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To cite this article: Laetitia Jacobs, Elizabeth A. Du Preez & Felicité Fairer-Wessels (2020) To wish upon a star: Exploring Astro Tourism as vehicle for sustainable rural development, Development Southern Africa, 37:1, 87-104, DOI: [10.1080/0376835X.2019.1609908](https://doi.org/10.1080/0376835X.2019.1609908)

To link to this article: <https://doi.org/10.1080/0376835X.2019.1609908>



Published online: 28 Apr 2019.



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To wish upon a star: Exploring Astro Tourism as vehicle for sustainable rural development

Laetitia Jacobs, Elizabeth A. Du Preez  and Felicité Fairer-Wessels

Division Tourism Management, Department of Marketing Management, University of Pretoria, Pretoria, South Africa

ABSTRACT

Tourism is regarded as a key sector through which to bring about sustainable development in rural areas. A suitable product offering should be identified that matches the rural area's unique resources with market demand. The Karoo Rural Node in South Africa's unique landscape coupled with hosting astronomy sites of global importance presents the ideal opportunity to develop Astro Tourism as niche offering. This paper explores the region's state of readiness to harness this potential through describing existing visitors' travel behaviour, experiences and expectations, alongside views from supply side stakeholders. Mixed methodology presents evaluations at the hand of an Importance Performance and a SOAR Analysis depicting the state of readiness. The paper describes how a unique experience such as Astro Tourism can be regarded as viable mechanism to bring about sustainable development in a rural context.

KEYWORDS

Rural development;
sustainable tourism; niche
tourism; Astro tourism; Karoo

1. Introduction

For decades, the notion of sustainability has been a challenge for many developing destinations in peripheral areas (Espiner et al., 2017). Sustainable tourism places emphasis on the '... spatial (local-global impacts) and the temporal scales, identification of beneficiaries and the intent' of developments (Espiner et al., 2017:1). Tourism is recognised in rural areas as a vehicle for revitalisation through its 'triple bottom line' (economic, environmental and socio-cultural dimensions). The rural tourism sector has shown to improve the local economic status and local development by being community-based and private sector driven (Visser & Rogerson, 2004). It contributes to poverty alleviation through job creation and skills development for the unskilled, youth, women, emerging entrepreneurs and people with disabilities; specifically focusing on training and skills development for the local communities (López-Guzmán et al., 2013; UNWTO, 2013).

Many scholars agree that rural areas present varied characteristics (Holland et al., 2003; Viljoen & Tlabela, 2006; Okech et al., 2012; Polo Pena et al., 2012; Rural Tourism Strategy, 2012). Although heterogeneity is present, there is one distinct feature common to all, which is that visitors to rural areas have an authentic interaction with the natural

environment, and over and above this, actively participate in the activities, traditions and lifestyles of the local communities (Viljoen & Tlabela, 2006; Huimina & Ryan, 2012; Okech et al., 2012). Tourists seek such unique experiences and understanding the drivers (push and pull factors) in decision-making are essential in developing a tourism destination (Najafabadi, 2012). A strategic approach to match unique products to a specialised group within the market is niche tourism. As a more community-orientated, protective and sustainable form of tourism (Chan & Bhatta, 2013; Espiner et al., 2017), it is unique and location-specific (Boekstein & Tevera, 2012); making it ideal for a rural tourism destination. A niche market growing globally in popularity is Astro Tourism (Fayos-Solé et al., 2014; Muir, 2014). It is categorised as sustainable tourism in which its greatest assets never need to be maintained or developed; making it completely unique in its features (Najafabadi, 2012; Belij & Tadic, 2015). Astro Tourism enables developing countries, even the smallest, to demonstrate offerings where spectacular planetarium or giant observatories and telescopes are not obligatory (Belij & Tadic, 2015).

The case study selected for this research is the Karoo Rural Node in South Africa. This rural region holds Astro Tourism potential and has already started experiencing its contribution to the local economy of the respective Karoo towns. As one of the poorest provinces in South Africa, the wider region is earmarked as a priority area to receive the government's support for economic development and improved service delivery (National Infrastructure Plan, 2012). One of the Strategic Integrated Projects (SIPs) approved toward this goal is SIP 16 – a global mega-science project known as The Square Kilometre Array (SALT) & Meerkat (also known as the Square Kilometre Array or SKA) (SKA South Africa, [Online-b](#)). The Astronomy Geographic Advantage Act (AGAA) was brought into law as a way of preserving and protecting areas that are most suitable for optical and radio astronomy (Astronomy Geographic Advantage Act, 2007; Govender, 2011).

2. Literature review

2.1. Sustainable rural tourism through appropriate product development

Global tourism studies imbed sustainability with distinctive emphasis on the local impacts of tourism (Espiner et al., 2017). Rural areas specifically identify tourism as a tool to revitalise the area as it contains the 'triple bottom line' that encompasses the three pillars of ecological, socio-cultural, and economic sustainability (Barbieri, 2013; Barcus, 2013; Boley, 2015; Sustainable livelihoods in Public Employment Programme, 2015). Even though scholars disagree on the definition given to rural areas, there are some common characteristics. These areas are (i) of low population and low economic activity (usually the agricultural sector); (ii) dominated by open areas such as fields, pastures, woods and forest, mountains and deserts; (iii) lack sustainable development alternatives; (iv) usually offer affordable land; and (v) require high transactions cost due to the vast distance from urban areas and poor infrastructure (from Viljoen & Tlabela, 2006; Okech et al., 2012). Sustainable rural tourism promotes the net benefits of the industry and increases the participation of rural communities in the management of tourism development. This development contributes towards infrastructure improvements and expansion as well as spin-off enterprise opportunities (Rural Tourism Strategy, 2012). Tourism serves as a way to attain indigenous or community growth, as it provides local communities

with an opportunity to have some level of control over local resources and by so doing, maintain its 'socio-cultural fabric' (Drammeh, 2015:5).

