GENERAL NOTICES • ALGEMENE KENNISGEWINGS

DEPARTMENT OF TOURISM

GENERAL NOTICE 2757 OF 2024

NATIONAL ASTRO TOURISM STRATEGY

I, Patricia De Lille, Minister of Tourism, in collaboration with the Department of Science and Innovation, hereby publish the National Astro-Tourism Strategy, for public comments.

Interested parties and/or organisations are invited to submit, within thirty (30) days of publication of the notice in the gazette, written representations on the draft National Astro-Tourism Strategy to the following addresses:

By Post:
The Director-General
Department of Tourism
Private Bag X424
Pretoria
0001
Attention: Dr Laeticia Jacobs

By Hand Delivery:
Ground Floor (Reception), Tourism House, 17 Trevenna Street, Sunnyside, Pretoria.

By Email: astrotourism@tourism.gov.za

Inquiries concerning the draft National Astro-Tourism Strategy may be directed to Dr Laeticia Jacobs at 012 444 6441.

Comments received after the closing date will not be considered.

P. de Lille

Patricia De Lille, MP
Minister: Tourism

National Astro-Tourism Strategy & Implementation Plan

[2023-2033]

science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

tourism
Department:
Tourism
REPUBLIC OF SOUTH AFRICA

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ABBREVIATIONS

Table 1: List of Abbreviations

AGAA	Astronomy Geographic Advantage Act (2007)
ASSA	Astronomical Society of Southern Africa
COGTA	Department of Cooperative Governance and Traditional Affairs
DSI	Department of Science and Innovation
DTI	Department of Trade and Industry
FGASA	Field Guides Association of South Africa
GDP	Gross Domestic Product
IAU	International Astronomical Union
IDP	Integrated Development Plan
IDSA	International Dark Sky Association
KDF	Karoo Development Foundation
LED	Local Economic Development
MeerKAT	Karoo Array Telescope
NCPG	Northern Cape Provincial Government
DT	Department of Tourism
NGO	Non-Governmental Organisation
NRF	National Research Foundation
NSI	National System of Innovation
NTSS	National Tourism Sector Strategy
OAD	Office of Astronomy Development
PPP	Public Private Partnership
ROI	Return on Investment
SAAO	South African Astronomical Observatory
SAASTA	South African Agency for Science and Technology Advancement
SALT	South African Large Telescope
SANPARKS	South African National Parks
SARAO	South African Radio Astronomy Observatory
SAT	South African Tourism
SATSA	South African Tourism Services Association
SC	Steering Committee
SCBP	SALT Collateral Benefits Programme
SDF	Spatial Development Framework
SDG	Sustainable Development Goals
SKA	Square Kilometre Array
SMME	Small, Medium and Micro Enterprise
STPP	Sustainable Tourism Partnership Programme
TGGSA	Tourism Guide Guild of South Africa
VICs	Visitor Information Centres
WTTC	World Travel and Tourism Council

EXECUTIVE SUMMARY

Dark night skies and astronomical heritage are significant to grow Astro-tourism and advancing social and sustainable development. Astro-Tourism is key for observational astronomy and scientific development. Africa has a huge cultural and astronomical heritage, as well as an unexplored dark sky which is beneficial for the continent's economic development. Preserving and protecting the dark night sky and investing in Astro-tourism is central to economic and tourism diversification, with an innovative approach to grow and contribution to Africa's Gross Domestic Product (GDP).

Nearly, 10.4% of global GDP and 7% of Africa's GDP is driven by the tourism sector, according to the 2019 report by the World Travel and Tourism Council (WTTC). Focusing investment on dark sky preservation and integrating Astro-tourism into the mainstream tourism industry will be a creative effort to boost GDP as a new economic diversification. Local and rural community involvement around dark sky sites in Astro-tourism will advance the tourism industry and can be used to create decent job opportunities, improve daily livelihoods and effective work-force, which will ensure economic development and long-term sustainability.

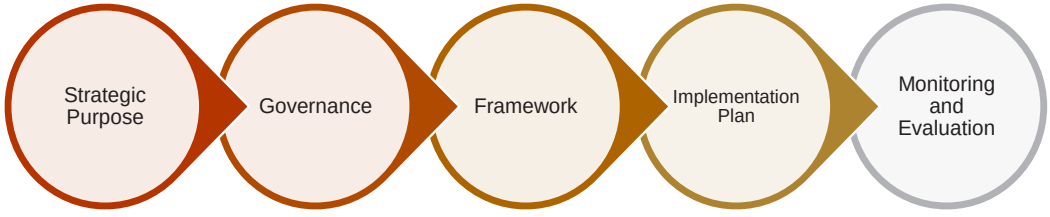
According to the International Dark-Sky Association (IDSA), Africa and South Africa has the opportunity to unlock the many undeveloped dark-sky resources. This shows that Astro-tourism, where dark night skies are a fundamental resource is an available subset of sustainable tourism.

South Africa is gaining increased global **competitive advantage** due to the following key critical factors:

- Majority cloudless skies providing unique tourism experience for skygazing (optical astronomy);
- Quality Dark skies (Low Light Pollution) and Radio quiet zones over large areas of the country, especially in rural tourism destinations; and
- The Southern Skies Advantage (South Africa is favourable positioned in relation to a number of celestial phenomena that cannot be seen from the Northern Hemisphere);
- Four of the world's best-preserved meteorite impact craters are found in South Africa (Unique Multi-Science Offerings);
- Host two of the globe's most significant astronomy initiatives, the SKA and the SAAO.

This document presents a Framework and Implementation plan for the development of Astro-Tourism in South Africa. Astro-Tourism is defined as "... *tourism using the natural resource of unpolluted night skies, and appropriate scientific knowledge for astronomical, cultural and environmental activities*".

Figure 1:Strategic Implementation Process



The Pillars are developed through a multi-discipline consultancy process involving both the tourism and astronomy stakeholders in South Africa. The Implementation Plan envisioned to grow Astro-Tourism in South Africa will be implemented, monitored and evaluated according to the three Pillars:

- Pillar One: Indigenous Celestial Narratives and Human Capacity Development
- Pillar Two: Infrastructure Development
- Pillar Three: Inclusive Tourism Growth and Partnerships

ACKNOWLEDGEMENTS

This Strategic document was made possible with the funding of the Department of Science and Innovation. The extensive research has been driven, collated and analysed by Sustainable Tourism Partnership Programme (STPP) and further revised by the Department of Science and Innovation, Department of Tourism and the Astro-Tourism Working Group.

Appreciation is given to all the Astronomy and Tourism stakeholders as well as the Northern Cape Department of Economic Development and Tourism for their invaluable inputs towards the development and implementation of this National Astro-Tourism Strategy.

STRATEGIC PURPOSE

To enhance the performance of South Africa's astronomy tourism sector through infrastructure developments and improvements, optimal functioning of various streams of astronomy with tourism offerings, and boosting transformation by enhancing the livelihoods of local communities.

Vision

"...to develop and position an inclusive Astro-Tourism sector that will yield sustainable benefit-sharing opportunities by maximising on marketing efforts and enhancing visitor experience in South Africa."

Mission

Global Competitive advantage

South Africa has the potential to be a leading Astro-Tourism destination for these main advantages:

- Lack of light pollution;
- Radio quiet zones;
- Favourable weather;
- The Southern Sky Advantage;
- Four of the world's best-preserved meteorite impact craters are found in South Africa;
- Indigenous Starlore.

Extreme Dark Skies (Lack of light pollution)

Light pollution refers to the inappropriate use of artificial light at night (ALAN), which is an environmental pollutant that harms the planet and prevents one from experiencing the wonder of a natural night sky.[1] Large parts of the Southern African sky are free from light pollution. In South Africa, the Karoo and Kgalagadi stand out as particularly dark. Dark skies are generally easily accessible from major cities.

Light pollution – the brightening of the night sky at night due to man-made lighting – inhibits the observation of celestial objects. 83% of the world's population lives under light-polluted skies (see map above[2]). Artificial light at night has a disruptive effect on the biological clocks of all living things, causing numerous physiological and socio-economic problems[3].

Conservation of dark skies needs to be framed as conservation of our natural environment. Partnering with the International Dark-Sky Association (IDA) will provide marketing opportunities for astro-tourism in Southern Africa, support and resources for dark sky conservation.[4]

Figure 2: Global light pollution

Radio quite zones (Lack of radio interference)

A radio quite zone is an area where radio transmissions are restricted to prevent damage to radio telescopes caused by radio frequency interference. These transmissions are concentrated in densely populated areas, through the use of electronics such as cell-phones and television sets,

[1] International Dark-Sky Association https://www.darksky.org
[2] Map: http://darksitefinder.com
[3] David Mitchell and Terrel A. Gallaway, 2016: 'Dark Sky Tourism: Economic Impacts on the Colorado Plateau of USA' https://www.researchgate.net/publication/335615136_Dark_sky_tourism_economic_impacts_on_the_Colorado_Plateau_Economy_USA
[4] International Dark-Sky Association https://www.darksky.org

microwaves, petrol cars and air conditioning. The karoo region in South Africa, is an ideal place for conducting Radio Astronomy, due to low radio frequency interferences.

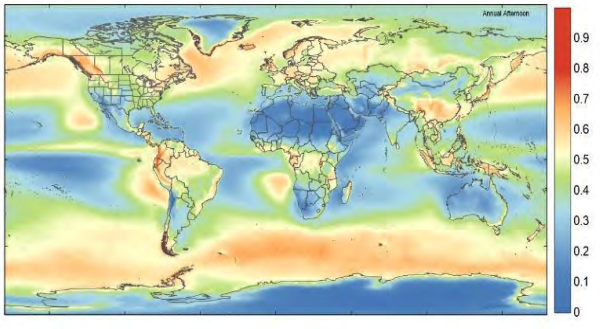
Data collected using Radio Telescopes almost becomes unusable or flagged during calibration when it has been exposed to interference. Hence the need for the enforcement of International Telecommunication Union (ITU) regulations and the Astronomy Geographic Advantage Act, 2007, which protects radio quite zones from interference.

This radio silence advantage is one of the most important attributes which contributed to South Africa winning the bid to host the international consortium project, SKA.

Cloudless Night Sky (Conducive Weather Conditions)

The North-Western parts of South Africa are particularly well-suited to Astro-Tourism due to low cloud cover (see map below[5] – other areas in Southern Africa also offer low cloud cover conditions, as do major Astro-Tourism destinations Northern Chile and Australia).

Figure 3: Global Cloud Cover



Southern Sky Advantage (Advantageous Positioned)

- The southern part of the Earth points towards the centre of the galaxy, allowing viewers in the Southern Hemisphere to see the densest, most interesting parts of the Milky Way;
- Seen from the Southern Hemisphere, the Milky Way is a spectacular sight consisting of billions of stars – the Sun being just one of them;
- Other phenomena best visible from the south include:
    - Two nearby galaxies (the Magellanic Clouds);

[5] Map: https://earthobservatory.nasa.gov/

- Constellations of the Southern Sky such as the Southern Cross and Mensa (a group of stars that look like Table Mountain)
- Celestial objects such as the globular cluster Omega Centauri;
- Alpha Centauri, the closest star to earth, is only observable from the south.

- The Southern Sky thus offers unique options for astrophotography and star gazing.

Figure 4: Milky Way visible with the Naked Eye in Southern Africa

Four of the world's best-preserved meteorite impact craters are found in South Africa (Unique Multi-Science Offerings)

An impact crater is a depression in the surface of a planet, moon, or any other solid body in the Solar System or elsewhere, formed by the hypervelocity impact of a smaller body. In contrast to volcanic craters, which result from explosion or internal collapse, impact craters typically have raised rims and floors that are lower in elevation than the surrounding terrain. Meteor Crater is a well-known example of a small impact crater on Earth.

Impact craters are the dominant geographic features on many solid Solar System objects including the Moon, Mercury, Callisto, Ganymede most small moons and asteroids. Where such processes have destroyed most of the original crater topography, the terms impact structure or astrobleme are more commonly used.

Impact craters are not to be confused with landforms that may appear similar, including calderas, sinkholes, glacial cirques, ring dikes, salt domes, and others.

Figure 5: Impact Crater

Indigenous Celestial Narratives (Starlore)

Astronomy is regarded as the first science in the world. Indigenous Astronomy (IA) is therefore given to the use and study of astronomical phenomena and their movements by indigenous peoples. Indigenous astronomy is an aspect of Indigenous Knowledge Systems (IKS), which are now used to describe and predict nature. This discipline encompasses culture, indigenous knowledge, and astronomy and a range of ideas, beliefs, and understandings connected to the sky. African indigenous peoples developed myths, legends, songs, proverbs and Starlore are *"stories told about the sky by indigenous people, providing unique access points to indigenous cultures*".

