming/structure is reported to be effective, however only the Records Officer, and to some extent the Finance and Administrative Officer, have knowledge of where to find which information. In order for staff to save information from their personal computers onto the server, they will have to be briefed and 'trained' in how the folder structure works. There is no documentation related to the folder structure. It is recommended that a basic administrative guide or "Folder Management Protocol" (FMP) is developed by the OKASEC Records Officer, that would a) keep track of the folder details and contents and b) assist in

[1] The figures in the table show screenshots of some of the folders and files that exist on the OKASEC server. These files are what Ms Ramodimo saves onto the server.

informing new staff, auditors or stakeholders who have direct interest in certain folders, with accessing the necessary data related to their requirements.

When comparing the folder structure to the requirements stipulated in the OKACOM Information and Communication strategy (OKACOM, 2012), there is a disjuncture between what the key communication needs and related documents are, versus how documents are stored/accessed. The disparity makes it potentially difficult to a) ensure that the communication is done effectively, and that the checklist can be assured and b) keep track of records related to the communication process and progress. A cleaner and clearer alignment between the Strategy (*ibid*) and the reality is needed.

Sub-folder names/structure

Sub-folders are generally well named. However, folder names are sometimes duplicated between levels for no apparent reason as can be seen in the figures below. These could be removed, to support a 'cleaner' folder structure.

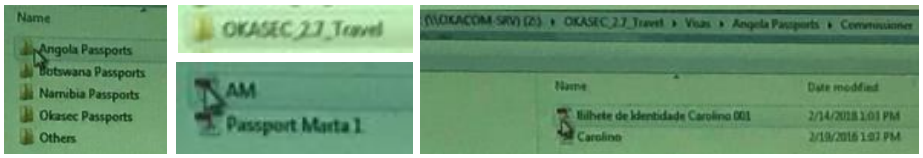


Figure: Examples of sub-folder names and contents (a) – inconsistent file naming

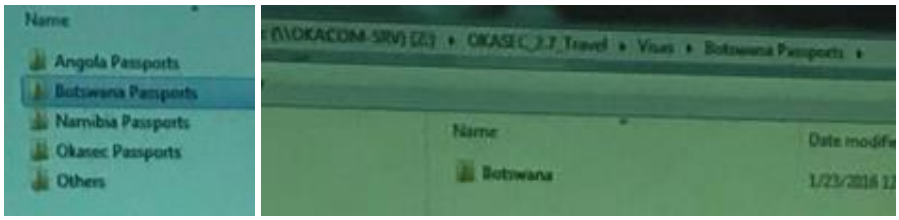


Figure: Examples of sub-folder names and contents (b) – unnecessary sub-sub folder name

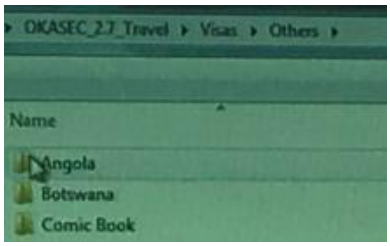
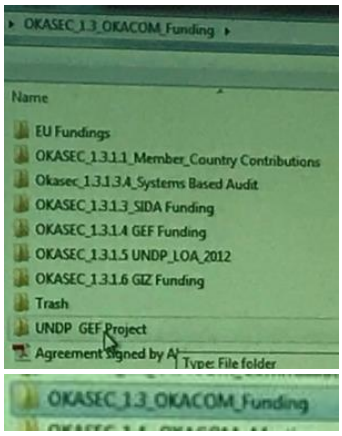


Figure: Examples of sub-folder names and contents (c) – potentially irrelevant folder/information



The figure below shows the existence of some strangely named folders in the folder structure: in this case "Comic Book", which makes the user wonder what this folder contains. If this is indeed valid OKACOM information, there is need to record this so that the folder is not by mistake deleted as perceived to contain potential irrelevant information.

Sub-folder numbering and naming does not seem to be consistent across the folder structure. The figure above, for example, shows the existence of sub-numbering, while other folders do not have the same format/naming protocol. The use of spaces versus "_" is also inconsistent across sub-folder naming, which can be improved on.

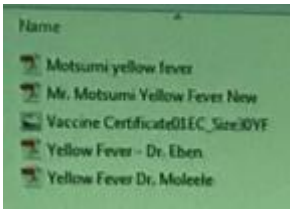
Figure: Examples of sub-folder names and contents (d) – inconsistent folder naming

File naming convention

The figures hereafter show examples of file names. To ensure consistency and the easy location of files, there is a critical need for standardised file naming across the OKASEC digital data repository. If files are not named well, it cannot be easily categorised or found during retrieval processes. The naming convention has to take into account elements such as:

- Origin,
- Project,
- Date,
- Editing body/person,
- Versioning, and
- Language (e.g. English/Portuguese).

The file naming convention has to be recorded and implemented, to support current and especially new staff to save files in a manner that make them easily search/retrievable.



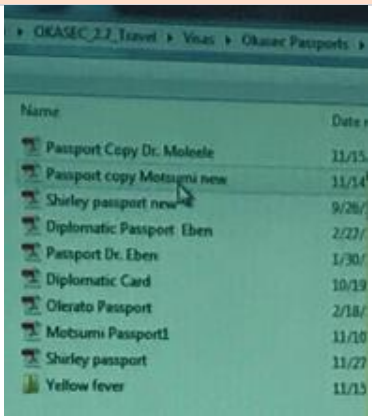


Figure Examples of file naming (a) – inconsistent file naming

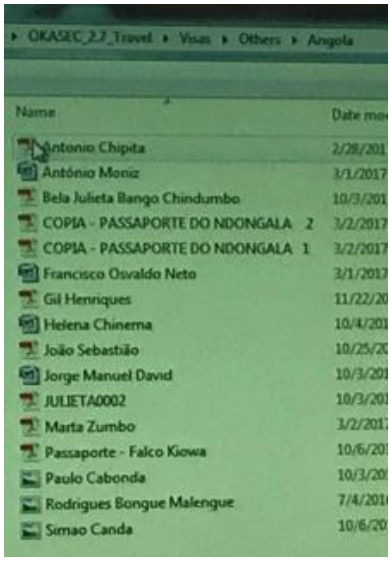


Figure: Examples of file naming (b) – 'Angola' folder, containing primarily Portuguese files