Sustainable tourism development recognises the importance of a situational analysis, quality product development and visitor monitoring and management (Butler & Rogerson, 2016; Laitamaki et al., 2016). The potential tourism products ought to be considered together with determining the interested target markets – thereafter followed by development, packaging and marketing of the offering (Sharpley, 2010). Visitor management is important as it provides an understanding of how visitors experience tourism activities and indicate levels of satisfaction with the destination's infrastructure (Chaoprayoon & Panyadee, 2013). The tourism industry encompasses many sectors and the model for tourism development identifies infrastructure and amenities as a main component of development plans for rural destinations (Gartner, 2005; Atkinson, 2009; Rogerson, 2016). Together with infrastructure, the quality and appealing nature of the road and transportation linkages between attractions and destinations add value to the destination and visitor's experiences. Yet, transport and infrastructure improvements are generally neglected (Grefe, 1994; Gartner, 2005; Atkinson, 2009; Visser, 2016). Tourism is produced and consumed at the same time and because of the vast distance and nature of rural tourism, the tourist must physically travel to where the product is located. This means that the transportation and infrastructure system of rural areas should be of such quality that the journey to the product is as pleasant as the end destination (Gartner, 2005; Rutty et al., 2015). Given the unique challenges posed to rural destinations, the next paragraph focuses on Astro Tourism as an ideal niche market for these areas.

2.2. Astro Tourism as a niche offering for a rural destination

Astro Tourism is defined as '... tourism using the natural resource of unpolluted night skies, and appropriate scientific knowledge for astronomical, cultural and environmental activities' (Fayos-Solé et al., 2014:664). It focuses visitor interests on the observation and appreciation of naturally occurring celestial phenomena (Weaver, 2011) and is perceived as a noble way to draw tourists closer to nature (Fayos-Solé et al., 2014), offering a form of ecotourism (Weaver, 2011; Najafabadi, 2012). It has been categorised as sustainable tourism in which its greatest assets never need maintenance or development. It is always available, completely unique in its features and, whether it be day or night, the sky is considered as one of the highest sustainable fascinations (Najafabadi, 2012). As a form of '... tourism in its most natural settings' (Najafabadi, 2012:129), location is key to looking deeper into space by means of a clear dark night sky. It has the potential to draw a vast number of visitors to a destination where skies are free from artificial light pollution. These desolate places with their apparent emptiness, once disregarded by earlier travellers, have now become noteworthy attractions (Ingle 2010a). Ingle (2010a:87) stated that one should make the most of 'space' and 'nothingness'. As urban areas become increasingly over-crowded, the world is seeking the beauty of open spaces.

This niche includes specialised activities very different to that of modern day mass tourism and offers tourists knowledge-rich experiences (Fayos-Solé et al., 2014; Muir, 2014). It entails travelling to Dark Sky sites for astronomical observations using high-tech equipment (Tuszynski, online); with hunting for stars and star counts being two of the most popular activities (Walker et al., 2007). Celestial observations also include

activities such as viewing comets and the northern lights, sky gazing, stargazing, observing interesting cloud formations, vivid sunsets and star-filled skies, all regarded as charismatic megacaela or mega-skies. Astro tourists show an interest in visiting astronomical observations, locations with aurora displays, national, provincial and local parks with dark skies as well as engagements with amateur astronomers who offer public programmes. Astro tourists usually travel in pairs, small groups or alone.

The various types of travel composition give the destination an opportunity to create a variety of travel packages consisting of varied activities and services (Collison & Poe, 2013). As such, Astro Tourism provides opportunities for unexpected collaborations between the tourism stakeholders, local communities and scientific institutions (Fayos-Solé et al., 2014). Tour guiding and interpretation appears to be a desired feature; with some level of specialist experience and guidance essential to boost product delivery (Ingle, 2010b). The niche is perceived as being exorbitant, requiring quality equipment that is expensive and less portable. The range of telescopes varies from accessories such as pointers, eyepieces and filters. In some locations tours are held during the day and night and even web-based tours where the visitor has no need to be physically present at the observatory (see Collison & Poe, 2013). Science Tourism travellers also use regular tourist infrastructure such as hotels, catering establishments and transport, as well as the most modern audio-visual technology for seminars and experiments (Molokacova & Domaracka, 2011).

2.3. Case study: SALT and SKA tourism development Initiatives in the Karoo rural node

The Astro Tourism market is slowly growing in South Africa, seeking to provide tangible socio-economic benefits (SKA South Africa, [Online-a](#)). The case study, which is part of an area of 12.5 million hectares, is the tourism destination surrounding the SALT and SKA astronomy projects in the Northern Cape Province. [Figure 1](#) illustrates the geographical area surrounding the core astronomy sites in a region of the Karoo. This region is most suitable because of its low population density and low radio frequency interference.