Before the invention of modern technology such as the telescope, indigenous peoples used their knowledge of the sky in agriculture, reproductive cycles, rain making, navigation, natural disaster management, etc. Indigenous people used their knowledge of the night sky to forecast the weather, and to determine seasonal changes. They looked to the sky as a map, clock and calendar for thousands of years. The movement of celestial objects were observed and followed using the stars as a compass, for orientation and direction.

For instance, the Batswana used their knowledge of the differences phases of the moon to determine the reproductive cycle of women. The rock art of Khoisan (or Bushmen) peoples is scattered all over Southern Africa and dates as far back as 26,000 years ago[6] documents pictorial representations [7] of what he believes to be comets, including a painting from the Fouriesburg District in Free

[6] Wendt, WE. 1976. Art mobile from the Apollo 11 cave, South West Africa: Africa's oldest dated works of art. South African Archaeological Bulletin. 31, 5-11.
[7] Woodhouse, HC. 1986. Bushmen paintings of comets? Monthly Notes of Astronomical Society of South Africa 45 (3), 33-35.

State, South Africa, and another from the Nachitalo Hill in Zambia[8]. Ouzman[9] presents photographs of San rock paintings from four sites in the Free State and one from the Waterberg area in Limpopo, South Africa. The Free State paintings, each separately, depict what appear to be a comet, a bolide, and two fireballs.

With the exception of the Khoisan, pre-colonial Southern Africans were largely agriculturists who depended on changes in the night sky and on earth to predict seasons. Although Tempelhoff[10] suggests that there were sites of irrigation-based agriculture during pre-colonial Southern Africa, most of agriculture in this region dependent heavily on rainfall. Therefore, it was critical each year, for tribes to commence cultivation at roughly the time of the first rains in September.

Snedegar[11] explains how the Isilimela stars (the Pleiades), observed as they rise in the late evening, would have been used as a harbinger of the first rains of the Zulu year. Snedegar[12] also indicates, however, that typically, the Zulu farmers will only start ploughing after the first rains. Other South Africans used the Pleiades for similar purpose. The first rains marked the beginning of a new year. Furthermore, the Xhosa people used the Pleiades when seen in the morning in June, to mark the coming out ceremony for circumcision schools. The Sotho-Tswana initiation schools commenced upon morning sighting of the Naka star (Canopus), this happened during the month of May, at the beginning of winter[13].

Torres Strait Islanders use the scintillation of stars (twinkling) to determine when the northwest monsoon is arriving, and Aboriginal people used the ice rings around the Moon to forecast when wet weather was arriving. The arrival of the Seven Sisters in the evening sky brought the return of warm weather and resources, while their setting in the evening sky brought the winter. It also appears that Aboriginal people built solar observatories, so that they could mark the time of the year by the solstices. Research into the development of Aboriginal astronomical knowledge was used to develop an educational program at the Sydney Observatory, called Dreamtime Astronomy. It includes activities such as creating a planisphere with both Western scientific and Boroong names for celestial objects.

[8] Clark, JD. 1959. The rock paintings of Northern Rhodesia and Nyasaland. In Summers R (ed) Prehistoric rock art of the Federation of Rhodesia & Nyasaland. Glasgow University Press, Glasgow, pp. 163-220.
[9] Ouzman S. 2010 Flashes of brilliance: San rock paintings of heaven's thing. In Blundell, G, Chippendale, C, Smith, B (eds) Seeing and knowing. Understanding rock art with and without ethnography. Wits University Press, Johannesburg, pp 10-31.
[10] Templehoff JWN, 2008. Historical perspectives on pre-colonial irrigation in Southern Africa. African Historical Review. Taylor & Francis. 40 (1) pp121-160.
[11] Snedegar KV. 2000. Astronomical practices in Africa South of the Sahara. In Selin H (ed) Astronomy across cultures: the history of non-Western astronomy. Kluwer, Dordrecht, pp 455-473.
[12] Snedegar, KV. 1995. Stars and seasons in Southern Africa. Vistas in Astronomy, 39, pp 529-538.
[13] Snedegar, KV. 1997. Ikwezi is the morning star. Mercury, 26 pp 12-15.

Entry-level astronomy knowledge is more memorable, if it is shared in a language which is understood by the general public, instead of a more detailed and technical scientific language. Starlore narrative development can be in form of visual arts, crafts and performances, festivals and events. Here, astronomy and tourism have the opportunity to develop sustainable incomes for respective communities.

Astro-tourism is therefore an innovative way, in which astronomy is linked to revenue generation for rural communities. Astro-tourism projects provides an opportunity for collaboration with observatories or scientific institutions, local indigenous communities, relevant government departments with socio-economic development and innovation at its core.

Figure 6: Picturesque of Indigenous Stories

To mention a few, some examples of this research on Indigenous Story-Telling, include the following:

- The Digital Bleek and Lloyd[14] ;
- Venus Rising – South African Astronomical Beliefs, Customs and Observations[15];
- Karoo Cosmos: |xam-ka !au and the |xam[16];
- SALT Cultural Astronomy Project[17].

[14] The Digital Bleek and Lloyd http://lloydbleekcollection.cs.uct.ac.za/index.html
[15] P.G. Alcock: Venus Rising – South African Astronomical Beliefs, Customs and Observations. First edition, 2014. *Full download*: https://assa.saao.ac.za/wp-content/uploads/sites/23/2014/08/Venus-Rising-2014-P-G-Alcock.pdf
[16] Parkington, John & Rusch, Neil & Morris, David & Deacon, Janette & Swartz, Katriena & Adams, Sophia & Abrahams, Dawid & Renier, Serena & Priega, Klaas & Hall, Simon & de Prada-Samper, Jose & Christie, Pam & Taylor, Russ. 2021. Karoo Cosmos: |xam-ka !au and the |xam. https://www.researchgate.net/publication/356187601_Karoo_Cosmos_xam-ka_au_and_the_xam
[17] SALT Annual Report 2020 https://www.salt.ac.za/wp-content/uploads/2021/09/AnnualReport2020_LR.pdf

GOVERNANCE OF THE STRATEGY

Led by the Department of Science and Innovation (DSI) and the Department of Tourism (DT), Astro-Tourism in South Africa is driven by collaborations between the many government departments, academic, and private sector institutions that have a stake in the success of this Strategy. The Strategy is therefore aligned to the directives of South African governance and that of the respective departments.

United Nations Sustainable Development Goals

A global commitment to end poverty, protect the planet and act on the shared belief that every life has value. The 17 SDGs were adopted by all UN member states in 2015, as part of the 2030 Agenda for Sustainable Development, and are applied by the South African government and development community.

The SDGs can be grouped into four main themes:

- Social Goals – An end to poverty and hunger, improved health and wellbeing, quality education and gender equality.
- Economic Goals – Economic growth, employment, infrastructure, industrialisation, the lessening of inequality, and sustainable production and consumption.
- Environmental Goals – Water and sanitation, clean and affordable energy, the development of cities and settlements, climate change, and the status of land and water.
- Governance, Peace, Justice and Security Goals – Peaceful and inclusive societies, access to justice, accountable and inclusive institutions, and global partnership (UN, 2015).

National Development Plan

Launched by the National Planning Commission in 2012, the NDP was heralded by many South Africans as the best way forward for the country and provides a vision for South Africa over the long term (Vision 2030).

It is also intended to serve as a socio-economic blueprint, not only for government but for all sectors of society.

The NDP sets out two overarching goals, to eliminate poverty and reduce inequality by the year 2030.

Vision 2030 presented the following key aims:

- Rural communities must have greater opportunities to fully participate in the economic, social and political life of the country;
- Rural people should receive high-quality basic services, healthcare and education;
- Rural economies will benefit from inclusive growth driven by agriculture and supported by non-farming activities; and
- Rural areas will be further integrated as a result of successful land reform, infrastructure development, job creation and poverty alleviation.

Rural Development Policy

South Africa's traditional communities suffer from higher rates of poverty and unemployment than anywhere else in the country. In the last decade, rural development policy was driven by the Comprehensive Rural Development Programme (CRDP). The Programme, has three distinct aims:

- agricultural transformation,
- rural development,
- and land reform.

It claims to offer a new 'community-based' approach, placing rural people at the centre of the development agenda.

The District Development Model

In his 2019 Budget Speech, President Ramaphosa commented on the 'lack of coherence in planning and implementation' across all spheres of government (PMG, 2019). These failures, he noted, have impacted government's capacity to deliver services, reduce poverty, and support job creation.

In response, the President has launched the new District Development Model aimed at coordinating development across all spheres of government.

The strategic objectives of this model are to:

- Improve integrated planning by creating and effectively implementing 'One Plan' for each District;
- Coordinate economic development, infrastructure priorities and land use planning across the District, and differentiate between short and long-term strategies;
- Mobilise available expertise, personnel and systems between the district and local governments;
- Support the effectiveness of Local Government by streamlining and consolidating capacity building programs at the district level; and

- Ensure that government programs are designed and implemented in a coordinated way and that their impact on community development is effectively monitored.

White Paper – Science, Technology & Innovation 2019, Science & Innovation

The 2019 White Paper on Science, Technology and Innovation (STI) sets the long-term policy direction for government to ensure a growing role for science, technology and innovation in a more prosperous and inclusive society. The focus is on using STI to help South Africa benefit from developments such as rapid technological advancement, geopolitical and demographic shifts, as well as responding to the threats associated with some of these global trends. In particular, the White Paper engages with the significant changes that are associated with the Fourth Industrial Revolution (4IR). [18]

Astronomy Geographic Advantage Act 2007, Science & Innovation

The Astronomy Geographic Advantage (AGA) Act is legislation that gives the Minister of Science and Innovation the power to protect areas that are of strategic national importance for astronomy and related scientific endeavours through regulation.[19]

Multi-Wavelength Astronomy (MWA) Strategy 2015, Science & Innovation

The MWA strategy aims is to develop Astronomy as a means to stimulate frontier science, cutting-edge technology and human capacity development within South Africa and throughout the African continent. The enormous infrastructure investment in Astronomy to date requires a coordinated approach to ensure sufficient return on investment both in terms of making South Africa a world-class player in Astronomy research and unleashing Astronomy as a force for socio-economic growth.[20]

In order to maximise South Africa's advantageous positioning in Astronomy, focus lands on Astronomy management and strategic support, in particular, Astronomy must attract a new generation of South Africans, especially historically disadvantaged groups, to build a new community for the future, and this community must also provide major spin-offs for the economy.

[18] White Paper – Science, Technology & Innovation 2019, Science & Innovation
[19] Astronomy Geographic Advantage Act 2007, Science & Innovation
[20] Multi-Wavelength Astronomy (MWA) Strategy 2015, Science & Innovation

Protection, Promotion, Development and Management of Indigenous Knowledge Act, 2019, Science & Innovation

Indigenous Astronomy is part of the national indigenous knowledge system, and therefore must be protected, promoted and developed through Act No. 6 of 2019, Indigenous Knowledge Act. This legislation seeks to offer protection regarding the prevention of exploitation, biopiracy and neglect of the body of knowledge by Indigenous Astronomers and their communities. To recognise this knowledge and skill, Indigenous Astronomy has been admitted as 1 of the 16 disciplines by the DSI that fall within the scope of the recognition of prior learning (RPL), which sets out the application process for persons wishing to register indigenous knowledge practitioners and to be certified in the register of designations as such. This recognition is one of the activities which aim to contribute to the benefits of the indigenous communities in upskilling them not only intellectually, but in the socio-economic context as well.[21]

The Decadal Plan 2022-2031, Science & Innovation

South Africa's Science, Technology and Innovation Decadal Plan is an instrument for enabling Africa's Reawakening and Inclusive and Sustainable Development. This represents an evolution of STI policy from the 2019 decadal plan where NSI increasingly focused on deriving increased socio-economic & environmental impact. The 2022-2032 decadal plan is an implementation plan for the 2019 White Paper which forms part of the last phase of the National Development Plan, and responds to the Sustainable Development Goals.

White Paper on the Development and Promotion of Tourism in South Africa, 1996

The White Paper on the Development and Promotion of Tourism in South Africa, 1996 provides framework and guidelines for tourism development and promotion in South Africa. While overall growth trends in this dynamic sector are positive, governments are always developing or improving policies that seek to maximize the economic, environmental and social benefits that tourism can bring.

Efforts have been made to develop new products and improve seasonality and further encourage increased visitors through aggressive branding and marketing, multiple use of attractions, and increased stable employment.