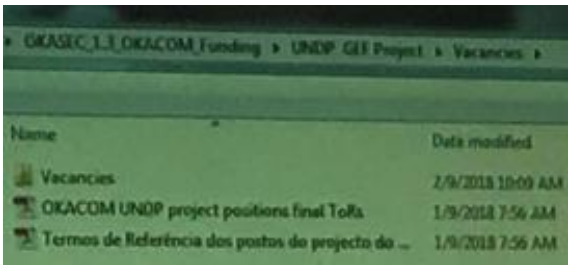


Figure: Examples of file naming (c) – Files of English and Portuguese language contained in a folder

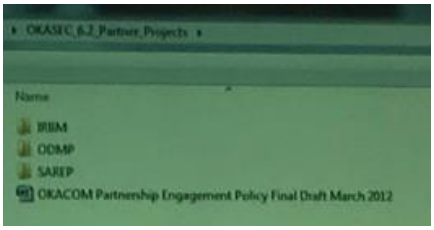


Figure: Examples of file naming (d) – Agreements/engagement policies/MoU's

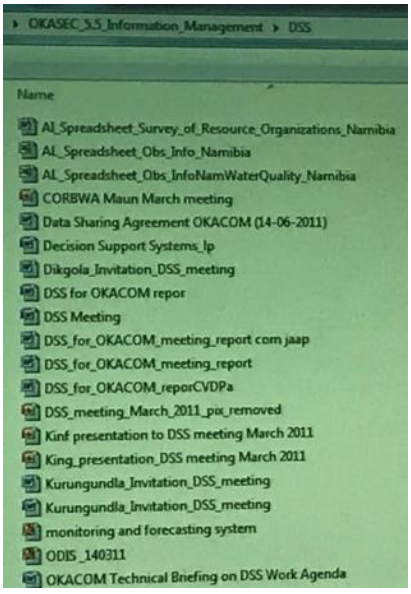
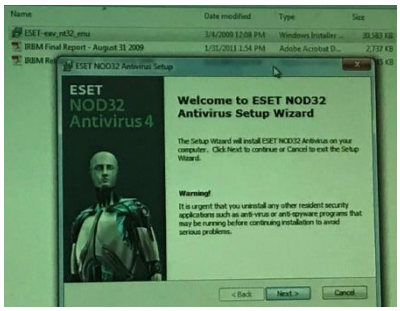


Figure: Examples of file naming (e)

Agreements/engagement policies/Memorandums of Understanding (MoU's) are across the system not named in a similar manner. This makes searching for these very important types of documents particularly challenging.

It is proposed that these documents are a) named in a similar manner and b) hosted in such a way in the folder structure (even if new folder(s) should be designed to host these documents) that the documents are easily accessible and identifiable

General folder and file clean-up



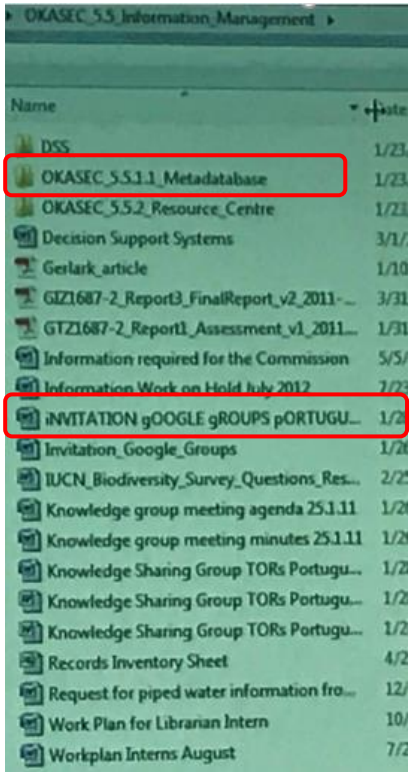
There is a need for overall clean-up of the folders, with removal of files that are irrelevant. An example of one of these are an antivirus program that is either still useful but just located in the wrong folder, or that should be deleted (as seen hereafter). Such a clean-up process will reduce the size of the server contents to be backed up frequently.

Figure: Examples of files to be assessed for relevancy/usefulness/applicability

Metadata

There is some level of metadata maintenance in the system. However, a general clean-up and ordering of the information is needed. The figure hereafter shows numbering inconsistencies and file naming convention requirements that were alluded to earlier, and the figure below shows an example of potential financial information that is contained in an inappropriate folder.

The documents containing 'metadata' is not always consistent with what can be referred to as 'metadata', but rather information that can in fact be considered 'raw data', or as input to GIS spatial data layer(s):



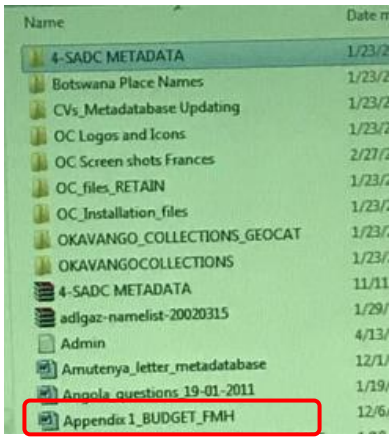
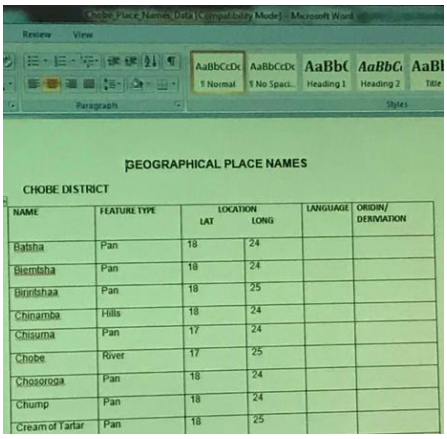


Figure: Metadata existence showing folder name standardisation and files potentially saved in inappropriate folders



GEOGRAPHICAL PLACE NAMES

CHOBE DISTRICT

NAME	FEATURE TYPE	LOCATION LAT	LOCATION LONG	LANGUAGE	ORIGIN/ DERIVATION
Batsha	Pan	18	24		
Biemtsha	Pan	18	24		
Birintshaa	Pan	18	25		
Chinamba	Hills	18	24		
Chisuma	Pan	17	24		
Chobe	River	17	25		
Chosoroga	Pan	18	24		
Chump	Pan	18	24		
Cream of Tartar	Pan	18	25		

Figure: Example of document containing 'metadata'

Figure: Metadata and examples of need for folder numbering attention and file naming edits required

Record distribution

There is currently no method to manage requests for access to information held by OKASEC, nor record of distribution of information. This is very important to address to ensure that the correct version of documents are shared at the appropriate time, with relevant stakeholder(s).