One of the towns in the case study area, Sutherland, is referred to as the ‘Star Gazing Capital’ as it is believed to be the darkest spot on Earth and perfect for star gazing and astronomical activities (Square Kilometre Array Telescope NCRA-TIFR, 2014). The influx of high profile astronomers, scholars, academics and engineers to the Karoo region has impacted positively on the daily livelihoods of local residents. Since inception of the Southern African Large Telescope (SALT), the most remarkable impact has been on the local tourism industry in Sutherland (Govender, 2011). Eighty-five percent (85%) of visitors to Sutherland travel from neighbouring provinces to break away from city life. Tarring of the road between Matjiesfontein and Sutherland has made SALT more accessible (Ingle, 2010b). Given such improved access, tour operators anticipated the establishment of an Astro Tourism route in the region and began apportioning tourism offerings to this smaller Karoo rural area, thereby addressing the unevenly spread tourism economy (Ingle, 2010a; Rogerson, 2014).

The tourism and hospitality industry has bought into the astro theme, adopting space motifs and stellar imagery in the naming of their establishments, for example Skitterland

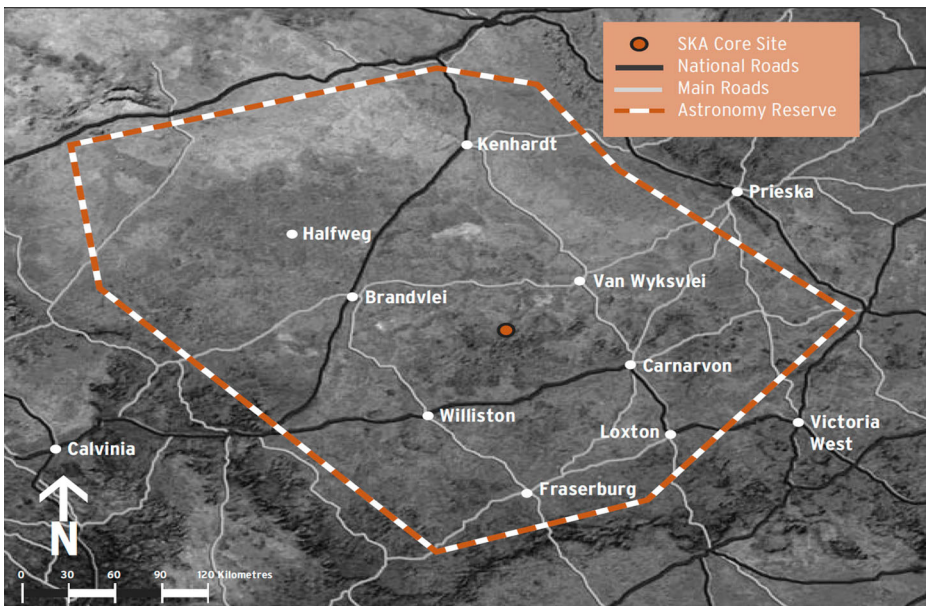


Figure 1. The Karoo central astronomy advantage area. Source: SKA South Africa (2014).

(Glitter land) Guesthouse, Jupiter Restaurant, Sterland (Star land), Southern Cross and the Vlieënde Piering (the Flying Saucer) (Ingle, 2010a). Private businesses offer tourists a variety of products and services such as accommodation, restaurants, curio shops and star gazing tours. Kambro Kind is one of a number of guesthouses that offers guests accommodation and refers guests to Sterland for informative stargazing lectures and star-gazing with 280mm telescopes throughout the year. The demand for tours during the peak season (June, July and August) exceeds the capacity of the observatory, to such an extent that operators use amateur telescopes and attractions provided by local communities (Govender, 2011). Star parties have become popular for ordinary people and amateur astronomers alike (Najafabadi, 2012; Belij & Tadic, 2015). Some guest farms in the surrounding rural area have their own equipment and maintain a strong relationship with amateur astronomers. These amateur astronomers offer astral events, such as astrophotography and star parties at these accommodation establishments. The multiplying effect of growth has resulted in packaged souvenirs, such as homemade knitted accessories (beanies, scarves, gloves) and warm meals – ideal for the cold winter months when the sky is most visible. Other attractions centred around the astronomical theme draw a great number of eco-tourists such as botanists, game rangers and authors-in-residence (Ingle, 2010a).

Tourism enhancement is occurring due to various individual initiatives such as improved stakeholder relations; tour guide training; upgrading the quality and tarring of the roads to make the observatory more accessible to visitors; and production of arts and crafts as marketable products and services for tourists (Govender, 2011). Still, essential elements are missing, for example neither Sutherland nor Carnarvon has a visitor information centre (VIC). This is a gap in the tourism product offering, as there is no central point where information about the destination and its offerings are available.

Baseline data and tourism statistics about the trends and patterns of tourists (demand) and the number of available beds (supply) are unavailable in the Karoo rural area (Atkinson, 2012, 2016). The absence of a coordinating body such as a tourism association also leads to limited stakeholder collaboration and less than optimal resource utilisation. Increased attractiveness of the area remains to a large extent illusive given the absence of a common goal amongst stakeholders (after Atkinson, 2012).

