

Impact of Astronomical Facilities on Local Development - Perspectives from Sutherland: An OAD Report

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Abstract

Astronomy has played an important role in shaping our understanding of the universe and our place in it, especially since our identity as the human race is in one way or another tied to the stars. In recent times, the role of astronomy in socio-economic development on the home base (Earth) has been brought into the spotlight, leading to the establishment of the Office of Astronomy for Development (OAD) of the International Astronomical Union (IAU). Put simply, the OAD's mandate is to work on translating astronomy into development related outcomes, guided by the Sustainable Development Goals (SDGs). The OAD strives to promote the attainment of various SDGs through participating in and funding different activities. Based on an assessment of past project lessons, experience, international consultations and trends, the OAD identified "flagship projects" that would be driven from the office itself. "Sustainable Local Socio-Economic Development Through Astronomy" is one of two main flagship projects that the OAD is currently seized with driving into the foreseeable future. This theme seeks to harness the potential of astronomical facilities (such as observatories) to stimulate local socio-economic development mainly through astro-tourism. To achieve that, it is important to understand development from the perspective of the community. Hence a diverse team of OAD fellows visited Sutherland [a town in Northern Cape, South Africa that hosts the Southern Africa Large Telescope (SALT)] in June 2019 to seek some community perspectives and to also qualitatively assess the impact of the SALT telescope and the Sutherland Observatory in general on local socio-economic development. After a series of interviews with different stakeholders of the Sutherland community, we note overall that the populations are either satisfied with, or have neutral opinions about the presence of the observatory and its outreach activities. The study reveals that although the SAAO has positively impacted local socio-economic development in the town of Sutherland through creation of jobs and its diverse outreach activities, many challenges such as unemployment and school dropout still face the local communities. We propose different ways in which the observatory can further use astronomy to leverage socio-economic development in Sutherland, and improve its relations with the local communities.

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1. Introduction and Background

The Office of Astronomy for Development (OAD) of the International Astronomical Union (IAU) has since its formation been focused on and engaged in activities that seek to translate astronomy to development outcomes. Primarily, the Sustainable Development Goals (SDGs) are the beacon guiding the thrust and objectives of the OAD. Two flagship projects which are currently key cornerstones within the broader strategic objectives of the OAD are (i) the promotion of astro-tourism⁵ and (ii) science diplomacy through astronomy. To enhance understanding of the different channels through which astronomy related projects/infrastructures impact local development (through astro-tourism and science diplomacy), it is important to draw on perspectives from the community who directly and indirectly benefit in one way or another. This view inspired a visit to the town of Sutherland in South Africa (where the [SALT](#) telescope⁶ is hosted) by a team of OAD fellows, who were accompanied by the OAD director Kevin Govender. An important component of the visit (informal data collection exercise) was the diversity of the fellows, who were drawn from Ecuador, Burkina Faso, USA and Zimbabwe - this diversity brings an external view on how SALT has impacted the Sutherland community.

Sutherland is in the Northern Cape and is part of the Karoo Hoogland municipality, along with two other towns: Fraserburg and Williston, respectively 108 km and 141 km away. Kimberley, the provincial capital lies 644 km away, which demonstrates the remoteness of Sutherland - a town of 2,836 inhabitants (Census 2011)⁷. The OAD visit took place between the 11th and 13th of June 2019 and consisted of 6 meetings with various stakeholders and development actors in the town. The trip aimed to (i) engage with the communities targeted by the SALT Collateral Benefit Programme (SCBP)⁸ in order to enquire about their experience and learn key lessons, and (ii) investigate ways in which the programme can be improved to better impact local development. The visits were facilitated by Anthony Mietas and Jeremy Stuurman, seasoned members within the South African Astronomical Observatory (SAAO) SCBP department. Apart from their rich experience working for the SAAO, Anthony and Jeremy were familiar with the people and culture of Sutherland since it is their hometown.

⁵ Astro-tourism is defined as a form of tourism that uses the unpolluted night skies, and appropriate scientific knowledge for astronomical, cultural or environmental activities.

⁶ The Southern African Large Telescope is funded by a consortium of international partners from South Africa, the United States, Germany, Poland, India, the United Kingdom and New Zealand.

