



Biodiversity Information Management Forum 2013

Briefing report

Table of contents

SECTION 1	Background	2
1.1	SANBI mandate	2
1.2	Partner organisations and the “managed network”	3
1.3	SANBI’s Biodiversity Information Management	3
SECTION 2	SANBI INFORMATION SYSTEMS	4
2.1	Lessons from the International workshop	4
SECTION 3	Stakeholders.....	5
3.1	Internal: SANBI user needs analysis.....	5
	Structural requirements of the system:.....	5
	Content requirements of the system:.....	5
3.2	Analysis of data requests	7
SECTION 4	Current baseline architecture	8
4.1	Current Architecture/IT System Description	8
4.2	Information standards	10
4.3	Publication standards.....	10
4.4	Cataloguing standards	10
4.5	Policies	10
SECTION 5	Principles.....	11
5.1	Business Principles	11
5.2	Data Principles	11
5.3	Application Principles.....	12
5.4	Technology Principles	13
5.5	Architecture Principles.....	14

SECTION 1 Background

This report provides background information to the 2013 Biodiversity Information Management Forum (BIMF), and background reading and supporting documentation relevant to topics for discussion at the workshop.

The purpose of the workshop is to:

- Develop a shared national vision of a biodiversity information system for South Africa through understanding partner organisations biodiversity informatics needs;
- Evaluate the achievements and identify the structural and content gaps within the South African National Biodiversity Institutes (SANBI's) current biodiversity information systems;
- Share lessons from international partners;
- Determine priorities and investigate ways to mitigate limitations;
- Develop an implementation framework;
- Establish roles and responsibilities of partners;
- Agree on governance and communication;

The framework emerging from the workshop will guide both the content and process of engagement with partners around the development of a biodiversity information system and feed into SANBI's Biodiversity Information Architecture Strategy.

1.1 SANBI mandate

The National Environmental Management: Biodiversity Act of 2004 established SANBI with the mandate to play a leading role in South Africa's national commitment to biodiversity management. According to the Act, the Institute must (among other things) collect, generate, process, coordinate and disseminate information about biodiversity and establish and maintain databases in this regard. This places information management at the core of SANBI's mandate. SANBI performs this function from information and knowledge generated within the institute and its partner organisations.

SANBI's mission is to champion the exploration, conservation, sustainable use, appreciation and enjoyment of South Africa's exceptionally rich biodiversity for all people.

SANBI reports to the Department of Environmental Affairs against the following key performance areas:

- Manage and unlock benefits of the network of National Botanical Gardens.
- Provide scientific evidence to support policy and decision making relating to the conservation and management of biodiversity and the impacts of climate change.
- Co-ordinate and provide access to biodiversity information and scientific knowledge.
- Provide science-based policy tools and advice for the effective management of biodiversity assets and ecological infrastructure.
- Drive human capital development, education and awareness in response to SANBI's mandate.
- Render effective and efficient corporate services for SANBI.

1.2 Partner organisations and the “managed network”

SANBI has adopted a “managed network” institutional model which consist of partner organisations, institutions and bodies with whom SANBI has (or should have) formal agreements that contribute towards delivering on SANBI’s mandate.

The purpose of the managed network is to allow SANBI to achieve its strategic goals and objectives, through developing a set of structured relationships with a range of strategic partners in the public and NGO sectors. In addition, the managed network allows SANBI to harness and engage with the extensive range of biodiversity expertise in South Africa, as well as to draw on organisations who may not currently see themselves as directly involved in the biodiversity sector but who have relevant knowledge, skills and experience to contribute to achieving biodiversity goals. The ultimate aim is to encourage greater efficiency in the use of scarce resources, to improve sharing of information and knowledge, and to harness South Africa’s Biodiversity capacity towards national goals.

1.3 SANBI’s Biodiversity Information Management

SANBI has made significant investments in developing large biological information resources and assembling this information into accessible databases. A range of systems, tools and policies have been developed in response to identified needs over time. The data and information is used to support research, planning, decision-making, policy formulation and monitoring the status and trends in biodiversity.

SANBI’s biodiversity information management work programme is executed by SANBI’s Biodiversity Information Management (BIM) Directorate.