2. FOLDER AND FILE SECURITY

There is currently 'blanket access' for all staff who has a login in the OKASEC office and who are connected to the OKASEC network, to the server. OKASEC staff has personalised passwords, however these may not be sufficient to secure especially sensitive information on the server (for example data related to finances). It is necessary that folder-level security is added, as well as permissions toward read/write access, for selected folders and selected staff. The decision as to what levels of security is required where should be done once there is a better understanding of what each of the folders contain.

APPENDIX L: Detailed technical specifications in terms of hardware and software infrastructure

The implementation options include a combination of possible platform (server) configurations as well as various levels of software implementations to make up the OIKMS. The proposed combined implementation options are described in Section 3**.** The hardware platform (infrastructure) and software options are described below.

Infrastructure

Since the OIKMS is proposed to be a centralised repository of information and knowledge, the platform (server software), the server hardware and the internet availability will play a significant role in the OIKMS success.

Internet enabled functionality is key to the requirements of the OIKMS. Unfortunately, internet access will a be a limiting factor for all designs of the system. Although rapidly improving, widespread broadband internet access is still a challenge in some of the MSs and the design of the system should take this into account. Since the server will host all the functionality of the system, specification of the server and the access to broadband internet will be key. Potentially the OIKMS will have to be able to share documents and data over the internet and the selected server should have access to the best possible internet access for both upload and download capabilities. Future ICP projects deliverables or monitoring data from Member States should be uploadable to the system from anywhere in the world without server timeouts due to slow internet connections.

Some of the main considerations when deciding upon the best platform for the OIKMS are as follow:

Capital costs: New servers are expensive and existing servers also need upgrades to processors, memory and storage after a few years. Cloud hosting on the other hand, is more customisable and costing options are accordingly flexible.

Server room: For security and cooling purposes, servers need dedicated space. This space is available at OKASEC, however could be managed more securely (refer to this report re: e.g. fire emergency training).

Maintenance skills and costs: Depending of the server software, upgrades are often required since software companies limit the support life time for each version of software, requiring organisation to upgrade the server software due to security concerns. Updating of existing server software is also required for security reasons and, although open source server software and its' updates are free, the skills availability to maintain these types of servers are limited. Firewall, anti-virus and malware software and maintenance are always crucial once organisational data is placed online. A big consideration would be to make use of an encrypted security key for the site which eliminates much of the security problems related to a webserver, but costs more. Onsite and off-site backup is required at regular intervals which also can be done remotely, given adequate internet bandwidth, Maintenance of all server software is usually achieved by annual IT maintenance contracts or by

in-house ICT resources. Cloud hosting enables involvement of skills external to the organisation, although internal ICT skills would remain a requirement.

Internet access speed and uptime: The biggest constraint with the development of the OIKMS is the availability of adequate internet access at OKASEC. Since OKASEC will be the custodians of all the data produced by and for OKACOM (no matter where the data is ultimately stored) the staff need to have adequate internet access to ensure efficient and effective information and data management. A dedicated line with at least 4 to 8 Mbs speeds would be required at OKASEC, especially if the OKASEC Server is to be used to host the OIKMS. The current internet speed is not feasible to support an OKACOM-hosted OIKMS but there are already current efforts to investigate improving the access speed.

The following approaches were considered in the implementation options:

(a) OKASEC Gaborone Server

Currently the OKASEC Server is only used for shared internet services, e-mail, anti-virus software distribution and for intranet purposes where the project folders house all project data produced by OKASEC. The OKACOM website is hosted on a 3rd party server and uploads to the website is done remotely from OKASEC and is currently the primary way in which documents and data are shared externally to the organisation.

To partly or fully host the OIKMS, the server hardware will have to be improved or the server will have to be totally replaced. There a several options for this from using the server as it is currently, to replacing the server completely. The current server specifications are as follow:

- HP Proliant ML 350 G9;
- Intel Xeon E5-2609 v3 1.90GHz 6 core Processor;
- 16 GB Physical RAM;
- 4 x 1 TB HDD RAID 5, Total storage 4TB;
- Windows Server 2012 R2 Standard; and
- The server is maintained through ad hoc IT support, and no formal Server Maintenance Contract exists.

Under the current configuration the server is still adequate for its purposes, however an annual service contract is required to ensure that proper long-term functioning and protection of the data on the system. In addition, the discussed security upgrades and other recommendations for the server room should be implemented. The need for hardware upgrades to the server will depend on the software and services that are chosen to be hosted on the server.

If it is decided to invest in the OKASEC Server via upgrades or replacement the need for a server maintenance contract is of even higher importance to ensure security on the webservice and to restore the webservice after potential break-ins. Upgrades to the server hardware, such as additional memory modules or additional processors, will depend on the number of Virtual Machines (VMs) that need to be created on the server to host services such as website hosting, a document management system and possibly a geo-server for spatial data.

The spatial data geo-server might only be hosted if the server is completely replaced with a higher specification server due to the intensive resources requirements for this service.

The one of the benefits of hosting some to all the functions of the OIKMS on the OKASEC Server is that there will be direct access by OKASEC staff to the system via the server intranet which will contribute towards the ease of the maintenance of the system by OKASEC staff.

(b) ORI Server Hosting

The ORI provides range of GIS, web- application development, hosting and training services to students of the University of Botswana (UB) and governmental departments. The Institute has several servers that are maintained by capable staff and that are partially financially supported by UB.

The ORI have been hosting products such as the Okavango Basin Information System (OBIS) and the Okavango Delta Information System (ODIS). OBIS is opensource software which houses thematic timeseries data, spatial data and documents from OKACOM ICP projects, of which The Future Okavango project is the main example. The project looked at ecosystem functions and services within this trans-boundary basin.