3. Methodology

This study made use of mixed methods to collect data from a case study. The quantitative component explored tourist demand by observing the travel patterns, requirements, perceptions and satisfaction levels of visitors to the area. Visitor data was collected by means of a survey using self-completion questionnaires. The qualitative component gathered stakeholder perceptions on the potential of Astro Tourism to bring sustainable development to the region. This was done through focus groups, semi-structured questionnaires and in-depth interviews with members of different stakeholder groups. The visitor sample included 130 visiting tourists to the respective towns, while the qualitative consisted of participation of 44 local community members and 23 tourism businesses. Of the non-residents in the region, 11 government sector representatives and nine (9) astronomy and tourism stakeholders participated. The researchers also participated in 11 pertinent stakeholder engagements such as workshops, meetings and various forums.

Descriptive statistics described the demographics, trends and experiences of visitors. Thereafter an Importance Performance Analysis (IPA) was conducted to determine the differences among the importance versus the levels of satisfaction with current tourism offerings. The IPA uses the mean ratings for importance and performance scores and creates a two-dimensional grid (refer to Figure 2) that identifies strengths and weaknesses of the area as a tourism destination as well as identify the opportunities for improvements that will guide strategic planning efforts (Gonçalves et al., 2014). The quality characteristics are divided into four categories according to their level of importance as well as the level of improvement required. The results are illustrated on a grid, where the features are evaluated according to strengths (keep up the good work), and weaknesses (concentrate here). The matrix with the four quadrants assists to produce an action plan to minimise the negative difference between importance and satisfaction levels. Inferential statistics (*T*-tests) were used to determine the differences between the expectations and satisfaction levels of visiting tourists (Saunders et al., 2012).

To assess a destination's potential for sustainable tourism development a SWOT (Strength, Weakness, Opportunities and Threats) analysis is recommended by Fayos-Solé et al. (2014). This study however, followed the recommendation by Sprangel et al. (2011) that the Strengths, Opportunities, Aspirations and Results (SOAR) approach is much more effective. Modern developers are moving away from the diagnostic perspective to a dialogic perspective; which is an innovative strategic way of thinking that leads to transformation (Hamel & Prahalad, 1996; Hitt et al., 1998; Lowendahl & Revang, 1998; Kim & Mauborgne, 2005; Stavros & Wooten, 2011). The SOAR analysis is a more action orientated strategic planning tool that focuses on strengths and seeks to understand the entire destination and its development, including inputs from all the relevant stakeholders (Capela & Brooks-Saunders, 2008; Stavros & Cole, 2013).

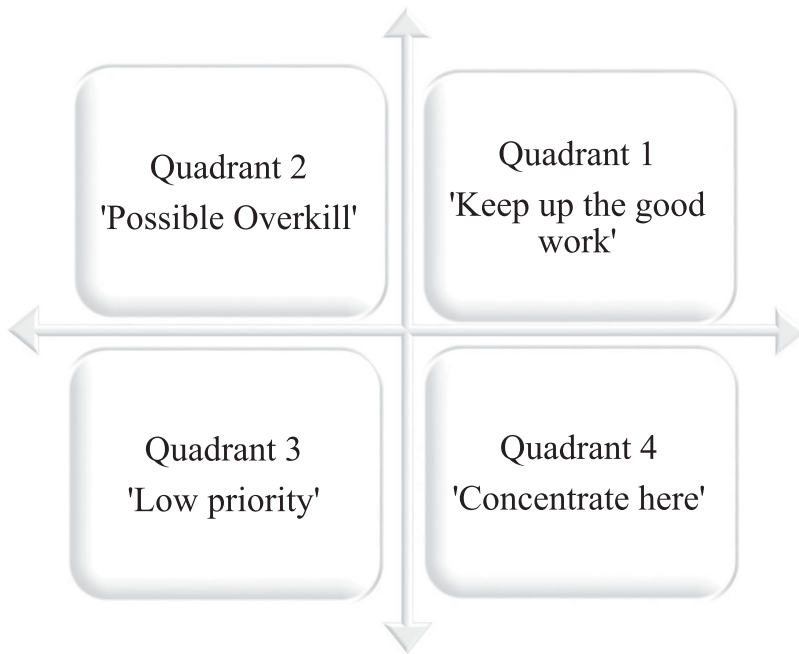


Figure 2. Importance performance (satisfaction) grid. Source: Martilla & James (1977) (adapted by Maumbe & Van Wyk, 2012).

4. Results

4.1. Sample description and travel characteristics

The sample of 130 tourists included a majority (97%) of domestic travellers from the Western Cape Province, followed by KwaZulu-Natal, Gauteng, and the Northern Cape Province. The international visitors originated from the United Kingdom, Germany and Zimbabwe. Reason for the lower number of international visitors is that, despite the international nature of the astronomy project, the astro physicists, engineers and technicians employed, are drawn predominantly from the South African labour force. In addition, as astronomy applies advanced technology to collect data remotely, the bulk of data is obtained at the South African Astronomy Observatory (SAAO) and SKA Head Offices based in Cape Town. Cape Town's international airport allows for easy and quick access to the head office's data resources and the relevant contact persons associated with the project as well as serving as the hub for data processing, interpretation and analysis. Cape Town is also a huge draw card for tourists as it offers a wide variety of tourism attractions and amenities. This popularity has been to the detriment of the Karoo which has not experienced a similar increase in the number of international tourists. This reality also reflected in the data, as was anticipated.