BIM’s 5 year strategic objectives (2013 – 2018)

1. Mobilise 5 million priority records of biodiversity data and information;
2. Create a following of 50 000 users and observers of biodiversity data and information and 10 % trained in management and application of data and information;
3. Have 10 post-graduates actively engaged in biodiversity informatics through the Centre of Excellence at the University of the Western Cape.
4. Have 100 % of SANBI’s digital information available online with 5 tools / services to support contributors, mangers and users of biodiversity information.

SECTION 2 SANBI INFORMATION SYSTEMS

SANBI currently maintains disparate information systems it developed, inherited or adopted. These systems provide valuable data, information and tools, but do not capitalise on the potential knowledge that can be generated through effective system integration.

The objectives of an integrated biodiversity information system are:

1. A modular, integrated system;
2. Supports SANBI's biodiversity reporting and monitoring functions e.g. National Biodiversity Assessment (NBA) Report;
3. Digital information to be available online with low effort for data capture and maintenance;
4. Manages all biodiversity information;
5. Support researchers; planners, conservationists, policy and decision-makers; and,
6. Reusable, high-quality, cost-effective and evolvable system.

2.1 Lessons from the International workshop

In February 2013, SANBI hosted a five day workshop with international organisations and countries to learn from their experiences in designing innovative biodiversity information systems. Represented at the workshop were countries such as Brazil, Mexico, Australia, Colombia, Denmark, Costa Rica, United Kingdom, United States of America, and international organisations such as the Global Biodiversity Information Facility (GBIF), Biodiversity Heritage Library (BHL) and the International Barcode of Life (iBOL).

The workshop emphasised the importance of partner organisations, which will contribute to, and benefit from the system, to be on board throughout the process. This BIMF initiates the process of working with partners to develop a vision and framework.

Key recommendations made at the Information Architecture Workshop include:

- SANBI must lead the development of a shared national biodiversity information vision for all role-players;
- Key to implementing a new system is the clear articulation of institutional, policy and regulatory environment for biodiversity information management;
- The need for national policy on biodiversity data standards and on the commercial use of biodiversity data;
- GBIF to take up the need for global initiatives such as Encyclopaedia of Life (EOL), GBIF and BHL to work towards greater synergy as this would have a positive impact at a national level; and,
- Strengthen the global network of partners that can support SANBI with the implementation of SANBI's new architecture.

The full report of the workshop has been distributed to workshop participants.

SECTION 3 Stakeholders

3.1 Internal: SANBI user needs analysis

A user needs analysis was conducted to determine SANBI's biodiversity information requirements. This was achieved via a web-based survey, workshops and discussion groups.

Priorities for the system should be guided by the SANBI's mandate and areas where SANBI is currently working and providing leadership. SANBI requirements of an updated, integrated system from internal processes are summarised below.

Structural requirements of the system:

- A single user point of entry which builds on the established brand, the Biodiversity Advisor;
- Data from any place in the system is accessible from any other place in the system – interoperability. SANBI's core data is species data and Geographical Information System (GIS) data and there should be seamless movement between these areas;
- There should be consistent branding across the system;
- Advanced and simple search functions across the system;
- Complete and accessible metadata;
- Transparent versioning with history maintained;
- Feedback from stakeholders is built into the system allowing tracking of usage and facilitating data quality feedback;
- Security built into the system;
- Data can be downloaded, uploaded and interrogated; and,
- A flexible, modular system that can grow.

Content requirements of the system:

1. Species data builds on a taxonomic backbone (morphological, biological and phylogenetic), with agreed taxonomic names, with links to enrichment data. Currently species data is held in a number of different SANBI websites and all the information should be available from one place. Species includes plants, animals and fungi across terrestrial and marine environments. Species enrichment data includes:
 - Description
 - Common names
 - Threat / conservation (local conservation ordinance) status
 - Sensitive data
 - Invasive / endemic / indigenous / exotic / naturalised
 - Legislative information – TOPS, CITES
 - Occurrence data (integrated with ecosystem data)
 - Species assessments – population levels, demographic data, historical distribution
 - Phenology
 - Behavioural ecology
 - Use (medicinal and other)