The ODIS is a database that supports the maintenance of the Botswana Okavango Delta Management Plan (ODMP) and makes use of ESRI software for spatial data display and storage of multiple datasets for multiple Botswana governmental departments. The datasets stored are all related to the management and planning for the Delta.

The institute therefore already have most of the hardware and software required with a dedicated IT team to maintain the servers and software, although the hardware would do well with some improvement/upgrade. The current internet connection at ORI is reported to be reliable and at least of reasonable speed. The current hosting activities suggests that it may, be adequate to host the OIKMS.

There are two options for making use of the ORI services:

- Host the OIKMS (or parts of it) on ORI Servers and invest in the upgrading of their infrastructure: Just as OKASEC would invest in upgrades to the OKASEC Server, they might decide that it would be more suitable to contribute towards ORI server upgrades or replacements since they already have some support and know-how to maintain the servers. If this is the case, then all options and costing for the OKASEC Servers can be substituted with ORI Servers. This option has one requirement that is not yet in place, but that may be met through a partnership with The Nature Conservancy – Africa Region: that of a dedicated GIS specialist to clean up existing data, and support development and sharing of data via the ORI server. In addition, a MoU must be designed between OKACOM and ORI that clearly define the relationship and responsibilities. This Option is provisionally considered to be cost-effective for the medium term, especially if staff secondment can indeed be arranged/agreed upon.
- Make use of ORI as a 3rd party hosting service provided with an annual service contract (see (c) for more details): The other option would be for OKASEC to make use of ORI hosting services like they would use any of the other commercially available service providers where all services are included in

an annual service contract. In this way there wouldn't be a requirement for capital contributions over time which should be included in the service contract annual pricing. If this is selected as an option, the comparative costs used in the Implementation Options for 3rd Party Hosting services should be the costs that should be associated with this service.

(c) 3rd Party Hosting Service Providers

The total cost of owning and maintaining organisational IT infrastructure is dependent on several factors including:

- What workload the server should be able to deal with;
- The number of databases;
- The size of the digital storage required;
- The network it should be supporting;
- Storage and electricity costs; and
- IT labour costs.

In the recent past there has been a growing trend (especially for smaller organisation) to move away from the expense of maintaining IT server infrastructure and knowhow and rather paying annually for "cloud storage" or Virtual Private Servers (VPSs). VPSs has the benefit that organisation does not have to keep on with costly capital layouts for upgrading of servers and the IT Support that it requires. All normal server maintenance, security, internet access and backup functions are included in the price, including in most cases 24/7 support services. Currently OKASEC is already making use of a 3rd party hosting company to host the okacom.org website. Making use of VPS service providers are very cost effective for smaller organisations that do not have access to ongoing capital investments.

Closing remarks regarding infrastructure

All OKASEC server and OIKMS functionalities can be hosted elsewhere, with very limited networking and perhaps intranet services remaining on the OKASEC Server with the current ad hoc maintenance structure. Even services like Exchange Server for e-mail can be hosted by Microsoft itself through the Office 365 Enterprise suite, which makes the management of e-mail accounts and enabling of Teams and Groups easy.

In summary there are the following pros and cons when it comes to 3rd party hosting:

Pros	Cons
No need for onsite hardware or capital expenses. Well suited to rapidly growing companies that may outgrow their infrastructure too quickly.	The user experience is limited by the speed of the Internet connection.
Easily scalable; can be added to as needed. Solutions are often on-demand, so you only pay for the options you want.	Third party cloud services could have direct access to your data.
Workers can connect from anywhere, using any computer, tablet, or smartphone. Companies can implement BYOD (bring your own device) policies.	If the Internet goes down on your side or on your cloud provider's side, you won't have access to any of your information.

Data can be backed up in the cloud as regularly as 15-minute intervals, minimizing data losses in disaster situations.	The costs can outweigh the benefits for companies not as dependent on uptime.

The pros and cons when it comes having in-house servers are as follows:

Pros	Cons
Gives you physical control over your server.	Requires a capital investment in hardware and infrastructure.
Keeps critical data in-house; no third party has access to your information.	Requires space in your office for rack space or a server room/closet, as well as dedicated IT support.
No need to rely on an Internet connection for access to data.	May be more susceptible to data loss during disaster situations due to in-house location. How often you take the data offsite will reflect how much data you'll lose in an emergency.
Can be more cost-effective for companies that are not as concerned about uptime.	No uptime guarantees.

Software

This section will discuss the different software that needs to be considered for functionality of the OIKMS. This includes day to day operation software (such as e-mail) which is key to proper knowledge management in an organisation. The software required for the OIKMS is discussed at the hand of the following:

- General Networking Services;
- Document Management System;
- Thematic database;
- Spatial Data Server; and
- Knowledge Management Tools.

Except for the general Networking Services, it is proposed to make use of open-source software for the development of the OIKMS and the costing reflects this. Open-source software comes at no charge, but often requires slightly more development costs. However, all software (free or not) needs to be installed, updated and populated with data, which makes the total implementation costs roughly the same. It is not recommended to pay per user for the OIKMS functionalities since this is a long-term solution that can be cheaply solved by existing freely available technology.

a) General Networking Services

The OKASEC Server has been supporting staff with all their day-to-day ICT requirements. It has been previously stressed that the internet access is the key to any future development of the OIKMS and will not be elaborated on her further.

Currently the server software and backup functions are done on an ad hoc basis. However, it is essential that if it is decided to invest further in this server that a server maintenance contract could be signed with a service

provider to ensure security of the data and uptime of the services. Many different software packages will be installed during the development of the OIKMS and the server support will be required to assist with this.

E-mail is key to any organisation and especially for proper Knowledge Management. Currently OKASEC email is provided through an Exchange Server on the OKASEC Server. The implementation options provided here suggests that there are many benefits in moving to the online Office 365 Exchange Services. This service functions the same to the users (typically through Outlook on PCs and Laptops) but have a multitude of additional advantages. The per user signup adds applications such as Sharepoint, Skype for Business and Teams, all focusing on knowledge management concepts of collaboration and team integration. It also allows the client to have direct control over their e-mail accounts. Sharing of calendars and customer (stakeholder) information is seamless and all this functionality will be available over all platforms (Windows, Android, OS etc). Best of all, OKASEC might qualify as a non-profit organisation which means that all these services will be made available free of charge. Office 365 Enterprise E1 or E3 seems the best solutions, with the latter including all Office 2016 applications for free.