[21] Protection, Promotion, Development and Management of Indigenous Knowledge Act, 2019, Science & Innovation

National Tourism Sector Strategy (NTSS) 2016-2026, Department of Tourism

The National Tourism Sector Strategy (NTSS) aims to inspire and accelerate the responsible growth of the tourism industry. It has the following three core themes, with specific focus areas which has a national, provincial and local perspective:

- THEME 1: Tourism growth and the economy
- THEME 2: An enhanced visitor experience
- THEME 3: Sustainability and good governance

National Rural Tourism Strategy 2012, Department of Tourism

The Department of Tourism (DT) has developed a National Rural Tourism Strategy, which is meant to ensure a developmental approach upon packaging rural tourism products and opportunities in South Africa. This approach also prioritises the spatial nodes which have a growth potential to stimulate tourism industry growth in South Africa.

Carnarvon – Sutherland Tourism Masterplan – 2020, Department of Tourism

The 30-year Tourism Master Plan has undertaken to boost tourism by identifying and exploring products that will attract tourists into Carnarvon – Sutherland Corridor in the Northern Cape Province. The Master Plan consists of tourism concept, natural and cultural features and captivating possible activities in the Carnarvon – Sutherland region of South Africa.

This Tourism Master Plan further elucidates areas that require intervention so that the tourism industry optimally perform in the next thirty (30) years, 2020 – 2050. This masterplan is leveraging the Sutherland Observatory and Square Kilometre Array to combine science, local tradition and folk tales for new tourism product development.

Northern Cape Province Revised Strategic Plan For 2020 – 2025

The Department of Economic Development and Tourism has developed a Strategic Plan with intentional interventions directed at addressing the high unemployment youth unemployment rate; to stimulate the labour market unable to absorb new entrants to the employment sector, to match the unemployed graduates to the requisite demand skills required by the diversified economy. The plan demonstrates that the department will intervene in all five districts in order to “help build a bridge to a prosperous future” for the citizens of the Northern Cape Province, the revised Strategic Plan for 2020 -2025 has been developed.

Northern Cape Tourism Master Plan

The purpose of the Tourism Master Plan is a comprehensive long-term strategy that provides a structural framework for success in the development, management and monitoring of tourism while pre-empting problems and mitigating impacts. This Tourism Master Plan Framework is an essential component of the Northern Cape as a sustainable tourism destination, providing a holistic "roadmap" for the Province to provide direction aimed at successfully surmounting these challenges and provides a blueprint to bring individual strategies together to serve one vision (thus acting as an overarching plan that guides all other tourism plans in the province).

BENCHMARKING

INTERNATIONAL

Research into Astro-Tourism in Australia, Chile, and the Canary Islands shows that the objectives in all cases are very similar, and include: enhancing the visitor experience; increasing jobs; increasing SMME development; protecting dark skies, and providing related education guide training programmes; increased niche market related activities; developing a marketing plan ; creating annual festivals; connecting youth to science; promoting stargazing for mental health; developing criteria for Astro-Tourism towns; dark sky certification; and creating awareness of light pollution.

Table 2: Examples of International Astro-Tourism products and offerings

ASTRONOMY FACILITIES WITH TOURISM EXPERIENCES	COMMUNITY- CENTRED INITIATIVES	ASTRO-TOURISM ROUTES
USA • JVLA Radio Telescope, New Mexico • McDonald Observatory, Texas • Colorado Plateau Dark Sky Cooperative[22] • Hayden Planetarium, New York **CHINA-** Five Hundred Metre Aperture Spherical Radio Telescope (FAST), Guizhou **UNITED KINGDOM** • Jodrell Bank Observatory, Macclesfield • The Royal Observatory in Greenwich, London	**INDIA:** Astro-stays Project - Himalayas **NEW ZEALAND:** Aoraki Mackenzie International Dark Sky Reserve, South Island **AUSTRALIA** • Warrumbungle Dark Sky Park, New South Wales; • River Murray Dar Sky Reserve, South Australia; • The Jump-Up, Queensland (Part of Australian Age Dinosaur Museum) • Bindoon, Western Australia • East Point Reserve, Northern Territory • Snake Valley, Victoria • Taroona, Tasmania	• **Sardinia**: Italy • **Italy**: Marche Region • **Spain**: Valencia • **Greece**: Taxiarchis

Detailed information of the above-listed international examples of Astro-Tourism products and offerings are illustrated in Annexure A.

AFRICAN CONTINENT

Africa should establish a policy and strategy for African dark sky and astronomical tourism in order to utilize its dark sky and astronomical legacies effectively. It is therefore, important that intergovernmental relations should include discussions with the African astronomical community about dark skies and astronomical heritage, gather ideas, exchange experiences, and find synergy to develope the continent's dark sky and astronomy tourism strategies.

Recognised amateur astronomy associations exist in 23 countries in Africa (including South Africa). All of these associations are listed by the African Astronomical Society,45 and some are affiliated to universities and planetaria. The existence of these experiences and products provides opportunities for inter-regional and cross-border collaborations for the continent.

[22] "Dark Sky Tourism: Economic Impacts on the Colorado Plateau of USA" (David Mitchell and Terrel A. Gallaway, 2016 www.nycgo.com

Astro-tourism attractions in African countries includes the following:

- BOTSWANA: Central Kalahari Game Reserve, Nxai Pan, Makgadikgadi Pan
- EGYPT: Sharm El Sheikh
- KENYA: Travelling Telescope, The Bamboo Tree Planetarium
- NAMIBIA: Gamsberg Observatory, NamibRand Nature Reserve, Sossusvlei Desert Lodge, Hakos Guest Farm, Tivoli Astrofarm, HESS, Sossusvlei - &Beyond Group
- MOROCCO: Stargazing Hotel SaharaSky48, Observatoire Astronomie Centre Culturel Atlas Golf Marrakech

Detailed information of the above-listed examples of Astro-Tourism products and offerings on the African continent are illustrated in Annexure B.

ASTRONOMY IN SOUTH AFRICA

Astronomy is a natural science that involves the study of the universe as a whole, and of celestial objects and phenomena such as the sun, moon, stars, planets, comets, gas, galaxies, dust, etc.

Astronomical observations from the Cape began in the 1700s, and the South African Astronomical Observatory (SAAO) was established in 1820. The Southern African Large Telescope (SALT) is the biggest telescope at the Sutherland site and is owned jointly with international partners. Many of the smaller telescopes at Sutherland are owned by foreign groups but are supported by South African technicians.

The South African Radio Astronomical Observatory (SARAO) was established in 2017. SARAO incorporates the radio astronomy activities at Hartebeesthoek (established in 1961) and the facilities associated with the Square Kilometre Array (SKA). The MeerKAT telescope is the first part of the SKA project and will be incorporated into the SKA in phases.

Aside from SAAO and SARAO, there are a few small observatories used by astronomy groups at universities (such as Boyden in Bloemfontein), but professional astronomers mostly use SAAO-SALT, SARAO, and the various international observatories.

As to South Africa's neighbours, the H.E.S.S. (High Energy Stereoscopic System) in Namibia is a world-class facility with five individual gamma-ray telescopes, which is used for observing high energy processes in the universe.

The Office of Astronomy for Development (OAD)[23] is a joint project of the International Astronomical Union (IAU) and the South African National Research Foundation (NRF) with the support of the Department of Science and Innovation (DSI). It aims to further the use of astronomy, including its practitioners, skills, and infrastructures, as tools for sustainable development globally.

The South African Government has also adopted a National Infrastructure Plan in 2012 that intends to transform our economic landscape while simultaneously creating a significant number of new jobs, and to strengthen basic service delivery. Eighteen Strategic Integrated Projects (SIPs) have been adopted and approved to support economic development and address service delivery in the poorest provinces. The SKA and MeerKAT is one of the 18 SIPs.

Professional and amateur astronomy: two distinct communities

Professional astronomers typically hold a PhD degree with published scientific results in accredited academic journals**.** The professional astronomy community in South Africa includes approximately

[23] https://www.astro4dev.org

150 PhD graduates, many employed at SAAO or SARAO. Significant research groups exist at many universities with active outreach projects.

On the other hand, the Amateur astronomers are enthusiasts who typically use their own telescopes for their observations and form part of the Astronomical Society of Southern Africa (ASSA). A few amateur-led observatories exist in South Africa, including the Cederberg Astronomical Observatory, and the LBF Observatory on Leeuwenboschfontein Guest Farm in the Central Karoo. These groups regularly host a range of astronomy events including meetings, outreach programmes, stargazing, astrophotography courses, etc. This group has also contributed to science, such as the following:

- Developed the concept of the 'Big Five of the African Sky'[24] (Milky Way; Southern Pleiades; Coalsack Nebula; Omega Centauri; Eta Carinae);
- Includes a substantial group of telescope specialists (building, operation, repairs) who can guide and assist entities to develop observatories, acquire and remain compliant with the necessary certifications for Dark Sky Recognition;
- Have an existing communication channels that can assist with marketing;
- Feature indigenous languages in past editions of its Sky Guide.

Planetaria

Planetaria are known for being educational centres which provide key accessibility for the general public to astronomical information.

Permanent planetaria in South Africa are the following:

- Iziko Planetarium, Cape Town;
- Johannesburg Planetarium, University of Witwatersrand;
- Naval Hill Planetarium, Franklin Game Reserve, Bloemfontein;
- Sutherland Planetarium, privately owned;
- The Museum of Science & Technology, Pretoria;
- The Unizul Science Centre, Richards Bay.

[24] Big Five of the African Sky http://assa.saao.ac.za/sections/deep-sky/big5/

TOURISM IN SOUTH AFRICA

Statistics South Africa (2017) defines tourism as the activities of persons travelling to and staying in places outside their usual environment, for not more than one consecutive year, for leisure, business and other purposes.

Tourism is a leading economic sector and often referred to as the world's largest industry (Hermann et al., 2016, World Tourism Organisation, 2016, Department of Tourism, 2018). Tourism contributes 10% of the global Gross Domestic Product (GDP) and 6% of the world's total exports (World Tourism Organisation, 2016, Department of Tourism, 2018). According to the World Tourism Organisation (2016), more than one billion tourists travelled internationally in 2015. A total of 3 309 712 travellers (arrivals, departures and transits) passed through South Africa's ports of entry during March 2017 (Statistics South Africa, 2017). The Department of Tourism (2016) reported 18,7% growth in international tourist arrivals during the last quarter of 2015-2016 compared to the previous year. Tourism contributed R136,1 billion (2.9%) to South Africa's GDP in 2017 and when indirect benefits across the value chain are included, the contribution amounted to R412,5 billion (8.9%) of South Africa's GDP (Department of Tourism, 2018).

Before the pandemic, South Africa was one of the world's most popular tourism destinations, with the tourism sector representing a major source of trade for the country. The global outlook for a return to 2019 levels of travel and tourism remains positive.[25]

Domestic tourism resumed in late July 2020. There is therefore significant potential for stimulating the tourism sector by resuming both overnight trips and day excursions.[26]

South African Tourism's Road to Recovery Reports note that:

- International arrivals into South Africa are currently comparable to international arrivals into other regions across the globe. All regions are still experiencing reductions in international tourism of more than 70% compared to previous years. [27]

- International arrivals are not recovering quickly, with travel and re-entry restrictions the most likely reasons for this. Arrivals from African countries are recovering fastest, driven by both land and air travel, while globally travel from Russia has shown significant growth since the opening of international arrivals in September. *(The war in Ukraine had not yet begun at the*

[25] Tourism Recovery Plan (COVID) 2020, Department of Tourism
[26] Domestic Tourism Survey 2018 (StatsSA)
[27] The Road to Recovery Report: Volume 2 – South African Tourism https://live.southafrica.net/media/280343/the-road-to-recovery-report-volume-2-31-mar-2021.pdf

time of publication of the report.) The USA and India are also recovering faster than other priority markets, but are still 86% lower than pre- COVID-19 Levels[28]

- International arrival volumes continue to improve, with South Africa still outperforming the global recovery average. This recovery is primarily driven by African land arrivals, with similar green shoots starting to show from the Middle East and North America. Lighter travel restrictions in key priority markets should start to encourage more international travel into South Africa. Most notable was the removal of South Africa from the UK red list as of 11 October 2021, given the importance of this market to South Africa's international tourism.[29]