- Life stages
 - Images
 - Checklists¹
 - Genetic sequencing
 - Literature and publications (BHL)
 - Links to spatial and ecosystem data
 - Links to relevant external websites
2. Ecosystem backbone
- Descriptions (terrestrial and marine)
 - Conservation status
 - Interactive maps
 - Relevé data
3. Spatial data
- Land-use decision making tool with links to reports
 - Conservation / biodiversity plans
 - Species lists for land parcels
 - Landcover / land-use
 - Layers inform SANBI reporting requirements e.g. monitoring
 - Municipal summaries (currently available on SANBI's Biodiversity Geographic Information System (BGIS), being updated by mid-2014)
4. Species Identification (tool currently under development)
5. Citizen science
- iSpot is an established and effective tool and should be integrated into the new system
 - Phenological data could be generated through a Climate Watch type tool and would be valuable to SANBI
 - Environmental Impact Assessment (EIA) tool has been developed by SANBI and generates information from EIA professionals
6. Crowdsourcing – potential to outsource tasks to a distributed group of people (e.g. capture of herbarium labels)
7. Biodiversity information that is available across a plethora of SANBI websites such as the Biodiversity Advisor, BGIS, South African Biodiversity Information Facility (SABIF), Cape Action for People and the Environment (C.A.P.E.²), Succulent Karoo Ecosystem Programme (SKEP³), Grasslands and Maputaland-Pondoland-Albany Hotspot (MPAH) should be consolidated into the

¹ For additional reading regarding checklists see

- Hamer, M., Victor, J., Smith, G.F. (2012). Best Practice Guide for Compiling, Maintaining and Disseminating National Species Checklists, version 1.0, released in October 2012. Copenhagen: Global Biodiversity Information Facility, 40 pp, ISBN: 87-92020-48-8, Accessible at http://www.gbif.org/orc/?doc_id=4752.
- Nozères, C., Vandepitte, L., Appeltans, W., Kennedy, M. (2012). Best Practice Guidelines in the Development and Maintenance of Regional Marine Species Checklists, version 1.0, released on August 2012. Copenhagen: Global Biodiversity Information Facility, 32 pp, ISBN: 87-92020-46-1, accessible online at http://www.gbif.org/orc/?doc_id=4712.

² The Cape Action for People and the Environment (C.A.P.E.) is a partnership programme that seeks to conserve and restore the biodiversity of the Cape Floristic Region (CFR) and adjacent marine environment, while delivering significant benefits to the people of the region.

³ The Succulent Karoo Ecosystem Programme (SKEP) is a long term, multi-stakeholder bioregional conservation and development programme. SKEP began as a bi-national initiative between Namibia and South Africa, with the aim of defining a way to conserve this ecosystem, and to develop conservation as a land-use rather than instead of land-use.

new system to facilitate access and impact. Information includes tools, guidelines, case studies, literature, handbooks, provincial information, sector information, programme information, etc.

SANBI work continues and information needs to be digitised and accessible throughout the process of developing this new system. The Biodiversity Information Management Directorate needs to give guidance on the best way to manage new and ongoing information through being clear on formats and timeframes.

3.2 Analysis of data requests

An analysis of data requests from users of current SANBI web services provides feedback from users on what information is being requested, as well as weaknesses in design and functionality.

An analysis of three of the websites (SIBIS:SABIF, Biodiversity Advisor and Plants of southern Africa) revealed the following:

- *Website functionality needs to be intuitive and easy to use, with clear instructions;*
- *Users do not know their way around all of the different web services offered on various SANBI websites;*
- *Functionality that is useful and now no longer fully available is frustrating for users; and*
- *Websites need to be current, up-to-date and visible.*

An analysis of BGIS data requests showed the following:

- *Users find it difficult to locate information on the website.* This is demonstrated when it is publicised that data will be available on BGIS e.g. the National Biodiversity Assessment, National Freshwater Ecosystem Priority Areas, and the National List of Threatened Terrestrial Ecosystems. SANBI has a high volume of requests for support in locating and downloading related data.
- *Users assume that data will be available.* Reasons for the lack of availability are the following:
 - data backlogs where data has been provided to SANBI but has not yet been loaded onto the website;
 - broken links;
 - baseline geodatasets providing context are not available for download e.g. cadastral boundaries or soil types;
 - raw data used in SANBI reports are not always the property of SANBI to make publically available; and,
 - the data is available on a different SANBI website (e.g. BGIS users looking for species distribution or threat status).
- *Users request species distribution and status datasets,* showing the need to integrate species information with spatial information.