Regarding the OKACOM Website: the website is currently hosted external to the organisation and documents are uploaded remotely from OKASEC to the site. During the implementation options it is suggested that the site becomes either part of a bigger VPS or should be moved to the OKASEC Server and published from these. The latter will give OKASEC staff direct access to the website via the intranet which means that there will be no more need for e-mailing or FTP-ing of document to 3rd parties.

The current intranet (in addition to the OBIS at the ORI) is the main store of electronic copies of data and information generated by or for OKACOM. With the development of the different components of the OIKMS, the data from the intranet will be gradually migrated into the different sub-systems making this folder structure eventually redundant. A new functionality that will be required for the intranet is for the creation of personal folders for each staff member of OKASEC. The staff should be required to store all work-related data and information on their personal drive and not on their PCs/Laptops. These drives will then be automatically backed-up when the server is.

b) Document Management System

Document management systems are key to categorise, store, access and version control all type of organisational documents from reports, policy documents, strategies and more. With proper document management systems, the need for typical filing structures on an Intranet becomes unnecessary and the management of document become more effective.

There are countless document management systems available. One business software indexing site (https://www.capterra.com) list 488 different document management systems. There are countless features that can be evaluated on, but the main characteristics of the software should be at least be:

- Web-enabled;
- Categories;
- In text search;
- Visibility of documents set based on user profile;

- Version control; and
- Must have guest account for publicly accessible documents.

It is important to note that some of these systems have several knowledge management capabilities (except for search) which should be considered, including workflow and collaboration capabilities.

There are free opensource document management systems, as well as licenced own-server based and per user cloud-server based software. Since OKACOM is not a very large organisation the free open-source systems are recommended. This option will initially be costly to setup but will have no costs afterwards, except for updates that should be done now and again through the server maintenance contract, while the OKASEC staff keeps the system up to date via a normal web-browser. There will also be no limits to the number of users of the system.

The pay for options could possibly be considered, but a server-based system is preferred to a cloud-based system which requires a per user subscription, which makes publishing public documents tricky.

c) Thematic Databases

Integrated water resources planning, and management require a multitude of different datasets to assess the status and trends of water resources and the associated ecology, as well as all the infrastructure and socio-economic impacts. To support the planning and management of the Okavango Delta, several monitoring activities takes place by all the Member States and detailed multi-disciplinary studies is undertaken using data gathered from the Member States. At the end of such studies it is crucial to not only obtain the study finding summarised in the report but also to capture the data from which the conclusions were made. It is necessary to capture these datasets (which often is not published in reports) so that the information cannot only be reused in other studies but that updates can be done to previous studies without having to redo previous work. These types of data include:

- Historical and real-time hydrological data such flows, water depths, water quality, groundwater levels;
- Climatic data;
- Aquatic ecosystem data;
- Land- and water-use data such as irrigation data, point abstractions and return flows;
- Economic data;
- Census data and growth scenarios;
- Geological and soils data; and
- Infrastructure data.

This is a very wide range of different datasets to make provision for in thematic databases. This does not even include all the spatial datasets generated for each type of data.

Currently these datasets are stored mostly on the Intranet Project Folder at OKASEC, but also in the OBIS at the ORI which stores some of the previous ICP project outcomes. Three considerations for software solutions are discussed below:

i) Read-only Online Project Folders

As an initial option it is proposed that, when the webserver is migrated to the OKASEC Server, that Read-Only Project Data Folders are created in which the now Intranet based data store is published on the Internet for people to browse, in the same way that one would browse the intranet through, say, Windows Explorer, but via your web-browser. This will automatically provide access to all data, although the content can only be changed or updated by OKASEC staff.

ii) OBIS

The OBIS stores 177 spatial datasets as well, although viewing capabilities of the datasets are limited. The OBIS contain data on:

- Soils;
- Vegetation;
- Hydrology;
- Climate;
- Reports;
- Modelling Scenarios outcomes; and
- Software.

This illustrates the flexibility of the system to store different thematic datasets. Unfortunately, this system is not being maintained anymore and the opportunity to build on this fantastic work might be lost. Therefore, the reuse of this system as part of the OKIMS is the option that should be highly recommended. Depending on the decision of the platform that is going to be developed (OKASEC server, ORI Hosting or 3rd Party VPS), it is also recommended to migrate the system to the preferred platform.

The OBIS of course also have its shortcomings but improving it should have the most impact for the least cost and effort. However, it is difficult to find fault with this system and overall it is a well-planned and constructed database which might require some customisation and improved user friendliness. Some of these considerations are as follow:

- Previous and subsequent studies' data weren't captured in this system and knowledgeable resources will have to be assigned to populate the other datasets into this system;
- There is still a need to display and house real-time data which this system does not cater for. This is one of the key requirements that all the Member States have identified;
- Some types of datasets are not catered for, but it seems simple enough to make provision for depending on the complexity of the backend of the system;
- Although document can be stored, no contextual search inside of documents are allowed for;
- The system allowed for the storage of personal and organisational data which should rather be housed in a separate more suitable system which access control etc.;
- To better integrate the system into OKACOM, the look and feel of the system might have to be changed to integrate with the rest of the OKIMS; and

- Due to the limited understand of the OBIS now, it is presumed that the GIS functionality is only usable within the system itself where other part of the OKIMS might also require web-based spatial information.

iii) HYDSTRA

HYDSTRA is the hydrological database that all member states use to store their monitoring data in. The database caters for flow, dams, climatic groundwater and other types of datasets. The option suggests that OKASEC purchases a copy of the software and integrate selected datasets (data that they feel comfortable with to publish) from each member state on an annual basis into the OKASEC server. Since MSs already have the same software the integration process will be seamless. HYDSTRA would also be remotely accessible so that any of the member states can upload their share of the data on an annual basis. The data can then be published on the internet via the OIKMS. MSs are reluctant to publish their hydrological data due to IT security issues at Governmental Departments, and due to some of the data not being of decent quality. However, only selected datasets need to be published, and initially only historical data. Near-Realtime data should eventually be the next step for drought and flood warning.