SOUTH AFRICA AS AN ASTRO-TOURISM DESTINATION

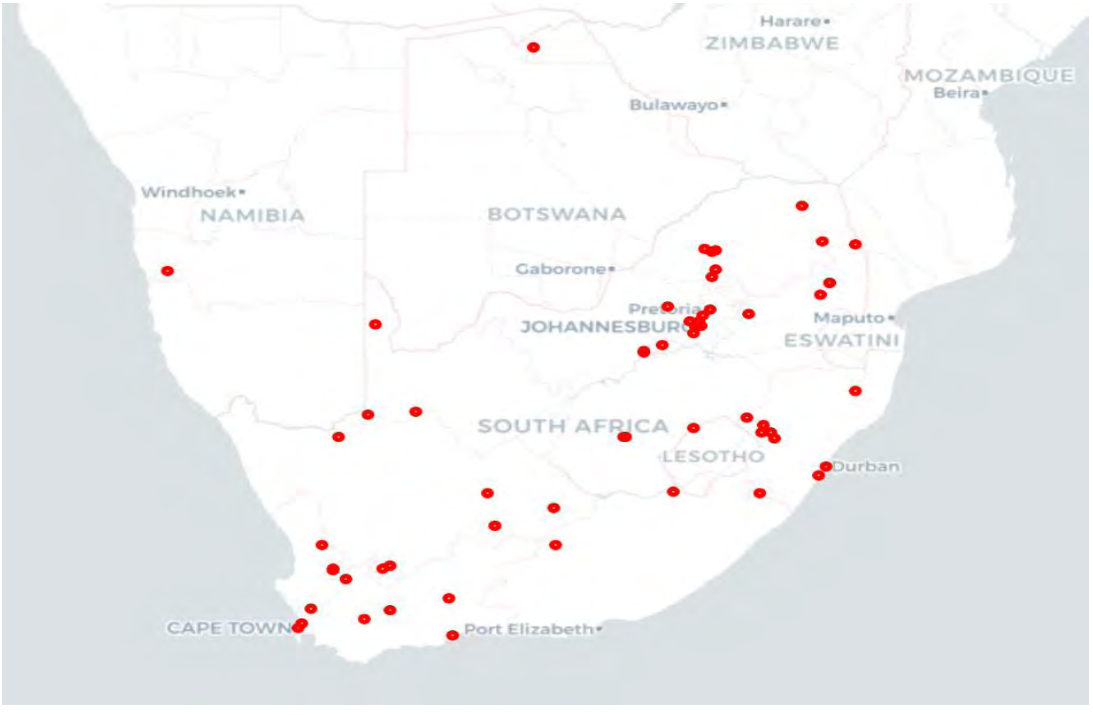
The science-based tourism market is gradually growing in South Africa, seeking to provide tangible socio-economic benefits with unique tourism experiences. Astro-Tourism activities includes stargazing, visits to dark sky areas and observatories, and participation in educational programmes. Astro-Tourists (with laser pointers, binoculars, phone apps, telescopes, etc.) are commonly interested in astrophotography, unique indigenous knowledge sharing, visiting our planetaria in South Africa; and attending astronomy talks.

During data collection in developing this Framework, tourists indicated that their most enjoyable Astro-Tourism activities included, Stargazing (91%), followed by witnessing celestial events (50%), Astrophotography (66%), Indigenous Story-telling (33%) and other science-tourism activities (8%).

The figure below, illustrates the various astro-tourism experiences and products in South Africa, including Namibia and Botswana. The comprehensive list is found in Annexure C.

[28] The Road to Recovery Report: Volume 3 – South African Tourism
[29] The Road to Recovery Report Volume 4 - South African Tourism https://live.southafrica.net/media/289325/the-road-to-recovery-report-volume-4.pdf?downloadId=392824

Figure 7: Astro-Tourism Experiences and products in Southern Africa



A ROI CASE STUDY- SUTHERLAND, NORTHERN CAPE PROVINCE

Sutherland in the Northern Cape Province was selected as the site for the Southern Africa Large Telescope, where the first telescope was installed in 1976. This small town has a unique combination of topographical and meteorological characteristics that makes it an ideal astronomical site. Since the construction of SALT, the ROI (return on investment) for this town resulted in becoming a key Astro-Tourism destination, where the demand for tours during peak season months (June, July and August) exceeds the capacity of the observatory, such that numerous operators are making use of amateur telescopes and attractions provided by local communities.

The tourism and hospitality industry bought into the Astronomy theme and adopted space motifs and stellar imagery by naming their establishments, Skitterland (Glitter land) Guesthouse, Jupiter Restaurant, Sterland (Star land), and Southern Cross, to mention a few. The construction and operations of the SALT and SAAO Telescopes have and will continue to ensure huge impact on the Karoo Hoogland Area and Sutherland in the following aspects as illustrated in the table below.

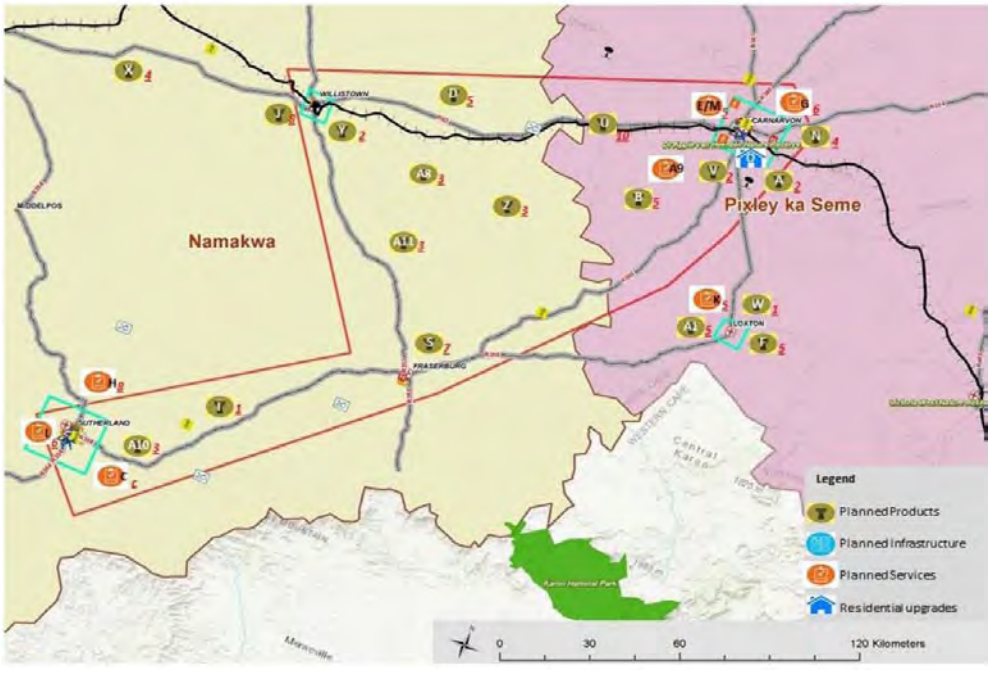
Table 3: Socio-Economic and Human impact of SAAO-SALT in Sutherland and Karoo-Hoogland Area

IMPACT	AREAS OF IMPACT
ECONOMIC	• The development of accommodation establishments has led to the creation of 302 jobs directly and several jobs indirectly; • The observatory has trained and employed 8 previously disadvantaged youth as tour guides, administrative and organisation staff all linked to the tours; • The observatory remains the single biggest employer in the town of Sutherland; • The observatory continues to utilize Sutherland based local enterprises for various projects; • The SALT Collateral Benefits Programme (SCBP) through support from the Department of Arts and Culture has trained numerous youths on entrepreneurship, supported local arts-based businesses and informal craft markets; • The SCBP partnership programme working with "Africa meets Africa", created opportunities for local actors and youth to feature in a movie called "*My room at the centre of the Universe*" – an astronomy movie based on a boy inspired by SALT and the Sutherland dark skies.
TOURISM	• Between 14000 -15 000 visitors per annum to the area; • SAAO inspired the opening of a local based planetarium and this led to job creation and tourism growth; • Rise in accommodation offerings in the town: 40 guest houses, 1 hotel & 10 guest farms – 8 with stargazing experience with further 15 rooms for visiting staff at SAAO; Increased offering of amenities such as 5 Restaurants, 4 big shops, 2 gas stations, 1 bank, 1 ATM, 1 hospital, 1 clinic, 1 police station, 1 post office; • SAAO offers guided Tour of Telescopes, Control room visit, stargazing, and a visitor centre; • Sutherland also offer a number of activities and attractions, such as the Dome Planetarium, stargazing, horse riding, snow, wild flowers, museum, mountain passes and mountain biking & hiking trails.
HEALTH	• Through support from SALT and SAAO, the local clinic received medical consumables valued at R100 000; • The clinic received 2 specialized trauma beds each valued at R50 000; • The clinic has access to free internet provided by SAAO; • Technical training was provided to local clinic staff. • SAAO and SALT staff assist in the maintenance of clinic equipment.
EDUCATION	• Two students from the SAAO/SALT education programmes in Sutherland are currently studying MBChB, 2nd year and 1st year BSc (Astrophysics) respectively at UCT. Of which 1 student was part of the team that won the National Astronomy Quiz in 2009; • The SAAO and NRF have refurbished both the primary and high schools' laboratories and supplied the schools with physics, chemistry and life science apparatus and utensils; • SAAO has secured 6 full cost bursaries from UWC for 2019 and 2020 for local students; • SALT purchased school desks for the intermediate learners in the Roggeveld Primary School; • SCBP organizes annual Career Expo and "*Take a child to work*" programmes for career information exposure;

	• Learners from Sutherland participate in the Astronomy Quiz, Science Festivals and Eskom Science Expo; • In collaboration with the Sutherland Library, SCBP and SAAO Library staff reading groups have been established and an astronomy corner has been created at the Sutherland Library; • The learning of mathematics and science is encouraged at the Sutherland schools through robotics programmes, science clubs and other national programmes such as National Science Week, Space Week etc.
SOCIAL	• The SAAO obtained and transformed an unused building into a Sutherland Community Development centre through a sponsorship from the Department of Science and Technology, the centre is equipped with 36 computers and provides free access to internet for learners, youth and the community. Learners are enabled to complete research for their education-based projects while the youth and the general public utilize the infrastructure for communication networks, job and business opportunities searches and applications; • The Community Centre serves as a platform to host various NGOs and government departments (e.g., Department of Labour and Social Services) to facilitate empowerment programmes such as construction internships for the unemployed youth, website and coding programmes for the youth and local businesses. Programmes on HIV, Drug Abuse and Alcoholic Foetal Syndrome have been implemented by Social Services Department. Training on social media, internet, email, CV writing have also been offered to the Sutherland youth at the centre; • Reading and Chess Clubs have been formed for the children of Sutherland; • Madiba and Youth Days are celebrated to encourage the spirit of community, social cohesion and generosity.

Sutherland further falls within the Carnavon-Sutherland Master Plan area and extends from Carnarvon along Karoo Highlands route and stretches about 542km on the R63 and R75 to Sutherland. The corridor extends from the town of Sutherland to Carnarvon in the interior of the Northern Cape Province.

Figure 8: Carnarvon-Sutherland Corridor (Department of Tourism, 2020 p4)



The Carnarvon – Sutherland Corridor is known for the South African Large Telescope (SALT) and the Square Kilometre Array (SKA). This corridor is home to unique natural and human attractions that could create a strong niche tourism market in the heart of Karoo, including agricultural activities. The Carnarvon-Sutherland Corridor (i.e. Sutherland, Fraserburg, Victoria-West, Loxton, Carnarvon) is characterised by broader science-based elements such as Palaeo-, Biodiversity-, Agriculture-, Geoglyph scientific significance.[30]

ASTRO-TOURISM ROUTE IN DEVELOPMENT

Tourism routes bring together a number of activities and attractions to enhance tourist experience under a joint marketing and branding initiative. Tourism routes are, moreover, a partnership of the historical, economic and cultural experiences in urban and rural areas, linked to historical, natural and scientific significance. The development of tourism routes is truly viable when in partnership by both the private and public sectors to develop tourism destinations (van Wyk-Jacobs, 2018).