SECTION 4 Current baseline architecture

4.1 Current Architecture/IT System Description

SANBI maintains and offers multiple information systems to support the range of biodiversity-related activities, from environmental impact assessments to species identification and taxonomy.

These include:

Biodiversity Advisor provides a single point of entry, making it easy to navigate to the right information and tools among the range of resources provided by SANBI.

URL: <http://www.biodiversityadvisor.org.za/>

SANBI's Integrated Biodiversity Information System (SIBIS): South African Biodiversity Information Facility provides access to over 11.6 million species occurrence records and comprehensive coverage of South Africa's 22 000+ plant species. SIBIS focuses on species and specimen information and offers threatened species information, distribution maps, area checklists and general species details. SIBIS aggregates information from a number of SANBI databases and SABIF data partnerships and digitisation grants.

URL: <http://sibis.sanbi.org/>

Biodiversity GIS (BGIS) offers information for landscape and mapping information. The aim is to assist in biodiversity planning and decision making by offering comprehensive and freely accessible spatial biodiversity planning information.

URL: <http://bgis.sanbi.org/>

Plants of Southern Africa an online checklist providing access to plant names and floristic details for southern African plant species.

URL: <http://posa.sanbi.org>

Red List of South African Plants provides up to date information on the national conservation status of South Africa's indigenous plants.

URL: <http://redlist.sanbi.org/>

Species Status a database that stores all the TOPS- (a threatened or protected species, listed under the National Environmental Management Biodiversity Act (NEMBA) regulations on Threatened and Protected Species) and CITES- (a CITES listed species, listed on one of the Appendices of the Convention on International Trade in Endangered Species (CITES) to which South Africa is a signatory) listed species.

URL: <http://www.speciesstatus.sanbi.org/>

Environmental Impact Assessment Portal is an online repository of Environmental Impact Assessment (EIA) Data and Reports. The EIA Biodiversity Publishing Portal is a website that provides access to the biodiversity data collected as part of the EIA process.

URL: <http://eia.sanbi.org.za.www12.cpt3.host-h.net/>

iSpot is a citizen science platform, aimed at helping the public identify anything in nature.

URL: <http://www.ispot.org.za/>

Species Identification Tool is a tool aimed at assisting customs officials, law enforcement officers, border police and Environmental Management Inspectorate’s with the identification of threatened species so placing them in a better position to regulate and monitor the trade in South African TOPS and CITES listed species and potentially other traded non-indigenous species without needing the assistance of provincial nature conservation staff.

PlantZAfrica is about plants indigenous to southern Africa and related topics presented by SANBI.
 URL: <http://www.plantzafrica.com>

Botanical Research and Herbarium Management System (BRAHMS) is an information system that supports the capture and management of fundamental taxonomic, specimen and floristic information for South Africa.

Garden Accession Database is an information system that supports the capture and management living collections within all gardens managed by SANBI.

SANBI’s Enterprise Image System is a single location for digital image storage, retrieval and dissemination, providing a secure repository where author’s rights on the images are upheld. Celum IMAGINE is the platform being used for digital asset management.
 URL: <http://seis.sanbi.local/webgate>

DNA Bank (DNA Lab Accessions) assists SANBI in partially meeting its mandate to support collections of biodiversity. The intent is that researchers around the world will be able to access the database and submit requests for material. This currently includes herpetological tissue and plant material.
 URL: <http://www.sanbi.org/programmes/conservation/dna-bank>