⁷ Although the census is 8 years old, the [2016 community survey](#) states that the Karoo population grew at 0.9% between 2011 and 2016.

⁸ The SCBP is a department of the South African Astronomical Observatory (SAAO) and was established during the construction of SALT (Southern African Large Telescope) and objectives of this programme were clearly directed at the benefits derived by society from building this large telescope.

A number of limitations⁹ affect the extent to which this report can present findings on the determination of social impact or a complete understanding of how much social change occurred and can be attributed to the presence of the Observatory in Sutherland. To address the social impact of the telescopes in the community a holistic and participatory research is needed and different factors should be taken into account such as: deep qualitative and quantitative information-gathering methodologies, comparison of information before and after the building of the telescopes, definition of variables and indicators; effectiveness of activities developed, and long term vision (sustainability of impacts). Although it was not feasible to develop all the activities described above, for the objective of this report a specific research methodology was chosen in order to gather information for a general understanding of the relationship between the Observatory and the local community and its potential social impact. A brief description of the methodology used for producing this report is presented in the next section.

Phase 1: Analysis and revision of relevant documents related to Sutherland, astronomy and socio-economic impact projects, SAAO and the SALT collateral benefits programme.

Phase 2: Field work to gather information.

Phase 3: Compilation and analysis of the collected information.

Table 1: Interviews and Focus Group composition

<i>Activity</i>	<i>Composition</i>
<i>Interviews 1</i>	SAAO employees
<i>Interview 2</i>	Astro-tourism private stakeholder
<i>Focus Group Discussion 1</i>	Secondary school Teachers
<i>Focus Group Discussion 2</i>	Intergovernmental Forum
<i>Focus Group Discussion 3</i>	Primary school teachers
<i>Focus Group Discussion 4</i>	Elderly community women, previously SAAO employees
<i>Focus Group Discussion 5</i>	Teenagers

Source: Authors' own illustration

⁹ Some of the limitations encountered are short time, language barrier, no existence of a participatory plan with local community or a Logical Framework with objectives and clear indicators from the SALT engagement department in relation to social challenges, no existence of previous evaluation reports and no funding.

The informal data gathering exercise (Phase 2) involved a number of activities (listed in Table 1) and described here as follows:

- 3 days of fieldwork (participatory observation) in the town. These included a visit to the Primary and Secondary Schools, Town Centre, the observatory, Visitor Centre, privately owned planetarium, Community Centre, and the municipality offices.
- Interviews of the local staff of the observatory, the Principal of the public primary school, representative of major business and local government officials.
- Focus group discussion with i) elderly women, ex-employees of SALT and local community members; and ii) teachers from the public secondary school.

The rest of the report is organized as follows. Section 2 outlines a summary of the most important insights that were gathered from the informal data gathering exercise. To understand the complexities surrounding how astronomy affects/impacts local development and to avoid astronomy related activities being perceived as “*top-down*” in approach, it is important to understand the present reality of the local community. Hence, Section 3 of the report presents a brief socio-economic profile of Sutherland as well as the challenges faced by community and related needs. Development initiators’/implementers’ understanding of “development” might be different from that of the local people. Thus, Section 4 of the report presents perceptions surrounding the benefits derived from SALT and socio-economic development through astronomy. Having shown the different perceptions of various Sutherland stakeholders, Section 5 outlines the economic impact of the SALT observatory on the community. Lastly, Section 6 concludes the report and proffers recommendations and best practices that may assist in ensuring that astronomy related projects achieve the intended benefits at the local level. The full list of recommendations is attached in the Appendices, and they are split into A) general recommendations, B) improving relations between the observatory and the community, C) managing computer labs and similar facilities, D) managing Visitor Centres, E) contributing to education and health and F) better impacting the economy. It is envisaged that this will be useful to would-be implementers of astronomy for development projects.