The majority of travellers in the sample was male (53%), between the ages of 51 and 60 (28%) and with a tertiary level of education (46%). Referring to Table 1, majority was first time visitors (62.8%) influenced to visit the region by word of mouth recommendations (45.2%), astronomy interest groups (12.1%) and their secondary or tertiary education institutions (10.5%). Of the visitors, 57% stayed an average of 2–3 nights, followed by

Table 1. Travel characteristics of respondents ($n = 130$).

Variable	Category	Frequency (n)	Percentage (%)
Number of visits	First Visit	81	62.8
	Return visit	48	37.2
Length of stay	Day visitor	11	8.6
	1 night	35	27.3
	2–3 nights	73	57
	1 week	6	4.7
	2 weeks	2	1.6
	1 month	1	0.8
Travel group composition	Family & friends	64	42.3
	Student group	17	13.1
	Alone	13	10
	Business associates	13	10
	Astronomy Club	12	8.5
	Tour group	11	6.9
Main reason for visit	Leisure	57	43.8
	Science	31	23.8
	Business	22	16.9
	Education	16	12.3
	Visiting Friends & Relatives	2	1.5
	Academics	1	0.8

those who only stayed for one night (27.3%) and day visitors passing through the town/region (8.6%). Day visitors indicated that they drove from the following towns: Calvinia, Richmond, Upington, Prieska and Beaufort West. None of the respondents stayed for longer than three nights. The short stay of astronomy interest groups and student groups in the region was unexpected, but was largely due to three factors. Firstly, the short distance between Cape Town and Sutherland makes it possible for visitors to drive in and out of the region frequently, and consequently, spend a shorter time in the Karoo. Leisure travellers, such as those travelling with friends and families, use the opportunity to make a quick weekend-away trip, rather than longer vacation stays. Secondly, the distance to Carnarvon is longer and a bit more difficult to reach, as the condition of the road is problematic, thereby, making the town less accessible and less appealing. Finally, the Karoo towns do not have a variety of quality tourism attractions and amenities to entice the wider international and domestic tourist market to stay for longer periods of time. Travel companions consisted of friends and family (49.2%), followed by those who travelled with a tour group (13.1%), an astronomy interest club (9.2%), alone (10%), business associates (10%) and student groups (8.5%).

Visitors' choice of accommodation establishments included hotels (32%), guesthouses (28.1%), self-catering (19.5%) and Bed & Breakfast establishments (12.5%). Visitors made use of their own vehicles (55%) to travel in the Karoo region, followed by those who travelled by tour bus (18.6%) and rental vehicles (14.7%). The main purpose for visiting recorded was for leisure 43.8%. Of the respondents, 37% indicated that they visited the region for science, education and academics related to astronomy, followed by those who travelled for business (16.9%) and visiting friends and relatives (1.5%). Sixty-eight percent (68%) of respondents indicated that astronomical activities were their primary activity undertaken during their visit.

These astronomical activities included visiting SALT at the SAAO (44%) and SKA (17.9%) as well as general star gazing at the various establishments that offer star gazing facilities and experiences (38.1%); corroborating the findings of Du Rand et al.

(2016). Reasons for not partaking in any astronomical activities during their visit to the region, included not having time (47.4%) and not being aware of any astronomical offerings (21.1%). Other activities that visitors actively enjoyed was the unique culture and heritage offering of the local communities (30.1%), touring (25.8%) and adventure and outdoor activities (17.2%). Other activities mentioned were business related activities, attending events, agricultural activities and travelling to observe the natural landscape of the Karoo.

Participants of the qualitative research provided their observations of the tourists visiting the Karoo region; with these observations concurring with the quantitative data collected from the visitors. Participants verified that visitors were predominantly retired and middle-aged couples. Visitors also included astronomy scholars and interest groups who visited the area to specifically experience the telescope at SALT. Local community participants specified that those visitors who came to the region for academic and scientific purposes stayed much longer at the astronomy sites for research purposes. In addition, tourism businesses indicated that some of the visitors were photographers and film makers who captured the unique desolate landscape of the Karoo. As the Karoo is marketed for its rustic authenticity and untarred roads, it poses an attractive adventure for driving 4x4 vehicles, mountain bike riding and hiking. It was noted by both the local communities and the tourism businesses that visitors especially sought the quietness and tranquillity of the Karoo; also as noted in a study by Gelderblom (2006). The vast semi-desert countryside has become a niche market enjoyed by adventurers.

4.2. Tourists' overall experiences of the destination

The Importance-Performance (Satisfaction) Analysis (IPA) was conducted to assess the weaknesses, strengths and impact of the tourism product offering in the respective towns based on the experiences of the visiting tourists. Respondents had to rate specific features of the destination in terms of its importance as well as their satisfaction level thereof. Ratings were indicated on a four-point scale (1 = very important, 4 = not important at all; 1 = very satisfied, 4 = not satisfied at all). For this analysis, the mean scores were used to test the gaps between the expectations (levels of importance) versus the level of performance (satisfaction). Paired sampled t-tests were used to determine the statistical significance of these relationships (refer to Table 2). As seen, the pair with the greatest IPA gap based on the mean scores was Pair 8: perceptions in terms of the visitor information centre (VIC). Only one factor (Pair 2) did not have a significant relationship, thereby indicating an overall significant discrepancy between visitors' expectations and the performance of the destination.