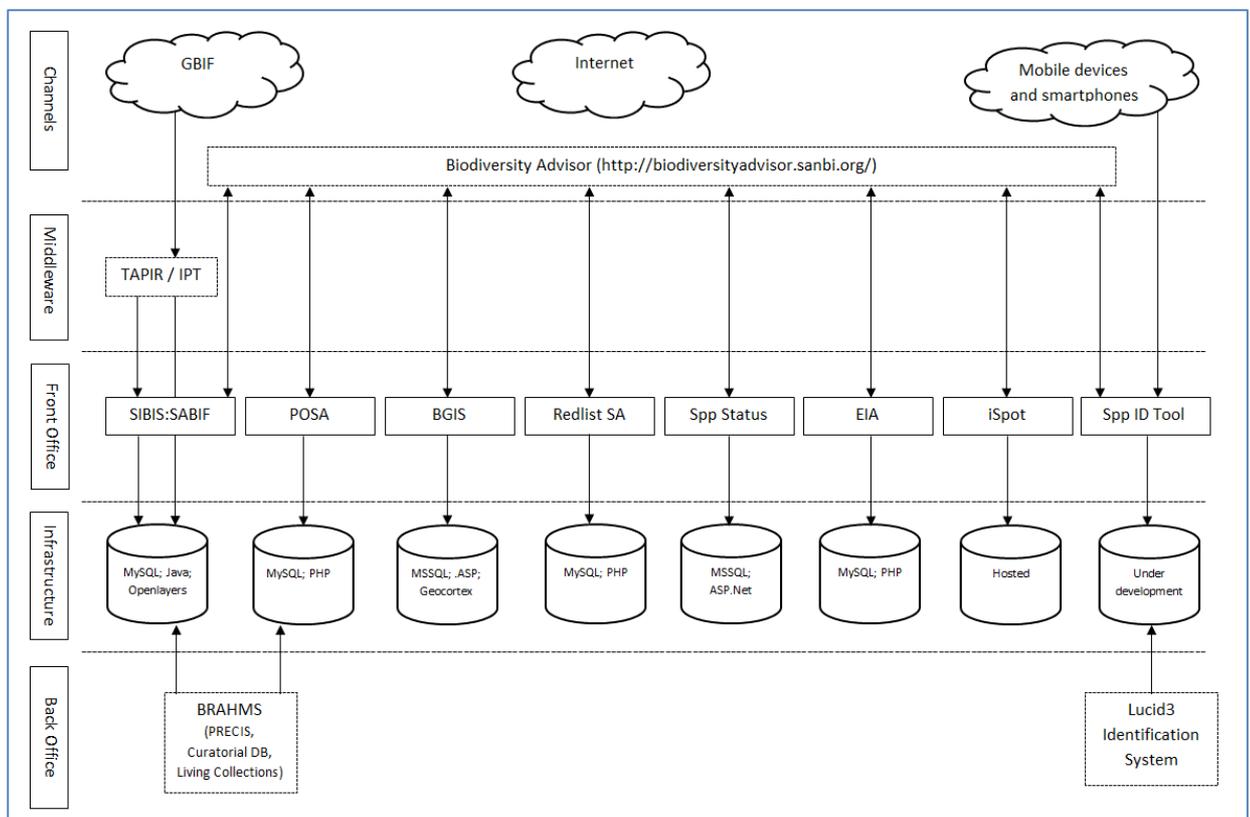


Figure 1: SANBI’s baseline architecture

4.2 Information standards

1. Darwin Core (DwC);
2. TAPIR;
3. National Spatial Information Framework (NSIF) – Metadata Standards;
4. BGIS Data Submission Guidelines.

4.3 Publication standards

1. Publication Guidelines for Bothalia;
2. ISI Rating criteria from Thomson and Reuters.

4.4 Cataloguing standards

1. Universal Decimal Classification;
2. Dewey Decimal Classification;
3. Anglo American Cataloguing Rules (AACR);
4. Library of Congress Subject Headings.

4.5 Policies

The management of data is covered by the Biodiversity Information Policy Framework, the Intellectual Property (IP) policy and the Protection of Sensitive Taxa policy. Our agreements with all partners stipulate the SANBI will protect IP and not distribute any information on sensitive taxa. The policies are available on the Biodiversity Advisor website (<http://www.biodiversityadvisor.org.za>)

SECTION 5 Principles

Principles are rules and guidelines that say how an organisation fulfils its mission and enables decision-making. The following principles are intended to govern SANBI’s approach to managing information and Information and Communications Technology (ICT) to enable the core activities of the organisation.

The principles listed below should be viewed as a starting point for subsequent decisions that affect the information architecture in SANBI.