HYDSTRA is presented as an alternative option to OBIS, however it is not as flexible for all types of data as the OBIS is. HYDSTRA is also very expensive and requires an annual maintenance and support cost, which might be negotiable due to the limited use of the product in OKASEC's case.

d) Spatial Databases

As mentioned before, most of the OKACOM spatial dataset are currently stored in the Intranet Project folders or in the OBIS. The OBIS do have some viewing capabilities of ArcGIS shapefiles but it is not built primarily for this functionality. In the implementation options it is proposed that the data:

- remains in the customised OBIS, or
- that it is made available by ORI through their current ESRI Publishing software, or
- that an opensource GeoServer or GeoNode installation is done on the selected platform.

ORI has license agreements with ESRI to publish spatial data, which will also be the platform for the ODIS. If it is decided that ORI should take responsibility for OKACOM spatial data, and annual maintenance agreement will have to be signed with OKASEC to contribute towards the hosting of the data.

GeoServer and GeoNode are two opensource spatial server software solutions that could be implemented on the preferred platform and enable IOKMS users to not only store their spatial datasets but also to build online maps from the data. Although initial setup cost might be high, these systems will not require any significant maintenance. ICP consultants will be able to upload their spatial data after projects for OKACOM for reuse in future studies.

e) Knowledge Management Tools

There are many systems that are categorised as Knowledge Management Systems which usually only cover some parts of knowledge management. Once again Capterra.com lists 130 different Knowledge Management

Systems. Knowledge Management elements that would support the OKACOM Commissioners, OKASEC, the TRG and ICP consultants should be addressed in the selected functionality. This might include:

- Shared calendars;
- Shared contact lists;
- Project Management tools such as task and resource scheduling per project, project e-mail addresses;
- Web application development;
- Discussion forums;
- Meeting management applications – minutes, presentations agendas and meeting recordings;
- Work flow and business process analysis as well as decisions support applications; and
- Video-conferencing.

Once again there are free opensource software that could be customised for OKACOMs needs, or more expensive enterprise wide options and cloud-based services. Due to the size of the organisation a cloud-based system such as Microsoft's SharePoint would be appropriate. At a low monthly cost per user this Application Platform fully integrate with the Microsoft Office 365 suite of programs so that collaboration through Word, Excel and PowerPoint is seamless. Microsoft Exchange will share organisational contacts and calendars even on a per project basis. It also allows for application development that links up with most databases including spatial and other databases.

Knowledge Management software however will have to be scoped in more detail with OKACOM before a final decision is made on what the most appropriate technological enablers should be used. A definite recommendation is for the installation of a video-conferencing room at OKASEC. Technical meetings can then be held from OKASEC Offices (barring better internet connection) without the time and cost related to travel for meeting attendees. Video-conferencing is a well-established technology and the Office 365 Enterprise Suite includes Skype for Business which allows for the management of large virtual meeting. There are some start-up costs like the purchase of a dedicated PC, camera, speakers and projector/LED display for the meeting room.

APPENDIX M: Implementation Options

The details of each implementation option are provided in the three tables below. The options listed below are cumulative and not incremental in terms of costs. That means that costs indicated is for undertaking the specific implementation option in full. For Options B and C incremental costs can be derived from subtracting the costs from each other for capital and start-up costs. Service costs stay the same for all options for both incremental and cumulative options. HYDSTRA is provided as an option for replacing OBIS in Options C to F. In the implementation options the OKASEC server is referred to as the platform that is being upgraded or replaced, however it OKASEC decides to rather invest in the ORI's hardware for hosting of the OIKMS, then all costs and upgrades will be towards ORI servers.

Table: Platform considerations

Option	General Server Services					Online OIKMS			
	Networking (Backup, printing, security, internet access)	Email	Website	Intranet		DMS	Thematic Data	Spatial Data Server	KM Tools (Collaboration, Shared Contacts and Calendars, Video Conferencing, Teams)
				Work Folders	Project Data Folders				
Current	OKASEC	OKASEC	3rd Party (For ext doc sharing)	-	OKASEC	-	3rd Party - ORI (some project data)	-	-
Option A "Data Structuring"	OKASEC	OKASEC	3rd Party (For ext doc sharing)	OKASEC	OKASEC	-	3rd Party - ORI (some project data)	-	-
Option B "Light Upgrade"	OKASEC	OKASEC	OKASEC	OKASEC	Redundent	OKASEC	OKASEC (Online Data Folders	-	OKASEC (Some)
Option C "Upgrade+ORI"	OKASEC	OKASEC	OKASEC	OKASEC	Redundant	OKASEC	OKASEC (HYDSTRA/ Custom OBIS)	3rd Party - ORI	OKASEC (Some)
Option D "Upgrade+ORI+MS"	OKASEC	3rd Party (Exchange Online)	OKASEC	OKASEC	Redundant	OKASEC	OKASEC (HYDSTRA/ Custom OBIS)	3rd Party - ORI	3rd Party (Exchange Online, Sharepoint, Skype for Business)
Option E "Replaced+MS"	OKASEC	3rd Party (Exchange Online)	OKASEC	OKASEC	Redundent	OKASEC	OKASEC (HYDSTRA/ Custom OBIS)	OKASEC	3rd Party (Exchange Online, Sharepoint, Skype for Business)
Option F "Virtual Office with OKASEC Backup"	OKASEC (For Backup service)	3rd Party (Exchange Online)	3rd Party (CloudServer)	3rd Party (One Drive)	Redundant	3rd Party (CloudServer)	3rd Party (HYDSTRA/ Custom OBIS)	3rd Party (CloudServer)	3rd Party (Exchange Online, Sharepoint, Skype for Business)

Table: Support considerations for platform, software and other 3rd party services