Results from IPA showed some notable gaps between the importance of specific features of the destination compared to the satisfaction level of those attributes. Figure 3 presents the populated grid from the data collected on participants' views of importance versus performance (satisfaction) of the key tourism offerings and services during their visit. As shown, most features' ratings placed them in the top right corner in quadrant 2, 'keep up the good work', which indicates both a high importance and satisfaction level. The only feature that appeared in the bottom right corner in quadrant 4, 'concentrate here', is the low satisfaction of available tourist information and maps en route, which is a clear indication of absent VICs in the related towns.

Table 2. Importance-performance (satisfaction) analysis.

	Tourism feature	<i>N</i>	MEAN	STD. deviation	<i>t.</i>	Sig.
Pair 1	Importance Roads	129	3.43	.635	3.216	.002
	Performance Roads	129	3.16	.667		
Pair 2	Importance Attractions	124	3.10	.719	1.614	.109
	Performance Attractions	124	2.96	.617		
Pair 3	Importance Rest Stops	125	3.41	.597	6.327	.000
	Performance Rest Stops	125	2.91	.622		
Pair 4	Importance Info	116	3.15	.826	4.751	.000
	Performance Info	116	2.61	.695		
Pair 5	Importance Signage Attractions	122	3.59	.627	7.576	.000
	Performance Signage Attractions	122	2.94	.647		
Pair 6	Importance Signage Towns	123	3.50	.670	4.893	.000
	Performance Signage Town	123	3.11	.612		
Pair 7	Importance Accommodation	123	3.54	.576	4.659	.000
	Performance Accommodation	123	3.18	.628		
Pair 8	Importance VICs	111	3.17	.737	4.907	.000
	Performance VICs	111	2.66	.732		

The tourists were asked via an open-ended question to share their most negative and most positive experiences during their visit in the Karoo region. With regards to the negative experiences, almost 40% indicated that the bad road conditions were their most unpleasant part of their trip. Despite the fact that tourists do not mind the gravel roads (Toerin et al., 2016), the dissatisfaction includes the bad and unmaintained conditions of these gravel roads as well as the number of speed traps and potholes. The negativity expressed by visitors referred specifically to the road between Sutherland and Fraserburg and the partial gravel road between Fraserburg and Williston. Another challenge that 13%

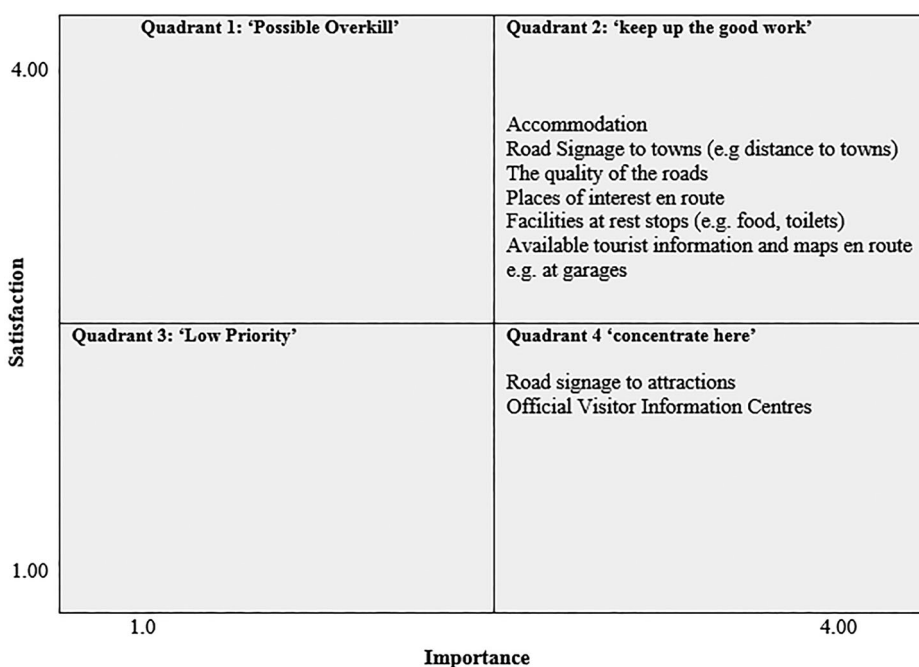
**Figure 3.** Researchers' application of the importance-performance (satisfaction) grid.

Table 3. Researchers' application of SOAR analysis.

Soar variable	Results and outcome of soar application
Strengths	<ul style="list-style-type: none"> Seasoned travellers are increasingly demanding a knowledge enriched experience. Demographics vary from the general public to astronomy enthusiasts to professional astronomers. Types of travel groups vary (e.g. scholars, students, families, retired persons and astronomy clubs). Area is free from artificial light and gives the destination a competitive advantage for Astro Tourism development. Friendly host communities. Unique Astro Tourism product offerings, beautiful landscape and biodiversity.
Opportunities	<ul style="list-style-type: none"> Opens up unsuspected possibilities for cooperation among tourism stakeholders, local communities and scientific institutions. Establishment of the SKA science VIC. Growth in various niche market segments e.g. outdoor and adventure, culture and heritage, agro, eco and nature.
Aspirations	<ul style="list-style-type: none"> Self-sustainable tourism initiatives that are government led, community-based and private sector driven.
Results	<ul style="list-style-type: none"> Specialisation to create advanced destination competitiveness; Increased travel for educational travel amongst domestic and international travellers. Improved geographic spread and seasonality.

of visitors experienced, was again the lack of information offices. A further 6% of visitors also mentioned the neglected state of some of the tourist attractions as an unpleasant experience.