5.1 Business Principles

Name	Information systems need to support SANBI’s mandate.
Statement	Information systems exist to support the needs of SANBI. Therefore, SANBI’s Enterprise Architecture must support the institutions vision, business strategies and plans. Information systems need to be mission driven. ‘Avoid shiny objects’ syndrome.
Rationale	The architecture has the most value when closely aligned with SANBI’s strategic plans and other corporate-level direction, concepts, and objectives.
Implications	<ol style="list-style-type: none"> 1. Technology choices must be linked to business needs. Some technologies will not be appropriate at SANBI. The SANBI Strategic Plan, goals and objectives will be utilised in developing key components of the architecture business vision and architecture components. The architecture must be generated with a specific purpose and for a specific audience to ensure it meets the expectations and needs of its intended stakeholders. SANBI must not implement technology simply because it is available. 2. SANBI’s Enterprise Architecture applies to all aspects of SANBI’s information technology (IT). 3. Data and information used to support SANBI’s decision-making will be standardised to a much greater extent.

Name	Sharing of information
Statement	Authorisation is needed from data partners to share and gather information.
Rationale	Information sharing initiatives must demonstrate a net benefit for SANBI and its data partners.
Implications	<ol style="list-style-type: none"> 1. Lack of sufficient authorisation can impede information sharing. 2. Written authorisation is needed from stakeholders.

5.2 Data Principles

Name	Data Requests
Statement	All data requests must be granted in terms of SANBI’s mandate, unless the provision of data will result in species loss, illegal activity or the infringement of a research project at SANBI. Third party requests will be referred back to the data owners.

Rationale	SANBI's data sharing protocol
Implications	<ol style="list-style-type: none"> 1. Providing data could jeopardize the species (sensitive species list), in which case special conditions need to be imposed and the security and bona fides of the researcher/manager/evaluator needs to be determined. This does not apply to contracted institutions where this data is core to their conservation mandate (e.g. SANParks, CapeNature, etc.) provided that they have signed an MoA with SANBI which includes agreements regarding sensitive species. 2. It would jeopardize a research project at SANBI, in which case, data should be provided on condition that the researcher's rights to research and publication are protected. 3. It is clear that the data are requested for potentially illegal activity, or the applicant(s) have a record of misusing information or using it for financial gain of some sort.

Name	Data Integrity
Statement	Authority to create and maintain the data will reside with those most knowledgeable about the data or those most able to control its accuracy.
Rationale	Those with the most knowledge of the data will have the greatest ability to maintain it accurately. Acknowledgement and metadata aspects easily obtained by users.
Implications	<ol style="list-style-type: none"> 1. The accuracy of data should be made obvious to its users, for example by providing clear statements about information ownership, and date of last revision, with agreed standards of currency and timeliness being met for each information type. 2. The trustworthiness of data should be a prime requirement in systems design and will include agreed standards relating to loss or alteration of critical enterprise information; access controls, systems security, audit trails and good contextual metadata about the information (e.g. who created it, when and for what purpose). 3. Data should be valid for 50 – 100 years regardless of the technology. The data is diverse and forever changing e.g. species names. The architecture will need to accommodate this.

5.3 Application Principles

Name	Application Documentation
Statement	Enterprise applications will be documented, both internally and externally.
Rationale	Poorly documented applications are expensive to maintain or modify.
Implications	<ol style="list-style-type: none"> 1. Documentation standards need to be developed.

Name	Business Alignment
Statement	Applications will have a stated business purpose. If there are multiple business purposes, they will be closely related.
Rationale	Technology is effective only when aligned with business needs. Also, it is easier to renew or sustain applications if there is modularity at a high level.
Implications	<ol style="list-style-type: none"> 1. Changes in applications and technologies are implemented only to meet business needs.

Name	Software Configuration and Change Management
Statement	Configuration and Change Management process will be documented and all parties will adhere to it.
Rationale	When software is put into production without a configuration and change management process, reliability suffers, users are adversely affected, and extra cost is incurred to fix the problems.
Implications	1. Developers and maintainers of enterprise applications will have a change management process.