The Karoo Highlands Route in the Northern Cape, which includes the towns, Victoria West, Loxton, Vosburg, Fraserburg, Carnarvon and Williston. These towns along this route all have the

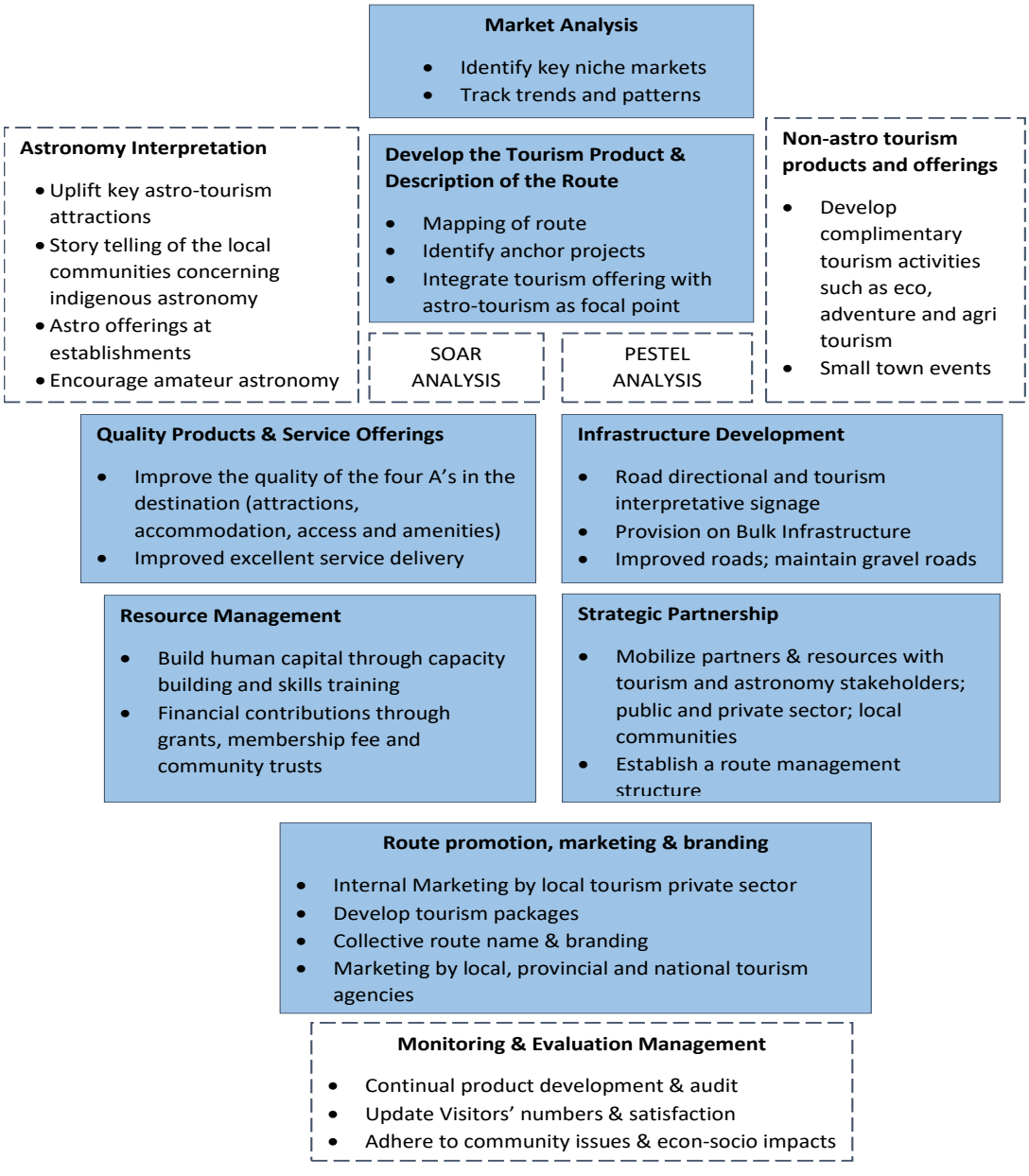
[30] Carnarvon-Sutherland Tourism Master Plan 2020-2050, Department of Tourism

potential to buy-in on the astronomy theme, and offer a diverse tourism offerings and activities such as, theatres, walking paths, arthouses, rock art, the SKA, clear dark skies and a unique culture and heritage.

The Astro-Tourism Route framework developed by van Wyk-Jacobs (2018) provides a practical step-by-step application with an approach which the Karoo Highlands Route can adopt to provide mutual beneficiation to local communities, tourism and astronomy businesses and stakeholders, by creating an enabling environment for sustainable development and growth. Importantly, local rural communities should be involved, as a key stakeholder, throughout the implementation stages to ensure sustainable socio-economic and environmental growth.

However, in order for this Astro-Tourism routes to be effective, the Northern Cape Department would have to improve the accessibility to these Astro-Tourism products and experiences through the upgrading of the road conditions, road signage and improved basic and bulk infrastructure.

Table 4: Astro-Tourism Route



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[31] Van Wyk-Jacobs, 2018. Astro-tourism as a catalyst for rural route development. PhD Thesis. Available at: https://repository.up.ac.za/handle/2263/70036.

FRAMEWORK

The Framework developed for this Strategy has three pillars, where efforts are focused to grow and develop Astro-Tourism in South Africa. These Pillars are 1. Human Capacity Development and Transformation, 2. Infrastructure Development and 3. Inclusive Tourism growth and partnership. The framework further explores these according to opportunities, challenges (through the PESTEL Analysis), key interventions and action projects.

Pillar One: Indigenous Celestial Narratives & Human Capacity Development

The opportunities to achieve the outcomes of Pillar 1, are the following:

- Active community workforces and local ownership;
- Self-sustainable tourism initiatives that are government led, community based and private sector driven;
- local and rural economic development;
- Entrepreneurs and tour operators initiate joint business ventures with profession astronomers;
- Recording, reclamation and representation of indigenous and historical stories.

The challenges related to this Pillar, are identified as follows;

Economic Challenges:

- High unemployment rate, low educational levels and skilled labour;
- Reduced funding from government & increased inflation due to macro-economic factors.

Socio-Cultural Challenges:

- The local communities' lack of awareness, & understanding of astronomy & tourism;
- Uncoordinated indigenous astronomy communities & entities.

Environmental Challenges:

- Global Warming & Climate change poses risk on astronomy & tourism industry sector.

The Pillar, Human Capacity Development and Transformation has the responsibility to intervene in regards to Tourist Guide Training, SMME Development, local ownership, indigenous astronomy

integration & recognition. This would be enabled by actioned projects such as an incorporated tourist guide training and the development of Astro-Tourism Handbook.

Pillar Two: Infrastructure Development

The opportunities to achieve the outcomes of Pillar 2, are the following:

- Production of World Class Science through collaboration & investment resulting in international recognition & attraction;
- Attract more visitors (longer bed-nights and increased spend);
- Dark Sky protection and development of Light pollution awareness campaigns;
- Partnering with the International Dark-Sky Association (IDA) to provide resources and marketing opportunities to support dark sky conservation and certification.

The challenges related to this Pillar, are identified as follows;

Technological Challenges:

- Poor signal and network within the rural area;
- High demand for upmarket technological facilities e.g. Wi-Fi;
- Restrictions due to the Astronomy Geographic Advantage Act limiting development and access;
- Radio Frequency Interference caused by traffic discourages support from Radio Astronomy community.

The Pillar, Infrastructure Development has the responsibility to intervene in regards to providing built Infrastructure, bulk basic services, improved accessibility, upgrade and maintenance of built infrastructure and Astro Tourism attractions. This would be enabled by actioned projects such as construction of the Carnarvon SKA science Centre.

Pillar Three: Inclusive Tourism Growth and Partnerships

The opportunities to achieve the outcomes of Pillar 3, are the following:

- Opens up unique opportunities for cooperation among tourism stakeholders, local communities and scientific institutions;
- Astronomy development across the African content;
- Recognition, growth, and increased interest in Multiwavelength Astronomy;
- International Astronomical Union General Assembly coming to SA in 2024.

The challenges related to this Pillar, are identified as follows;

Political Climate Challenges:

- Lack of synergy between local, district and national policy;
- Lack of capacity at local government level;
- Lack of Astro-Tourism content, alignment, integration & coordination.

Legal Scenarios:

- Poor registration of tourism businesses, tour guide registration and the grading of establishments;
- Lack of formalised Agreements with indigenous astronomy communities and general Astro-Tourism governance.

The Pillar, Inclusive Tourism Growth and Partnerships has the accountability to intervene in regards to Inclusive tourism value chain, effective marketing, Public Private Partnerships, tourism route development, data and analytics, events and festivals. This would be enabled by actioned projects such as establishment of a National Astro Tourism governance body and develop an Astro-Tourism Route.

Table 5: Framework

ASTRO TOURISM FRAMEWORK			
PILLARS	**INDIGENOUS CELESTIAL NARRATIVES & HUMAN CAPACITY DEVELOPMENT**	**INFRASTRUCTURE DEVELOPMENT**	**INCLUSIVE TOURISM GROWTH AND PARTNERSHIPS**
OPPORTUNITIES	• Local economic development through active community workforces. • Growth in various niche market segments e.g. outdoor and adventure, culture and heritage, agri-, eco- tourism. • Self-sustainable tourism initiatives that are government led, community based and private sector driven. • Recording, reclamation and representation of indigenous and historical stories	• Construction of world-class astro-tourism products and offerings • Attract more visitors (longer bed-nights and increased spend) • local economic development • rural economic development	• Opens up unique opportunities for cooperation among tourism stakeholders, local communities and scientific institutions. • Entrepreneurs and tour operators initiate joint business ventures with professional astronomers. • Astronomy development across the African content
CHALLENGES ACCORDING TO THE PESTEL ANALYSIS (POLITICAL, ECONOMIC, SOCIO-CULTURAL, TECHNOLOGICAL, ENVIRONMENTAL AND LEGAL SCENARIOS)	• ***ECONOMIC***: High unemployment rate and Low educational levels and skilled labour. • ***SOCIO-CULTURAL***: Lack of interest/understanding of astronomy and tourism from local communities. • ***ENVIRONMENTAL***: Climate change affecting the tourism industry sector.	***TECHNOLOGICAL:*** • Poor signal and network within the rural area. • High demand for upmarket technological facilities e.g. Wi-Fi at various points of interest. • Restrictions due to the Astronomy Geographic Advantage Act limiting development and access.	***POLITICAL***: • Lack of synergy between local, district and national policy. • Lack of capacity at local government level. • Lack of social cohesion and a platform for dialogue. • ***LEGAL SCENARIOS***: Lack of proper registration of tourism businesses as well as tour guide registration and the grading of accommodation establishments.
INTERVENTIONS	Tourist Guide Training, SMME Development, local ownership, indigenous astronomy development	Built Infrastructure, Bulk Basic Services, Improved accessibility, upgrade and maintenance of built infrastructure and astro-tourism attractions	Inclusive tourism value chain, effective marketing, Public Private Partnerships, tourism route development, data and analytics, events and festivals
ACTION PROJECTS	Incorporated tourist guide training	Establishment of the SKA science Centre	Establishment of a National Astro Tourism governance body.

ASTRO-TOURISM IMPLEMENTATION PLAN

IMPLEMENTATION PLAN

The Implementation Plan is the practical approach to achieve the Strategic Objective of the Astro-Tourism Strategy. The plan addresses each Pillar according to its specific objectives and interventions. The implementation plan further explores the implementation process, milestones and proposes the establishment of the Astro-Tourism Governance Body with roles and responsibilities of respective stakeholders.

PILLAR ONE: INDIGENOUS CELESTIAL NARRATIVES AND HUMAN CAPACITY DEVELOPMENT

Pillar Objectives: *To enhance transformation and inclusivity of the economic benefits of the Astro-Tourism sector*

Interventions: *Tourist Guide Training, SMME Development, local ownership, indigenous astronomy development*

Table 6: Implementation Plan- Pillar 1

PROJECT NAME	PROJECT SCOPE	LEAD STAKEHOLDER	SUPPORT STAKEHOLDER	BUDGET	IMPLEMENTING YEAR	IMPACT
Tourism Enterprise Development - Carnarvon	Financial support to start-ups and established tourism enterprises.	NC DEDAT	DT	R200 000 (Funded)	2023 - 2024	Tourism enterprises targeted as delivering on SKA Carnarvon Exploratorium MOU.
Tourist Guide Training	Train and register in the star-gazing corridor – Sutherland, Carnarvon, Fraserburg, Williston.	NC DEDAT	DT	R200 000 (Funded)	2023 - 2024	Prospective tourist guides targeted.
Cederberg Guide Training	Provide practical experience for guides-in-training	Cederberg Observatory	DSI	R120 000 (Not funded)	2023 - 2024	Guides-in-training gain hands on experience of running Astro-tourism experiences in dark sky environment

Cederberg Transformation Camp	Provide transport and camping opportunities for learners from disadvantaged communities (and possibly family members) so they can visit the observatory. Use selection as scientific literacy driver	Cederberg Observatory	DSI	R700 000 (Not funded)	2023 - 2024	Transformation and improving scientific literacy
Qualified Tourist Guide Bursary Scheme	Provide funding to attend SAQA accredited tourist guide course with strong Astro-tourism component (in collaboration with for example the Tourist Guide Institute)	Cederberg Observatory	DSI DT	R12 000/guide (Not funded)	2023 - 2024	Fully qualified Astro-tourism tourist guides
Accreditation of Astro-tourism Guides	Provide suitable education material as well as guidance /support/training towards accrediting Astrotourism Guides at National Parks	ASSA	DSI	R2million (Not funded)	2023 - 2024	Skills development of tour guides in astronomy
Indigenous Astronomy Research and Dissemination	Dedicated research project to record and disseminate indigenous starlore from a variety of African cultures	SAAO	DSI UNW	R6million (Not funded)	2023 - 2024	The preservation of the incredible trove of indigenous knowledge existing in South Africa
Astrophotography as a tool for science enrichment and human capacity development.	To expose the general public (local and International visitors) to the science and art of astrophotography and to	Prof Peter Dunsby	DSI	R300 000 (Not funded)	2023 - 2024	Potential large impact for astronomy enrichment.