On the other hand, 36.2% of visitors indicated that their most positive experience was their visit to SALT in Sutherland. Tourists said that the scenery, tranquil nature and the beautiful town (33.6%) were most enjoyable and 16% said that their most positive experience was the welcoming local communities. Some (4.6%) made a special mention, concerning the excellent and friendly service received from their tour guides and staff at SALT. Other most positive experiences mentioned were the unique local cuisine (2.6%) and SKA (2.6%) and the snow experience in Sutherland (1.7%).

Respondents were asked to indicate their level of overall satisfaction on a five-point scale from very dissatisfied to very satisfied. Despite the negative experiences, 85% indicated that their time in the Karoo region was satisfactory. When asked if they would recommend others to visit the respective Karoo region, almost 90% of the visiting tourists indicated that they would definitely recommend a trip through this region. When asked when they would likely return to the region, majority (68%) were unsure. A further 9.2% indicated that they would return to the next event or festival and 6.2% would return during the following school holiday.

Although many tourism businesses have acknowledged the significance of astronomy in the region, very few of them provide Astro Tourism experiences such as astral themed events, activities or tours as part of their business offerings. Experiences on offer range from hosting star gazing sessions, artists who design t-shirts related to the Astro Tourism theme and printed booklets that summarise Astro Tourism activities, such as where one can experience stargazing and obtain observatory information. Reasons mentioned for a lack of provision of such experiences included a general lack of interest, the perceived high cost of purchasing telescopes and their limited knowledge of astronomy. Notwithstanding this lack in the offering, several business owners indicated

that they definitely intended to provide some form of Astro Tourism related activities in the near future given the increased interest in astronomy due to SALT and SKA.

4.3. Karoo tourism products and offerings: stakeholder perspectives

Respondents advised that Astro Tourism is a unique experience in South Africa that needs to be marketed more aggressively in hybrid packages within the Karoo region; with the region ideally developing an Astro Tourism brand. One principal government representative suggested that ‘Astro Tourism promotional material should be developed and distributed to all places of interest in the Karoo especially at the tourist information centres and accommodation facilities.’

The notion of ‘going beyond Astro Tourism’ is important. Local tourism business representatives as well as industry stakeholders advised that experiences in both Astro Tourism and non-astro related activities should be developed. This statement corresponds with a stakeholder’s pronouncement that ‘the stars alone will do nothing to boost tourism ... we need a bigger plan and one that makes use of all that is great in the area’ and another saying that ‘tourism that focuses only on astronomy might not be sufficient’.

Industry stakeholders mentioned that the Karoo is known for hosting a multitude of mountain bike races that are considered world class. Visitors to the Karoo love the outdoors and combining this type of event with Astro Tourism in a package could promote a wider appeal. They mentioned that it is important to brand and link Astro Tourism to the Karoo’s heritage in respect of archaeology, the richness of paleontological sites and the indigenous astronomy knowledge of the Khoi-San people. This is an opportunity for the local community to share their indigenous stories and the significance of the stars and to link them to the actual science that lies behind the celestial phenomena. Focus groups with local community members reflected that the area is very well known for the number of unique corbelled houses that were built between 1811 and 1815. These corbelled houses are small domed houses that are built of flat stones, the name of which stems from the lack of a word for roof trusses by the Trekboers. The cement is a mixture of chaff and soil mixed with water and kneaded to the correct texture. Floors of these corbelled houses are a rich red colour derived from a mixture of fat and oxblood polished with a smooth stone. The Karoo has a rich heritage of nature and tortoise reserves, handmade local Karoo arts and crafts, Anglo-Boer War tours, 4x4 self-drive tours and marked farm trails.

A range of additional uniquely Karoo features were mentioned. Local community members boast with cultural expressions of indigenous groups such as the ‘Rieldans’ (a cultural dance) and traditional rooibos tea making. Well-known local (Afrikaans language) authors (NP van Wyk Louw and WEG Louw) originated from the Karoo. The Northern Cape province as a whole is known for its extreme climatic conditions (also mentioned by Antkinson, 2016) and Sutherland is nationally known as one of the coldest towns in the country, with its winter snowfall consistently drawing large numbers of visitors. The province’s landscape is one of extremes, as stated by a government official: ‘the Northern Cape Province is branded as the extreme province for its extreme sport, extreme weather, extreme culture and extreme adventure’.

Various suggestions were made by interview participants of elements that could be incorporated into Astro Tourism offerings. Cultural and heritage artefacts and sites can be incorporated into the story of the people of the Karoo, from the KhoiSan community

to the Afrikaner farmers that settled in the area. There are various elements that showcase the beauty of the historical significance of the Karoo residents, their livelihood and their traditions. Historical transport is evident amongst the 'Karretjiemense' as well as the railway history and the truck museum. Small town events, as one way of commercialising the local culture and heritage, create marketing opportunities to wider audiences and have significant potential to boost the local economy. Local communities should ideally get involved and take the lead in such events, using the platform to share their story and their day-to-day lives, and most importantly, be the best ambassadors for their towns. Cuisine tourism is another untapped opportunity for the local community to demonstrate their local culinary specialties, such as the traditional method of cooking in cast iron three legged pots on an open fire, harvesting and using fresh herbs and the production of 'karusaf', 'skuinskoek' and cheese. The Karoo is most famous for its Karoo Lamb and is known as the 'Red Meat District' of South Africa or as referred to by Atkinson (2016) as 'Karoo Lamb country' (Du Rand et al., 2016).