Name	Systems Development Lifecycle (SDLC)
Statement	The systems development lifecycle will be documented and repeatable.
Rationale	Without an SDLC, software development is haphazard and risky.
Implications	1. Developers and maintainers of enterprise applications will have a documented SDLC.

5.4 Technology Principles

Name	Technology that has consistent interoperability
Statement	An environment in which consistent, internationally accepted and interoperable standards are adopted so that information can be readily exchanged and shared within SANBI and with the wider community and so that technology choices do not create counterproductive barriers.
Rationale	Standards help ensure coherence, thus improving the ability to manage systems, raise user satisfaction, and protect current IT investments, thus maximizing return on investment and reducing costs.
Implications	<ol style="list-style-type: none"> 1. An environment with facilities and tools which are easy to use, reliable, and which do not require extensive, difficult or slow setup. 2. Interoperability and international standards must be followed unless there is a mandatory business reason to implement a non-standard solution. 3. A process to establish standards, periodic revision, and exceptions must be established. 4. Current IT platforms must be identified and documented.

Name	Technology that is sustainable
Statement	Information assets that support SANBI's core activities will be maintained by systems that are centrally managed, such as data warehouses, designated enterprise information systems, and an electronic document and records management system.
Rationale	Enterprise applications that consider only a subset of needs are unsuitable for enterprise-wide use. The result is a necessary proliferation of extension systems, which is inefficient.

Implications	<ol style="list-style-type: none"> 1. Enterprise information systems and data storage facilities built on robust, documented (see principle Application Documentation) and sustainable information, ICT and service architectures that enable data sharing and management reporting. 2. New information systems and services should not create additional workload for staff, unless there is a significant business benefit is proven. 3. A decision to custom build a system can be made only after an analysis that considers other alternatives.
---------------------	---

5.5 Architecture Principles

Name	Cost reduction
Statement	Strategic decisions for solutions must always strive to maximise benefits generated for the institution at the lowest long-term risks and costs.
Rationale	Decisions must not be made based solely on reaching lower solution costs. Every strategic decision must be assessed based on cost, risk, and benefit perspectives. Lower costs often represent greater risks and, perhaps, fewer benefits. Limiting the number of supported components will simplify maintainability and reduce costs. Technical administration and support costs are better controlled when limited resources can focus on this shared set of technology.
Implications	<ol style="list-style-type: none"> 1. A solution must be selected based on a qualitative or quantitative cost, risk, and benefit assessment. 2. SANBI welcomes technology advances and will change the technology blueprint when compatibility with the current infrastructure, improvement in operational efficiency, or a required capability has been demonstrated.

Name	Ensure a consistent user experience across multiple channels (integration).
Statement	Applications are easy to use. The technology is transparent to users, so it enables them to concentrate on their tasks, rather than on system operation issues.
Rationale	The more that users need to understand the technology employed, the less productive they will be. The easy-to-use concept is a positive reinforcement for using applications. It encourages users to work within the integrated information environment rather than developing isolated systems to perform tasks outside of the integrated environment. Most of the knowledge required to operate systems is very similar. Formatting is limited to a minimum, and system misuse risks are low. Using an application must be as intuitive as driving a car from another brand.
Implications	<ol style="list-style-type: none"> 1. All applications must have the same appearance and layout. Thus, a standard layout must be developed and usability testing criteria must be implemented. 2. Dependency on shared system applications mandates that the risks of business interruption must be established in advance and managed.

Name	De-skill (skills reduction)
Statement	Technological diversity is controlled to minimise significant costs related to the maintenance of expertise and connectivity between several different processing environments.

Rationale	Limiting the number of supported components and suppliers simplifies and reduces maintenance and management costs. A smaller number of suppliers and software packages represent a greater ease and lower integration costs. (See principle on cost reduction).
Implications	<ol style="list-style-type: none"> 1. Policies, standards, and procedures that regulate the acquisition of technology or contracting with new suppliers must be directly bound to this principle. 2. Technology decisions are guided by the technological blueprint. 3. Procedures to increase the set of acceptable technologies to meet evolved requirements must be developed and implemented. 4. This principle does not require freezing the technological baseline. Technological advances are welcome and incorporated into the technological blueprint when they are compatible with current infrastructures, are likely to improve operating efficiency, or there is a need to increase capacity. 5. Information system simplification.