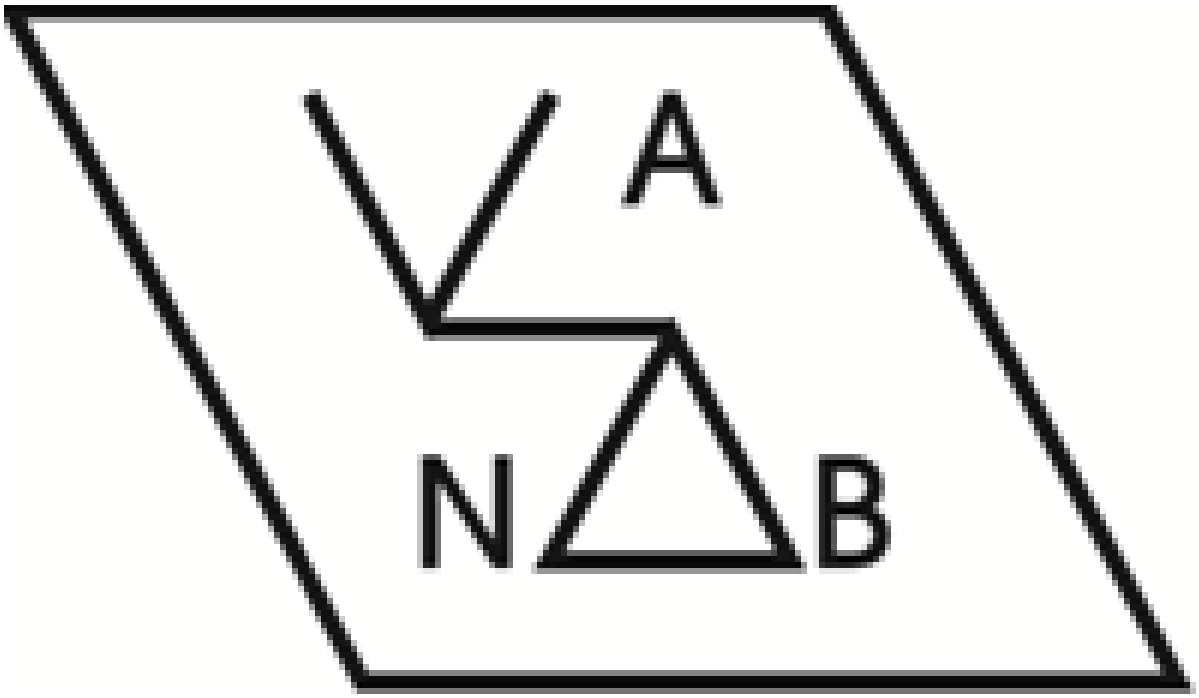
Options:			Current	Option A "Data Structuring"	Option B "Light Upgrade"	Option C "Upgrade+ORI"	Option D "Upgrade+ORI+MS"	Option E "Replaced+MS"	Option F "Virtual Office with OKASEC Backup"
Platform Maintenance Support (Security updates, Backups, Software Updates)	**OKACOM Server**		Informal external IT Maintenance and Support (server [project data folders and printing services], security, backups and e-mail software)	**Formalised** external IT Maintenance and Support Contract (server [printing, **personal** and data folders], security, backups, e-mail software)	Formalised external IT Maintenance and Support Contract (server [printing, personal and **online data folders**], security, backups, e-mail, **web publishing software**)	Formalised external IT Maintenance and Support Contract (server [printing, personal and online data folders], security, backups, e-mail, web publishing software)	Formalised external IT Maintenance and Support Contract (server [printing, personal and online data folders], security, backups, e-mail, web publishing software)	Formalised external IT Maintenance and Support Contract (server [printing, personal and online data folders], security, backups, e-mail, web publishing software)	Minimal IT External Maintenace and Support Contract.
	3rd Party Services	**ORI**	Free ORI Hosting Support for OBIS (all spatial and thematic data for 2 projects)	Free ORI Hosting Support for OBIS (spatial and thematic data for 2 projects)	Free ORI Hosting Support for OBIS (all spatial and thematic data for 2 projects)	Formalised Annual Hosting Support of Spatial Datasets at ORI	Formalised Annual Hosting Support of Spatial Datasets at ORI	-	-
		(Unknown) Website Hosting	Formalised external support contract (publishing and backup of website)	Formalised external support contract (publishing and backup of website)	-	-	-	-	-
		MS Office + Sharepoint Services	-	-	-	-	MS Office Enterprise Per User Subscription (Exchange, MS Office, Sharepoint, Skype for Business) - Online 24/7 Support included	MS Office Enterprise Per User Subscription (Exchange, MS Office, Sharepoint, Skype for Business). Online 24/7 Support Included	MS Office Enterprise Per User Subscription (Exchange, Sharepoint, Skype for Business, One Drive for Business). Online 24/7 Support included
		Cloud Server Services	-	-	-	-	-	-	Azure Annual Prescription (Webserver, DMS, Thematic Data and GeoServer)
Current IM	**Stakeholder Database**		OKASEC	OKASEC (Update Stakeholders Database and share with OKASEC members over network)	-	-	-	-	-
	Intranet Project Data Folders + Website Document Uploading		OKASEC	OKASEC (Standardise and update intranet folder structure, website documents)	-	-	-	-	-
OIKMS Development	**DMS**	**Initial**	-	-	External Consultant - Develop and initially configure DMS	External Consultant - Develop and initially configure DMS	External Consultant - Develop and initially configure DMS	External Consultant - Develop and initially configure DMS	External Consultant - Develop and initially configure DMS
		Ongoing	-	-	OKASEC - Upload documents	OKASEC - Upload documents	OKASEC - Upload documents	OKASEC - Upload documents	OKASEC - Upload documents