Another significant attraction on offer and that could be built upon, is a dinosaur footprint in Fraserburg. This prehistoric feature offers a very unique, yet under-utilised and under-appreciated footprint of palaeontology. Palaeo-tourism complements astronomy very well as both improve peoples' understanding of history and the evolution of science. The tourism packages should be designed to intrigue the type of tourist who seeks to learn and understand the world around them. Furthermore, these unique tourism packages need to be paired with proper infrastructure and the management thereof.

4.4. State of readiness as an Astro Tourism destination

The results of the empirical research are synthesised in a SOAR analysis to determine an overview of the destination and its state of readiness for development of the Karoo as an Astro Tourism destination. This tool assists stakeholders by identifying the strengths and opportunities which all contribute to the economic growth of these towns. As suggested in this analysis, the Karoo region has the potential to become a leading Astro Tourism destination.

5. Conclusion and recommendations

The respondents stated unequivocally that the active rural economic sectors such as agriculture and culture and heritage need to work together with the tourism industry so that more experiences can be available for tourists. Fayos-Solé et al. (2014) also confirm that the success of Astro Tourism product development is dependent on an integrated destination developmental approach. Activities such as events, adventure and cultural activities should be packaged into a single experience together with the astronomy features. By so-doing this unique arid landscape could appeal to a wider target market. Almost half of the tourism business representatives stated that the Karoo should market the destination intensely in terms of its unique Astro Tourism offerings. Farmers have the opportunity to demonstrate their agricultural processes be it from sheep shearing, cheese making, taxidermy, guest farm stays (agritourism), day-to-day farming activities, horseback riding or nature-based products, just to mention a few. Respondents recommended that new

technology needs to be embraced to stimulate a greater understanding of tourism, its social development benefits as well as its economic value for local and provincial authorities, the business community and local residents. Drawing from the inputs from most of the respondents across the various domains, there is a need for all stakeholders to work collectively, and be committed to growing Astro Tourism products with specific offerings to become a leading niche market.

Local tourism businesses should be linked and co-marketed in a manner that is aligned to the theme of astronomy and science. The provincial destination marketing organisation (DMO), the Northern Cape Tourism Authority (NCTA), should include Astro Tourism into its marketing strategy and encourage organisations to host their events in the Karoo region. The Karoo needs to be more aggressive with its marketing efforts to draw more visitors with a general interest in astronomy and science into the region. Furthermore, NCTA has to partner with the national DMO, South African Tourism, for marketing campaigns in order to draw greater domestic but also international audience to the region. Marketing needs to occur more often at international trade shows, especially in Europe, where the similar time zones and weakness of the Rand can be beneficial to lure an increasingly growing number of foreign visitors.

Marketing research is very important for the Karoo, so that tourism products and services are able to provide for the explicit travel requirements of travellers and accommodate the behavioural needs of those who visit the region as astro tourists. Market members' demographics and travel behaviour has to be assessed to effectively enhance visitor experiences through customised themed travel packages. Travel packages are a necessity and should include both Astro Tourism and non-Astro Tourism activities in order to lure the visitor to stay longer. A longer length of stay will mean increased tourism income for rural areas (Gössling et al., 2016). The visitors' satisfaction index will give developers and tourism businesses an indication of the current status of the tourism industry in the area, the infrastructure improvements required and the quality of supporting goods and products. Weaver (2011) confirms the findings of this research, namely, that the main reason astro-tourists travel is to observe and appreciate the naturally occurring celestial phenomena. These considerations should continue to be the focal point of destinations that have quality dark night skies, but this also means that the supporting tourism value chain has to provide quality services and high standards. No destination develops in isolation. Therefore, the tourism industry, through the establishment of a tourism association should pool all their resources to develop areas into Astro Tourism destinations.

The success of Astro Tourism product development is largely dependent on the degree to which advanced destination development and the governing systems are professionally integrated into the product. It is indicated that entrepreneurs and tour operators should initiate joint ventures alongside professional astronomers to improve their tourism packages. Professional inputs provide a solid knowledge foundation together with an in-depth understanding of tourism markets and their demands. The mix of resources, support services and high quality Astro Tourism products should be carefully developed in a strategic plan and within a set timeframe (Fayos-Solé et al., 2014).

The study shows the potential of Astro Tourism as a niche market that can contribute to sustainable rural tourism development. It employed both the market (demand) and stakeholder (supplyside) perspectives to ascertain the readiness of the case study area as an

Astro Tourism destination. Two analysis tools, the IPA and SOAR analyses, proved useful in this process. Future research should consider a longitudinal approach where these analyses are continued at intervals between major new developments or periods of improvement. Comparative studies can also be useful to identify whether other niche products and this same niche in other destinations follow similar stages and challenges with development in a rural context. Understanding the wider value chain involved in niche product development will be an important aspect to explore as part of a sustainable rural tourism offering. Lastly, it is imperative to package Astro Tourism using an array of complementary niches.

Disclosure statement

No potential conflict of interest was reported by the authors.

ORCID

Elizabeth A. Du Preez  <http://orcid.org/0000-0001-8144-1999>

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