	encourage young people into the physical sciences and engineering.					
Tourist Guide Astronomy training	Training Guides per Province Routes	STPP	DT	R250 000 per province R2 250 000 (Not funded)	2023	Site Guide and Astronomy Guide Training
Astrotourism SMME Development	Workshops – Sustainable tourism and Benefits of Astrotourism with 'How to'	STPP	DT NC DE-DAT	R500 000 (Not funded)	2023	Upskill existing SMME's in the Tourism environment on chosen routes – Create permanent jobs

PILLAR TWO: INFRASTRUCTURE DEVELOPMENT

Pillar Objectives: *To enhance destination competitiveness through optimal use of new and existing infrastructure, equipment and resources*

Interventions: *Built Infrastructure, Bulk Basic Services, Improved accessibility, upgrade and maintenance of built infrastructure and Astro Tourism attractions*

Table 7: Implementation Plan- Pillar 2

PROJECT NAME	PROJECT SCOPE	LEAD STAKE-HOLDER	SUPPORT STAKE-HOLDER	BUDGET	IMPLE-MENTING YEAR	IMPACT
Carnarvon SKA Science Visitor Centre	Interactive space SKA science centre and planetarium	SARAO	DT DSI	R62million (Funded)	2022 - 2024	Tourism Development Community Development Economic Development Education & Awareness
!Xaus Lodge Star-Gazing	Financial support to !Xaus Lodge to construct a star-gazing platform, procure 12-inch telescope with tracking ability and tourist guide training in star-gazing.	NC DEDAT	DT	R200 000 (Funded)	2023 - 2024	!Xaus Lodge further diversify its tourism activities and become a more attractive and greater value-for-money tourism experience.
Wits Digital Dome	Education/outreach/marketing of astro-tourism opportunities.	Wits University	DSI	R75million and R3Million Per year on ops (Funded)	2023	Be both a venue for and showcase national astro-tourism opportunities, establish a Gauteng node of astrotourism gateway
Cederberg Exhibits	Expand visitor experience to allow a much deeper understanding of Astronomy in South Africa and benefits thereof	Cederberg Observatory	DSI	R300 000 (Not funded)	2023	Expanding visitor activities at the Observatory will provide income streams and job creation. It also achieves goals of lifting scientific awareness more effectively.
SaNS (Save the Night Sky	Major centres in South Africa; selected locations of specific	Auke Slotegraaf Centre for Astronomical Heritage	DSI	R2.1 million (Not funded)	2023 - 2024	First baseline dataset of light pollution in South Africa; ongoing automated monitoring at sensitive locations

	ecological sensitivity					
Sutherland AstroPlay-PArk	Building an Astronomy-themed play-park designed to educate while having fun. Free for Sutherland residents, tourists pay.	DSI/DT	DSI DT	R500 000 (Not funded)	2023	Provide tourism products that educate about Astronomy while providing fun activities for families. Provides community facilities for Sutherland
Stargazing infrastructure Consulting	Consult on required infrastructure and requirements for a stargazing offering, e.g., telescopes, binoculars, lighting	ASSA	-	R2million (Not funded)	2023 - 2024	Increased access to specialist knowledge in setting up a small observing offering
Cape Town Visitors Centre	Complete and improve Cape Town Visitors Centre	SAAO	DSI	R1.5million (Partly Funded)	2022 - 2023	Cape Town Tourism and Northern Cape Tourism
Cape Town Site Upgrades	Restore and repair the historical Cape Town Observatory site and buildings	SAAO	DSI	R20million (Not funded)	2023 - 2024	Cape Town Tourism, National Heritage
Cape Town Museum Upgrades	Improve the SAAO Museum with new exhibits	SAAO	DT	R1.5million (Not funded)	2023 - 2024	Cape Town Tourism, National Heritage
Sutherland Visitors Centre	Up-date and revamp the centre and included new indoor and outdoor exhibits	SAAO + appointed experts	DSI DT	R20million (Not funded)	2023 - 2024	Sutherland tourism
Dedicated Remote Observing Telescope	Installation of a dedicated outreach telescope able to perform online stargazing from anywhere in the world	SAAO	DSI	R2million (Not funded)	2023	Access to interactive live stargazing from anywhere in the country including science centres and schools
Astro-Tourism App	The creation of a South African Astro-Tourism App with news,	SAAO	DSI DT	R3million (Not funded)	2024	Easy access to all information related to Astronomy in South Africa

	events, attractions and tips					
Sutherland Guest Accommodation	Setting up a Guest House at the SAAO in Sutherland	SAAO	DT	R20million (Not funded)	2023 - 2024	Increased availability for visitors to access the site and experience the night sky
Sutherland Restaurant	Setting up a restaurant at the SAAO in Sutherland	SAAO	DT	R6million (Not funded)	2023 - 2024	Improve tourism offering at the SAAO
Sutherland Planetarium	Purchase and running of Sutherland Planetarium	SAAO	DSI	R20million (Not funded)	2023	Improve tourism offering at the SAAO
Karoo Highland Route – Loxton Transformation Hub – Stargazing Deck	Building Deck at Art House in Loxton - a Community Based Transformation Hub	STPP	DSI DT	R155 000 (Not funded)	2023	Create 4 permanent Jobs includes Skills Training for 1 Welder Astro Training for 2 Site guides. Increase Tourism Activity
Boyden Observatory & Science Centre	Education/outreach/marketing of astro-tourism opportunities.	UFS ASSA Boyden Network	DSI	TBD (Not funded)	Operational	Boyden is committed to bringing a high standard of scientific education and exposure to the public and youth.
Naval Hill Planetarium	Education/outreach/marketing of astro-tourism opportunities.	UFS – Centre for Earth and Space. DSI. DESTEA. Mangaung Municipality.	DSI	TBD (Not funded)	Operational	A venue for and to showcase national astrotourism opportunities. This establishment offers immersive digital experience from the smallest atomic particles to the largest cosmological scales
Deelfontein Observatory – Vredefort Dome	Education/outreach/marketing of astro-tourism opportunities	DT WITS Municipality	DSI	TBD (Not funded)	Operational	Be both a venue for and showcase national astrotourism opportunities.
Johannesburg SAASTA Observatory	Education/outreach/marketing of astro-tourism opportunities	SAASTA NRF	DSI	TBD (Not funded)	Operational	Be both a venue for and showcase national astrotourism opportunities.
Cederberg Observatory	Education/outreach/marketing of astro-tourism opportunities	Chris Fonder, Wayne Trow, Cliff Turk, Malcolm Cerfonteyn, Peter Schonu, Dany Dupree, Jeff Groom, Gerhard Pool	DSI	TBD (Not funded)	Operational	Be both a venue for and showcase national astrotourism opportunities.

Iziko Planetarium & Digital Dome	Education/outreach/marketing of astro-tourism opportunities	Dept. of Arts & Culture, DSI, NRF, UWC, UCT, CPUT	DSI	TBD (Not funded)	Operational	Be both a venue for and showcase national astrotourism opportunities.
Telescope Deck at !Xaus Lodge	Construction & equipping of a night-sky viewing deck	NC DEDAT	DT DSI	R600 000 (Not funded)	2024	To further diversify its tourism activities and become a more attractive and greater value-for-money tourism experience.
Astro-Tourism Route Development	Upgrading strategic roads and signage along the Karoo Highlands Route	NC DEDAT	DT DSI Dpt. of Road & Transport	TBD (Not funded)	2024-2030	To improve accessibility to Astro-Tourism products & offerings and improve the lives of local communities.
Feasibility study for the establishment of a National Science Museum	This project will assess the feasibility of establishing a National Science Museum	DSI	DT	TBD (Not funded)	2024-2026	The museum would provide a platform for the public to engage with the latest scientific and technological advancements, helping to foster a greater understanding and appreciation of scientific and technological concepts. It would also provide an invaluable resource for students and teachers, providing a great opportunity for hands-on learning and exploration.

PILLAR THREE: INCLUSIVE TOURISM GROWTH AND PARTNERSHIPS

Pillar Objectives: *To strengthen South Africa's Astro-Tourism competitiveness through deliberate collaboration efforts and destination development.*

Interventions: *Inclusive tourism value chain, effective marketing, Public Private Partnerships, tourism route development, data and analytics, events and festivals*

Table 8: Implementation Plan- Pillar 3

PROJECT NAME	PROJECT SCOPE	LEAD STAKE-HOLDER	SUPPORT STAKEHOLD-ERS	BUDGET	IMPLEMENT-ING YEAR	IMPACT
Space Shop	Provide outlet for Astron-omy-themed crafts	African Space-shop	DSI	R1million (unfunded)	2023	SMME growth, sig-nificant job creation, richer experi-ence for tourists, in-creased sci-entific awareness
AstroMusic and As-troArt	Promote as-tronomy-in-spired mu-sic and art	African Space shop	DSI DT	R300 000 (unfunded)	2023	Growth of the astro-tourism value chain, in-creased scientific awareness
Interna-tional Dark Sky Certifi-cation of Parks /Re-serves	ASSA will coordinate the accredi-tation of suitable government Parks for In-ternational Dark Sky Certifica-tion.	ASSA	DSI	R2million (unfunded)	2023 - 2024	The accredi-tation of IDAs across the country
Astronomy corners in Science Centre	Installation of a dedi-cated as-tronomy corner in each of the over 60 sci-ence cen-tres in the country	Science Centre Network	DSI	R4million (un-funded)	2023	Astronomy presence in every sci-ence centre reaching hundreds of thousands of students a year
Astronomy Festival	A large week-long Astronomy festival in-corporating public,	African Space shop	DSI DT	R10mil-lion (un-funded)	2024	Reach tens of thousands of learners, educators and

	school and educators' events					members of the public
New Astronomy Planetarium Film	A world-class planetarium film highlighting the astronomy facilities and research in the country	SAAO	DSI	R3million (unfunded)	2023 - 2024	SAAO + appointed experts
The Cosmic Savannah Podcast	Improve and expand The Cosmic Savannah Podcast	SAAO	DSI	R300 000 (unfunded)	2023	Reach hundreds of thousands of members of the public globally
Cape Town Observatory Virtual Tour	The creation of a virtual tour for the Cape Town National Heritage Site	SAAO + appointed experts	DSI DT	R1million (unfunded)	2023 - 2024	Local and Global public

IMPLEMENTATION PROCESS

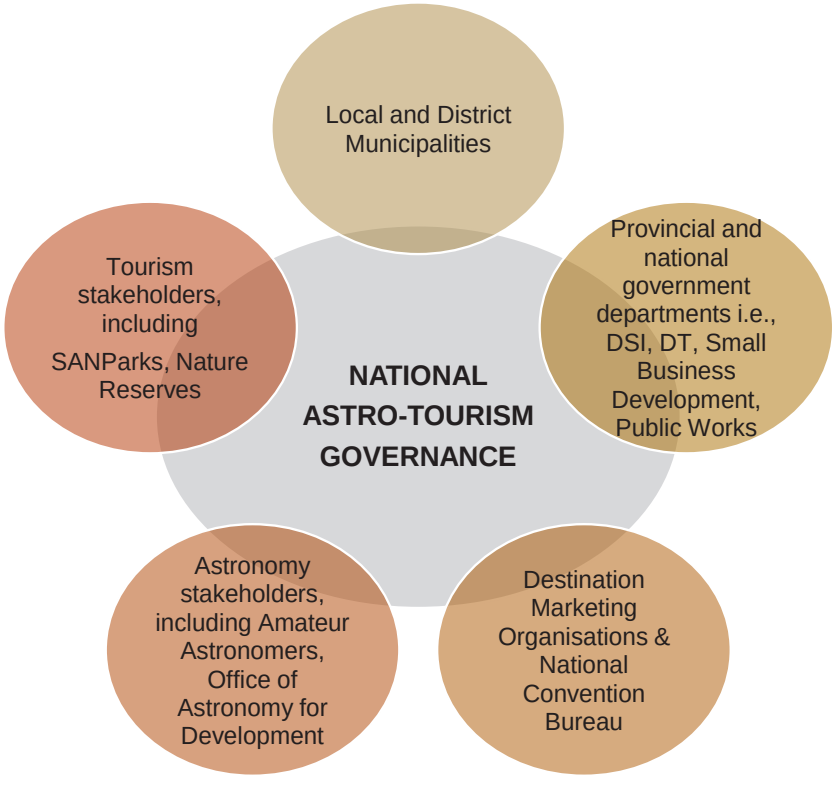
It is proposed that an Astro-Tourism Governance Body should be responsible to roll-out of the Implementation Plan and be led duly by the Department of Tourism and the Department of Science and Innovation until fully established and in operation. It is proposed that the chairing and secretariat function should be implemented and divided between the leading departments, at a rotational basis with the following proposed for the first three (3) years:

Year 1 (2023/24)	- Department of Science and Innovation (Chair) & DT (Secretariat)
Year 2- (2024/25)	- Department of Tourism (Chair) & DSI (Secretariat)
Year 3 (2025/26)	- Northern Cape Department of Economic Development and Tourism (Chair) & Department of Tourism (Secretariat)

The roles and responsibilities of the Astro-Tourism Governance Body will include the following, but not limited to:

- to collaborate and coordinate relevant stakeholders, ensuring the objectives of the Implementation Plan are achieved across all the Pillars;
- Assess the list of initiatives and lobby at both private and public investors to provide funding for viable un-funded projects (request for proposals);
- Provide strategic support to the Northern Cape Province, as the identified pilot Astro-Tourism destination.