	Thematic Data	**Initial**	-	-	OKASEC (Online Project Data Folders to be publish through Server Support Contract)	External Consultant - Develop and initially configure OBIS/HYDSTRA	External Consultant - Develop and initially configure OBIS/HYDSTRA	External Consultant - Develop and initially configure OBIS/HYDSTRA	External Consultant - Develop and initially configure OBIS/HYDSTRA
		Ongoing	-	-	OKASEC (Update Online Project Thematic and Spatial Data Folders via the intranet to Webserver)	OKASEC/IDP Consultants (Uploads project based thematic datasets)	OKASEC/IDP Consultants (Uploads project based thematic datasets)	OKASEC/IDP Consultants (Uploads project based thematic datasets)	OKASEC/IDP Consultants (Uploads project based thematic datasets)
	GeoSpatial Server	**Initial**	-	-	-	OKASEC provides historical Spatial Datasets from IDP's Project to ORI for uploading. OKASEC+IDP provide/upload spatial datasets to ORI	OKASEC provides historical Spatial Datasets from IDP's Project to ORI for uploading. OKASEC+IDP provide/upload spatial datasets to ORI	External Consultant - Develop and initially configure GeoServer software and upload historical spatial data	External Consultant - Develop and initially configure GeoServer software and upload historical spatial data
		Ongoing	-	-	-	ORI provides ongoing support to the storage, upload and backup of spatial data from OKASEC	ORI provides ongoing support to the storage, upload and backup of spatial data from OKASEC	OKASEC and IDP Consultants upload spatial data to Geo-Server	OKASEC and IDP Consultants upload spatial data to Geo-Server
	KM Tools	**Initial**	-	-	OKASEC (Publishing of stakeholder contacts and shared calendars for Commissioners and TTTs Online to be done through Server Support Contract)	OKASEC (Publishing of stakeholder contacts and shared calendars for Commissioners and TTTs Online to be done through Server Support Contract)	External Consultant (Setting up Exchange Online and migrate stakeholder database. Configure Sharepoint utilities for OKASEC. Setup Skype for Business at OKASEC Conference room). Train OKASEC how to manage Exchange + Sharepoint	External Consultant (Setting up Exchange Online and migrate stakeholder database. Configure Sharepoint utilities for OKASEC. Setup Skype for Business at OKASEC Conference room) Train OKASEC how to manage Exchange + Sharepoint	External Consultant (Setting up Exchange Online and migrate stakeholder database. Configure Sharepoint utilities for OKASEC. Setup Skype for Business at OKASEC Conference room) Configure One-Drive/Intranet -Azure. Train OKASEC how to manage Exchange + Sharepoint
		Ongoing	-	-	OKASEC (Update Online Stakeholders Database and shared Calendars)	OKASEC (Update Online Stakeholders Database and shared Calendars)	OKASEC (Maintain new users and groups for sharing of documents and web-publishing and blogs.	OKASEC (Maintain new users and groups for sharing of documents and web-publishing and blogs.	OKASEC (Maintain new users and groups for sharing of documents and web-publishing and blogs.

Table: Estimated capital and start-up costs, as well as annual services costs

Cost	Item	Description	US$					
			Option A "Data Structuring"	Option B "Light Upgrade"	Option C "Upgrade+ORI"	Option D "Upgrade+ORI+MS"	Option E "Replaced+MS"	Option F "Virtual Office with OKASEC Backup"
Initial capital and startup costs (once-off)								
Capital	OKASEC Server	Improvement to the current server to handle additionaal Vitual Machines (VMs) to host website, thematic data and GeoServer configurations. This includes additional memory, more storage and additional processors.	-	400,00	1 000,00	1 000,00	4 500,00	-
	Video Conferencing Facility	Basic PC, Camera, Directional Microphone, Speakers, Projector/LED Display. Estimate $1500	-	-	-	1 500,00	1 500,00	1 500,00
	HYDSTRA^	Single Seat - $11250	-	-	11 250,00	11 250,00	11 250,00	11 250,00
Consultants	OKASEC Server	Installation, configuration and population with historical data of different components of OIKMS on any platform*. Estimated costs: Online Shared Folder and shared Stakeholder Database - $1000; DMS - $4000; Thematic Database (customised OBIS) - $4000; GeoServer - $5000; KM Tools (Full) - $2500	-	5 000,00	8 000,00	8 000,00	15 500,00	15 500,00
	HYDSTRA^	Initial Configuration - $7500	-	-	7 500,00	7 500,00	7 500,00	7 500,00
Total (Excluding HYDSTRA)			**-**	**5 400,00**	**9 000,00**	**10 500,00**	**21 500,00**	**17 000,00**
Total (With HYDSTRA excluding OBIS))					**21 250,00**	**22 750,00**	**33 750,00**	**29 250,00**
Annual Services Costs								
Server Maintenance	OKASEC Server	Annual Contract: $1200 per month (Setting up and maintenance of all networking, security, backups, e-mail, web publishing, intranet, share folders)	Ad hoc	3 700,00	3 700,00	3 700,00	3 700,00	Ad Hoc
3rd Party Services	Current OKACOM.ORG hosting	The website is currently hosted by 3rd party services. Current costs are unknown.	1 500,00	-	-	-	-	1 500,00
	ORI	Contributions towards the hosting of spatial datasets on ESRI publishing software licenses. Estimated annual fee.	-	-	1 500,00	1 500,00	-	-
	MS Office 365 Enterprise E1	Includes Exchange for Business, Sharepoint, Skype for Business etc. $8 /user/month. For non-profit** - Donation only. 5 OKASEC, 3 Commissioners, 9 Technical team members (IDP could add accounts per project). For this estimate working with 20 users.	-	-	-	1 920,00	1 920,00	1 920,00
	Virtual Private Servers	VPS service providers located in Botswana. Ranges between $31 to $120 per month. Estimated $50 per VM per month.	-	-	-	-	-	1 800,00
	HYDSTRA^	Annual license fee for support and updates = $5625, however might be negotiable since product will not be that frequently used.	-	-	5 625,00	5 625,00	5 625,00	5 625,00
Total (Excluding HYDSTRA, Non-Profit Registration for MS)			**1 500,00**	**3 700,00**	**5 200,00**	**5 200,00**	**3 700,00**	**3 300,00**
Total (Excluding HYDSTRA)						**7 120,00**	**5 620,00**	**5 220,00**
Total (With HYDSTRA excluding OBIS, Non Profit Registration for MS)					**10 825,00**	**10 825,00**	**9 325,00**	**8 925,00**
Total (With HYDSTRA excluding OBIS)						**12 745,00**	**11 245,00**	**10 845,00**

* - Additional cost will apply when moving already installed components from one platform to another.
** - Organizations in Botswana must be registered as non-profit organizations or trusts with the Department of Civil & National Registrations or the Registrar of Deeds.
^ - HYDSTRA is an optional consideration, but is recommended since all Basin States use this system for all hydrological datasets which makes integration optimal. HYDSTRA would be an alternative to the customisation of the OBIS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