2. Summary of Interviews

1. The team first visited the local planetarium for an hour-long conversation with Alta Steenkamp - the planetarium manager. The discussion revealed that the planetarium had initiated a stargazing programme for tourists a week prior to the visit. Alta is very passionate about her businesses “Discover Sutherland” and the Sutherland Planetarium. She operates and maintains the town’s information center, which features information about most attractions within a 50 kilometer radius of Sutherland. She operates Sutherland’s active [Facebook page](#), which has more likes than the town’s residents. She independently maintains the information centre’s [website](#) and social media pages; as well as advertising and operating her privately owned planetarium. Alta identified that there are high costs associated with marketing and maintenance of the websites, which

is a major roadblock in light of the lack of funding she receives from the municipality or elsewhere. Some financial costs she indicated were for SEO (search engine optimisation) services and for printing flyers; and the time that she invests in all this. It emerged from the discussion that Alta is 'stretched' in terms of the time she invests in marketing Sutherland and her own business(es). There clearly was need for more hands on deck but funding constraints were an important issue, against the background of very few people in the community willing to volunteer without financial incentives. Alta also spoke about high unemployment rates in the town, many of which -- in her opinion -- are voluntary, as many residents receive monthly grants from the government. We discussed the possibility of creating an internship program for students, or getting funding from a development agency to create a paid internship for students in which they learn marketing skills through working with Alta. She mentioned the geological attractions of the region that are highlighted on tours of Sutherland as well.

2. The second meeting was held with the staff of the high school "Hoërskool Sutherland". The teachers of the school had positive things to say about the overall presence and impact of the observatory¹⁰. They indicated that it helped to put Sutherland on the map. Further, SALT has engaged in a number of initiatives that have benefited the high school, for which they were very appreciative. The observatory was previously responsible for paying the salary of a maths teacher (along with the government or municipality) but this was discontinued. The observatory also assisted in the rebuilding of Sutherland High School after it burned down. The observatory also would regularly bring students up to SALT for tours, which the students enjoyed; but, according to the teachers, this was discontinued due to a lack of funding (it is worth noting that we could not verify whether the programme had really stopped due to lack of funding). Additionally, SALT took initiative to bring some of the students to an annual Science Festival in Grahamstown (some 700km away), which also became too expensive. However, the teachers noted that the observatory tours were generally far too high-level for the students and that the information was not brought down to a level they were able to understand. The teachers indicated that there is a low level of interest in astronomy among the students to begin with, and that due to external requirements of the school, it's a very small percentage of the academic curriculum. When asked, the teachers could not identify any negative impacts of tourists on the environment, but that the tourists do not interact with the locals. This sentiment was reiterated by other interviewees. While several positive impacts were indicated during this interview, the teachers also noted that they wished the observatory could provide more consistent support. They wished for a stronger relationship with the observatory, in which students could gain more exposure to astronomy and their career prospects. For example, a teacher referred to a time where one student entered a prestigious nation-wide science competition, yet SALT did not follow through in supporting the student despite the student's entry being related to SALT's interests. Summarizing the state of affairs in Sutherland, the principal attributed much of the issues brought up in conversation (students' lack of support, interest, and

¹⁰ Throughout this report, 'observatory' is used to designate the SAAO.

motivation; drug use and alcoholism; parents not encouraging their children; and issues with maintaining a more involved relationship with the observatory) to poverty.

3. The data gathering exercise also included a meeting with elderly women of the community, who had previously worked for the observatory. The community elders had very positive things to say about the observatory's presence, while also highlighting some systemic/structural issues and inequalities they did not necessarily believe could be addressed by SALT/SAAO. All four interviewed women were previously employed by SAAO and had resided on site for the duration of their careers. Their husbands were the ones who had obtained jobs at the observatory first, before the women were hired as well. This raises an important aspect of empowerment since before that, the women had been employed as domestic workers and farmers. With their new employment came not only a huge raise in salary (such that they were able to afford cars), but a change in perspective: *"It was very different from the one dimensional vision I had of the world when I worked in the kitchen. I got a sense of belonging in society, because I could afford things."* Their jobs had brought the women and their families very close together, forming a tight-knit community that transcended the racial divisions of apartheid. To quote another of the women, *"There was a feeling that - regardless of the expectation by the white parents that children of different races shouldn't mingle - the kids mingled and played together when they had a chance - especially in the bus they shared to and from school."* The women appreciated (they showed excitement in the interviews) the new houses that had been built for them at the observatory. Even though they were racially segregated, they felt a sense that someone catered for them. The racial cohesion existed mostly within the observatory site, but racial divisions persisted in school settings, where it was less socially acceptable for races to intermingle. When asked about how children can be motivated to aspire for other jobs other than being a police officer or teacher (absolutely nothing wrong with these two), they noted that *"parents in the town aren't dreamers"* themselves, thus it was hard to inspire dreams amongst their children. Due to their elevated opportunities and perspectives that were different to ordinary people in the community, the elderly women said that their children had managed to pursue diversified career paths, some becoming electricians, nurses and finance professionals. On some of the social issues affecting youths in the town, the women highlighted drug addiction and alcoholism in children, as well as a lack of respect for parental authority.