Figure 9: National Astro-Tourism Governance Body



IMPLEMENTATION MILESTONES

With regards to the proposed milestones to kick-start the Astro-Tourism Governance Body, along with a Terms of Reference is subsequently developed to realise the Astro-Tourism Strategic objectives and implementation. The Governance Body will ensure that the following milestones are achieved for the following MTEF Period.

Table 9: MTEF Period Target

MTEF Period		
2023/24	**2024/25**	**2025/26**
Implementation of the Astro-Tourism Strategy	Implementation of the Astro-Tourism Strategy	Implementation of the Astro-Tourism Strategy

The following table illustrate the Annual and Quarterly Targets for the first implementation year of the National Astro-Tourism Strategy.

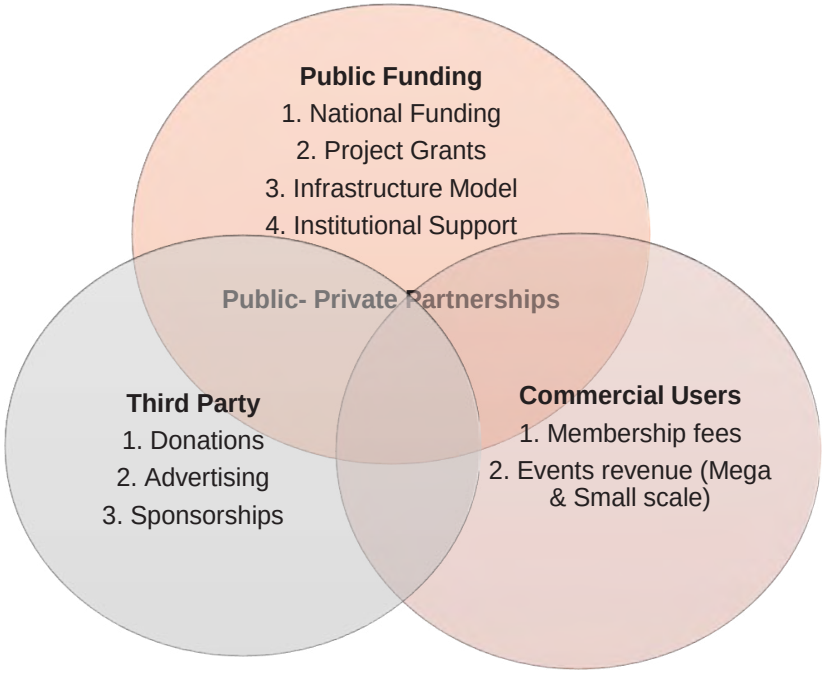
Table 10: Annual and Quarterly Milestones

Output Indicator	**Annual Target 2023/24**	**Quarterly Targets**			
		Q1	**Q2**	**Q3**	**Q4**
Implementation of the Astro-Tourism Strategy- Pillar 1	**Tourist Guide Training in Carnarvon**	Quarterly Progress Report on the implementation of the Tourist Guide Training submitted.	Quarterly Progress Report on the implementation of Tourist Guide Training submitted.	Quarterly Progress Report on the implementation of Tourist Guide Training submitted.	Quarterly Progress Report on the implementation of Tourist Guide Training submitted.
Implementation of the Astro-Tourism Strategy- Pillar 2	**Monitor construction of SKA Carnarvon Exploratorium Centre**	Quarterly Progress Report on the construction of Interpretation Centre submitted.	Quarterly Progress Report on the construction of Interpretation Centre submitted.	Quarterly Progress Report on the construction of Interpretation Centre submitted.	Quarterly Progress Report on the consultation of Interpretation Centre submitted.

Output Indicator	Annual Target 2023/24	Quarterly Targets			
		Q1	Q 2	Q3	Q4
	Wits Digital Dome	A newly refurbished Dome and operational offices open to the public.	Report on the monitoring visitors' numbers and impact of the tourism offering	Report on the monitoring visitors' numbers and impact of the tourism offering	Report on the monitoring visitors' numbers and impact of the tourism offering
	SAAO Visitor Centre	A newly refurbished CPT Visitor Centre open to the public.	Report on the monitoring visitors' numbers and impact of the tourism offering	Report on the monitoring visitors' numbers and impact of the tourism offering	Report on the monitoring visitors' numbers and impact of the tourism offering
	Monitor construction of Vredefort Dome Interpretation Centre	Quarterly Progress Report on the construction of Interpretation Centre submitted.	Quarterly Progress Report on the construction of Interpretation Centre submitted.	Preparations for official opening and operations	Official Launch of the Centre
Implementation of the Astro-Tourism Strategy- Pillar 3	**Establishment of the Astro-Tourism Governance Body**	Existing Working Group initiate the institutional Arrangements, i.e. the Terms of Reference, develop members criteria and determine roles and procedures for decision-making.	Astro-Tourism Governance Body quarterly meeting and report on implementation of Astro-Tourism Strategy.	Astro-Tourism Governance Body quarterly meeting and report on implementation of Astro-Tourism Strategy.	Finalise the Terms of Reference for inter-Departmental and stakeholder Governance Body Structure finalised.
	IAU – GA 2024	Conference Preparations and Marketing	Hosting of the IAU-GA Conference	Report of the state of Conference and flagship projects	Monitoring and Follow-up of Conference and flagship projects

MODEL FOR MULTIPLE STREAMS OF FUNDING

Figure 10: Funding Model Options



The National Astro-Tourism Governance Body, will be responsible to review which funding models will be best suited for the implementation of the Strategy.

The lead departments, the Department of Science and Innovation and the Department of Tourism will have to leverage this inimitable niche market as a unique selling point to investors, both private and public and both domestic and international.

Co-funding of this Strategy is proposed for the Implementation Plan and combining investment from a variety of sources, such as related industry institutions, venture capitalists, and many more invest alongside the crowd to support great investors, donors, private funding, and government funding sources businesses.

Co-funding has been sought from other donors, private institutions or with the host government. Co-funding in this way is becoming an increasingly common and powerful model of investment. It gives investors access to a broad range of innovative high growth technology businesses with the added reassurance that they are investing alongside some of the South Africa's best investors.

MONITORING AND EVALUATION

The successful implementation of the Astro-Tourism Strategy will be possible through proper monitoring and evaluation. The areas of tracking progress for growing the tourism niche market are: supply, economic development and transformation, demand followed by developing a gap analysis.

This could be done through the Astro-Tourism Governance Body to track progress and mitigate risk and challenges. These areas of M & E can also be investigated by the Research units from the Department of Tourism, the Department of Science and Innovation and the respective DMOs.

Table 11: Monitoring and Evaluation Objectives and Proposed Action

M & E OBJECTIVES	ACTIONS
1. Review of existing and potential Astro-Tourism products and related science tourism for planning and implementation purposes (supply).	• Conduct a comprehensive audit of Astro-Tourism products. • Documentation and compilation of information.
2. Assess the impact of Astro-Tourism products, to inform planning and implementation of initiatives (economic development & transformation).	• Set appropriate measurable indicators and produce periodic reports on monitoring and evaluation.
3. Visitor profile and experience, to inform planning regarding the needs and expectations of visitors (demand).	• Constant research and provide data supply on visitor profile and experience.
4. Trends and best practices, for benchmarking and planning purposes (gap analysis).	• Regular research and data supply on current trends and best practices.

ANNEXURES

ANNEXURE A: International Astro-Tourism Products and Offerings

Country	Facility	Overview	Local Relevance
United States of America There are over 350 observatories and over 250 planetaria in the USA	JVLA Radio Telescope[32] – New Mexico	Daily visits; Student research support programmes; Summer schools.	Introduce summer school programmes
	McDonald Observatory[33] – Texas	Offers guided tours of selected research sites; Hosts special evening activity-based programmes; Star Party viewing; Constellation tours; School field trips. Offers 'Dark Sky experiences': 65 % of visitors to the national parks rated dark skies as 'very important or extremely important.' Aggressively markets tourism activities and celestial events through a calendar, tourist maps, brochures, and social media.	Introduce more activities at local observatories
	Colorado Plateau Dark Sky Cooperative[34]	"The Colorado Plateau Dark Sky Cooperative empowers landscape-scale dark-sky conservation efforts and leads the way in protecting natural darkness as a precious resource in collaboration with local, state, and federal agencies, tribes, businesses, non-profits, educational institutions, and community partners throughout the Colorado Plateau and beyond"	Collaboration between government agencies, cultural organisations, private enterprise, etc.
	Hayden Planetarium[35] – New York	Welcomes 5 million visitors per annum at an average $23 per ticket for a 30-minute show. 7 shows a day, Wednesday to Sunday	Capitalise on astro shows at planetaria
China	Five Hundred Metre Aperture Spherical Radio Telescope (FAST)[36] – Guizhou Province	FAST attracted nearly 3,8 million tourists in the first half of 2017. Hospitality facilities have grown in the neighbouring town, Pingtang, to accommodate the number of visitors drawn to the telescope. Tourists are encouraged but not forced to store electronic devices such as mobiles and digital cameras before entering the buffer zone. However, because of the number of visitors, the	An example of intense astrotourism that opens hospitality opportunities

[32] The Karl G. Jansky Very Large Array https://public.nrao.edu/visit/very-large-array/
[33] McDonald Observatory, University of Texas at Austin https://mcdonaldobservatory.org
[34] Colorado Plateau Dark Sky Cooperative https://cpdarkskies.org
[35] Hayden Planetarium visitor information https://www.amnh.org/research/hayden-planetarium
[36] FAST on Wikipedia https://en.wikipedia.org/wiki/Five-hundred-meter_Aperture_Spherical_Telescope

		interference caused by those devices that were brought into the area poses challenges for the scientists operating the telescope.[37]	
United Kingdom	Jodrell Bank Observatory[38] – Macclesfield	Open weekends; Annual festival; Telescope talks; 150,000 visitors per annum.	
	The Royal Observatory in Greenwich[39] - London	2.4 million visitors per annum; Observatory open daily 10h00 to 17h00 Planetarium shows, e.g.: Sat & Sun: Ted's Space Adventure School Holidays: Mon – Sat: The Sky Tonight Mon – Sat: Meet the neighbours	Example of the number of visitors a facility can host if it is managed for tourism, and properly marketed
European Astrotourism Routes[40]	Sardinia, Italy[41]	*Stones, Stars and Paths: From Tradition to Big Science*. An itinerary that includes visits to archaeology, astronomy & natural attractions. Includes a guided tour of Sardinia Radio Telescope. Also includes Neolithic sites (300-400 B.C.E.), and the Sardinia Miniature Park, which houses exhibits of celestial bodies, artificial satellites and launches, telescopes, etc.	Example of combining archaeology, palaeontology, and astrotourism into routes. Similar itineraries and packages can be developed in South Africa
	Italy - Tender, Marche Region[42]	*In and Over 7-day Tour* - cultural tour including history, art, poetry, nature, and cuisine, as well as the stars and the skies. Includes visits to observatories.	
	Spain - Valencia[43]	Inland and rural tourism. Hiking route featuring astronomy, palaeontology, and archaeology; visit an astronomical observatory	
	Greece - Taxiarchis[44]	*Myths and Astronomy Tour* explores the magic and mystery of ancient and modern Greece. Includes Thessaloniki Science Centre and the Technology Museum Noesis; the dark skies village of Taxiarchis for a stargazing experience, etc.	
India:	Astro-stays Project - Himalayas[45]	The Astro-stays Project in the remote areas of the Himalayas offers stargazing activities combined with accommodation. The project has uplifted communities, which were provided with skills training as well as telescopes and solar power panels.	The Astro-stay Project can be mirrored in South Africa for community upliftment

[37] Chen, S.: 'How noisy Chinese tourists may be drowning out alien signals at the world's biggest telescope.' South China Morning Post, 24 August, 2017 https://www.scmp.com/news/china/society/article/2107893/how-noisy-chinese-tourists-may-be-drowning-out-alien-signals
[38] Jodrell Bank Observatory https://www.jodrellbank.net/visit/
[39] The Royal Observatory in Greenwich https://www.rmg.co.uk/plan-your-visit
[40] European Astrotourism Routes http://www.euskyroute.eu
[41] European Astrotourism Routes Sardinia, Italy http://www.euskyroute.eu/wp-content/uploads/2015/06/03sardinia.pdf
[42] European Astrotourism Routes: Italy, Tender, Marche Region http://www.euskyroute.eu/wp-content/uploads/2015/06/04tender.pdf
[43] European Astrotourism Routes: Spain, Valencia http://www.euskyroute.eu/wp-content/uploads/2015/06/02valencia.pdf
[44] European Astrotourism Routes: Greece, Taxiarchis http://www.euskyroute.eu/wp-content/uploads/2015/06/07grecia.pdf
[45] India Himalayas: Astrostays Project, https://www.astrostays.com

New Zealand	Aoraki Mackenzie International Dark Sky Reserve[46] – South Island	Light pollution is strictly controlled, and is therefore limited. Mount John Observatory[47] is situated within the Dark Sky Reserve, which offers magnificent views of the Southern Cross, the Magellanic Clouds, and the Milky Way. Activities include stargazing, astrophotography, storytelling (mix of history, culture and stargazing). Sir Edmund Hillary Alpine Centre – Digital Dome Planetarium[48]. Overnight facilities vary from hiking huts to backpackers to 5-star accommodation.	
Australia	Western Australia - Coral Coast[49] *and* Golden Outback[50] regions	Attractions include dark skies, astrotourism towns. astrophotography hotspots, specially chosen observation sites, local communities equipped with telescopes and binoculars for stargazing, etc.	Attractions adapted by region (elevation, landscape features, rainfall, etc.)
	Narrogin[51] Dark Sky town	"*People now travel to see a dark night sky just as they travel to see other icons such as the Great Barrier Reef, the Amazon Rainforest, or Antarctica. A dark night sky has become a rarity and cannot be seen everywhere*" ~ Narrogin Tourism Strategy 2019.[52]	

[46] New Zealand: Aoraki Mackenzie International Dark Sky Reserve https://mackenzienz.com/scenic-highlights/dark-sky-reserve/
[47] New Zealand: Mount John Observatory https://mackenzienz.com/scenic-highlights/mountjohn/
[48] New Zealand: Sir Edmund Hillary Alpine Centre – Digital Dome Planetarium https://www.myguidechristchurch.com/things-to-do/sir-edmund-hillary-centre-planetarium
[49] Australia - Coral Coast (Astrotourism WA) https://www.australiascoralcoast.com/business/tours/astrotourism-wa
[50] Australia - Golden Outback (Astrotourism WA) https://www.australiasgoldenoutback.com/business/attractions/astrotourism-wa-stargazing-western-australia
[51] Australia - 'Dark night sky an asset for Narrogin' https://www.narrogin.wa.gov.au/news/dark-night-sky-an-asset-for-narrogin/10718

[52] Australia - Narrogin Tourism Strategy 2019 https://www.narrogin.wa.gov.au/Profiles/narrogin/Assets/ClientData/191013_Narrogin_Tourism_Strategy_Final_Draft_SG_editspdf.pdf

ANNEXURE B: Astro-Tourism Products and Offerings on the African Continent

Country	Facility	Overview	Local Relevance
Egypt	Sharm El Sheikh[53]	Camel rides to Bedouin tents with guided stargazing experiences	Example of an authentic experience hosted by indigenous people
Morocco	Fez	University of al-Qarawiyyin[54] - said to be the oldest University in existence. Observatory, museum, library, etc.	
	Fez (rural)	*Stargazing Hotel SaharaSky*[55] – the first private observatory attached to a hotel and restaurant in North Africa. The 500m² observation area on the roof of the hotel provides 360° views of the sky. Stargazing with professional guides equipped with state-of-the-art GPS telescopes of up to 400mm aperture, and with specialised telescopes for astrophotography. "In our hotel the sky is not limited to night time. In our inventory, we have a special telescope and a special pair of binoculars for safe Sun observation." Marketing of the hotel emphasises that constellations of the southern hemisphere that are out of range from central or northern Europe are visible from Fez; and that the area averages 300 days of clear, cloudless skies in total absence of light pollution.	Example of a private-sector project built on astrotourism
	Marrakech	Observatoire Astronomie Centre Culturel Atlas Golf Marrakech[56] - one of the world's largest privately-owned observatories, offers individuals, groups, companies and schools' access to improving stargazing skills. Public Observations are held on Fridays. Hosts the Marrakesh Astronomy Festival	
	Casablanca, Marrakesh, Rabat and Oujda	Universities Offer Graduate Programmes in Space Sciences	
Kenya	Nairobi	*Travelling Telescope,*[57] a social enterprise led by Susan Murabana, provides	

[53] Morocco, Sharm El Sheikh. Stargazing, Bedouin evening https://sharmersexcursions.com/excursions/sharm-el-sheihk/star-gazing/
[54] Morocco, Fez: University of al-Qarawiyyin https://en.wikipedia.org/wiki/University_of_al-Qarawiyyin
[55] Morocco, Fez: Stargazing Hotel SaharaSky http://www.saharasky.net/hotel/index.php
[56] Morocco: Observatoire Astronomie Centre Culturel Atlas Golf Marrakech https://www.atlasgolf-marrakech.com/en/cultural-center/observatory/
[57] Kenya: Travelling Telescope https://travellingtelescope.co.uk/about/

		access to astronomy for school goers and tourists. *The Bamboo Tree Planetarium*[58] in Nairobi offers 3 different shows appealing to scientists, visitors and children. Funding for the organisation is provided by donors	
Namibia	Range of experiences:[59]	Gamsberg Observatory, NamibRand Nature Reserve, Sossusvlei Desert Lodge, Hakos Guest Farm, Tivoli Astrofarm, HESS *Namibia Tourism: Exploring Namibia's Starry Skies*[60] – Dark skies, astrophotography, stargazing, etc.	Develop tour packages that incorporate astrotourism
	Sossusvlei - &Beyond Group	High end lodges such as &Beyond Soussusvlei[61] offer stargazing experiences with knowledgeable astronomers. "&Beyond Sossusvlei Private Desert Reserve neighbours Africa's only International Dark Sky Reserve"	Encourage private lodges to create astrotourism products
Botswana	Central Kalahari Game Reserve, Nxai Pan, Makgadikgadi Pan.	Various lodges and safari operators offer accommodation options under the stars: "One of the highlights of a safari for most visitors is to view our Southern constellations free from the light pollution of big cities" "Probably the best locations for star watching are the Kalahari parks – Central Kalahari Game Reserve, Nxai Pan and Makgadikgadi Pan. The flat horizons here make for an amazing field of view. The best time of year is our dry season, when skies are usually cloudless (May – October)" - Khaki & Dust Safaris[62]	Botswana is constrained by shortages of trained guides and appropriate equipment

[58] Kenya, Nairobi: Bamboo Tree Planetarium https://africanplanetarium.org/bamboo-tree-planetarium-2/

[59] Stone, Chris, "*Prospects of an Astrotourism Site in Namibia*" (2019). Pence-Boyce STEM Student Scholarship. 12.
https://digitalcommons.olivet.edu/pence_boyce/12

[60] Namibia Tourism: Exploring Namibia's Starry Skies https://namibiatourism.com.na/blog/Exploring-Namibia-s-Starry-Skies

[61] Namibia: &Beyond Soussusvlei https://www.andbeyond.com/experiences/africa/namibia/sossusvlei-desert/stargazing/

[62] Botswana: Khaki & Dust Safaris https://khakianddustsafaris.com/activities/star-gazing/

ANNEXURE C: Astro-Tourism Offerings & Products in South Africa

Establishment Name	Town	Province/Country	Attraction Type
Aligeo Hotel	Sterkspruit	Eastern Cape	Hotel
@Nieu-Bethesda	Nieu-Bethesda	Eastern Cape	Info Hub
BON Hotel Bloemfontein Central	Bloemfontein	Free State	Hotel
Central University of Technology	Bloemfontein	Free State	University
University of the Free State	Bloemfontein	Free state	University
Kibiti Tours	Ficksburg	Free state	Tour operator
Boyden Observatory	Bloemfontein	Free state	Planetarium
Naval Hill Planetarium	Bloemfontein	Free state	Planetarium
Deelfontein Observatory	Vredefort Dome	Free state	Observatory
Wits Planetarium	Johannesburg	Gauteng	Planetarium
Firelight Tours & Safaris	Randburg	Gauteng	Tour operator
Aahaah Shuttle & Tours	Soweto	Gauteng	Tour operator
Alpine Attitude Boutique Hotel	Menlo Park, Pretoria	Gauteng	Boutique Hotel
Hartebeeshoek	Magaliesberg	Gauteng	Radio Telescope
Johannesburg Planetarium	Johannesburg	Gauteng	Planetarium
Museum of Science & Technology	Pretoria	Gauteng	Inflatable planetarium
SAASTA Observatory	Observatory	Gauteng	Observatory
Antbear Lodge	Drakensberg	KwaZulu Natal	Lodge
Berg Adventures	Estcourt	KwaZulu Natal	Tourist guide
ANEW Resort Ingeli Forest	Kokstad	KwaZulu Natal	Resort
Tugela River Lodge	Winterton	KwaZulu Natal	Lodge
Ardmore Guest Farm	Winterton	KwaZulu Natal	Guest farm
ATKV-Natalia	Illovo Beach	KwaZulu Natal	Resort
ATKV- Drakensville	Jagersrust	KwaZulu Natal	Resort
Nongoma CTO For All	Nongoma	KwaZulu Natal	Community tourism
Isizulu Science Centre	Richards Bay	KwaZulu Natal	Inflatable planetarium
Leobo Lodge	Vaalwater	Limpopo	Lodge
Waterberg cottages	Waterberg a	Limpopo	Accommodation
Oliphants camp SANPARKS	KNP	Limpopo	Rest camp
Bateleur Enterprises	Modimolle	Limpopo	Nature reserve
ATKV Klein-Kariba Holiday Resort	Bela-Bela	Limpopo	Resort
Abelana Guest Farm	Phalaborwa	Limpopo	Guest farm
Ants Nest	Waterberg	Limpopo	Game lodge
Vele villa Lodge	Thohoyandou	Limpopo	Guest lodge
Celestial Events SA	Mbombela	Mpumalanga	Events & training
Extreme Adventure Camp	Hazyview	Mpumalanga	Adventure company
Ramandire Bed and Breakfast	Emalahleni	Mpumalanga	B&B
OTJ Pride Guesthouse	Hazyview	Mpumalanga	Guest house
!xaus lodge	!xaus lodge	Northern Cape	Dark sky sanctuary
Tutwa Lodge	Augrabies	Northern Cape	Lodge
Sutherland Planetarium	Sutherland	Northern Cape	Planetarium
Victoria West Tourism	Loxton	Northern Cape	Tourism association
Die Peperboom B&B	Victoria West	Northern Cape	B&B
Blesfontein Guest Farm	Sutherland	Northern Cape	Guest farm
Bushwhacked Outdoor Adventures	Kotzeshoop	Northern Cape	Adventure company
Wickens Guesthouse	Pofadder	Northern Cape	Guest house
Khoisan Karoo Conservancy	Hanover	Northern Cape	Guest farm
Jakhalsdans	Loxton	Northern Cape	Guest farm
Victoria West Tours (Pty) Ltd	Victoria West	Northern Cape	Tourist guide
Siyanda ZF Mcawu Tour Operator (Pty)Ltd	Upington	Northern Cape	Tour operator
Astrotourism Africa	Sutherland	Northern Cape	Accommodation & tours
andbeyond (Namibia)	Sossusvlei	Nambia	Lodge
H.E.S.S.	Windhoek	Nambia	Telescope
Savute Elephant Lodge	Savuti	Botswana	Lodge