3. The need to understand socio-economic challenges/needs in astronomy for development

The link between astronomy and development clearly exists, but is not so straightforward. It is important for future observatories to seriously consider how they can play a role in addressing some of the needs at the community level. It has to be acknowledged that astronomy tends to address the softer (but equally important) issues such as stimulating possibilities in the minds of

underprivileged communities, confidence building and promotion of STEM education, yet communities face “real” problems on a daily basis. Sutherland, like many small, remote towns in South Africa (and other places both within and outside Africa in general) faces numerous challenges. Some of the prominent challenges affecting the town as came out in the data gathering exercise are highlighted in Figure 1 and summarised in Table 2. Some of the challenges were gleaned off from the Karoo Hoogland Municipality Integrated Development Plan (IDP) (2019). Figure 1 and Table 2 emphasize the existence of a plethora of challenges at the community level, and this report underscores the role that astronomy may be able to play to help lessen the burden.

Figure 1 Sutherland Community Needs



Source: Karoo Hoogland Municipality Integrated Development Plan (IDP) (2019)

Table 2 Social challenges affecting Sutherland community

- High rate of illiteracy (second highest in Northern Cape province).
- High rate of unemployment of 57% according to Vorster and Eigelaar-Meets (2019)’s representative sample. As a result, about 2/3 of Sutherland families live off social grants from the government
- Teenage pregnancy - the different interviews revealed that many teenage girls fall pregnant at a very young age
- High school dropout rate - As at May 2019, the student headcount of the high school was 120, compared to a higher figure of 140 at the same time in 2018. This speaks to less children spending time in school over the review period.
- Alcoholism (including among teenagers and pregnant women).
- Lack of public transport between Sutherland and the rest of the province (including nearby towns and big cities).

- Social discord - It came out several times during the discussions that there is an ethnic divide in Sutherland. It was established that people of different ethnic backgrounds do not live, share or study in the same spaces. There is a strong economic, cultural and social border between white and coloured people, such that public schools are mainly used by the coloured community while the white children tend to go to private schools. The white and coloured communities separately organise the different cultural festivals that take place from time to time in the community - reminiscent of the status quo before the democratic rule attainment of 1994. The following quotes from most coloured interviewees illustrate this:

“The Whites don’t want to lose power, they have the resources.”

“They are not interested in meeting us, we could invite them to any social event, but they won’t accept the invitation.”

“White children go to another school, a private school”

“Their children will not mix with our kids”.

“I will not expose my children anymore, I will not go to that school anymore.”

“Some of them didn’t even want White mentors”.

- Lack of technical skills and funding for coloured people (they cannot afford to establish a bed & breakfast, they are not business owners, most of them are employees).
- Lack of interest/motivation on the part of both children and parents to really excel academically and professionally; to expand the children’s worldview so that they aspire to pursue different career routes beyond the police officer, nurse and other professions they have only had exposure to. It was established that motivated by *“power and elevated financial status”*, most of the school learners aspire to be police officers. *“Although it is not safe to be a policeman, it is a well paying job”*.
- Lack of support structures for children. *“Some parents don’t have a dream for their kids, even don’t have a dream for themselves. If I don’t believe, my kid will give up”*.

Source: Various Sutherland Interviews (2019) and Vorster and Eigelaar-Meets (2019)

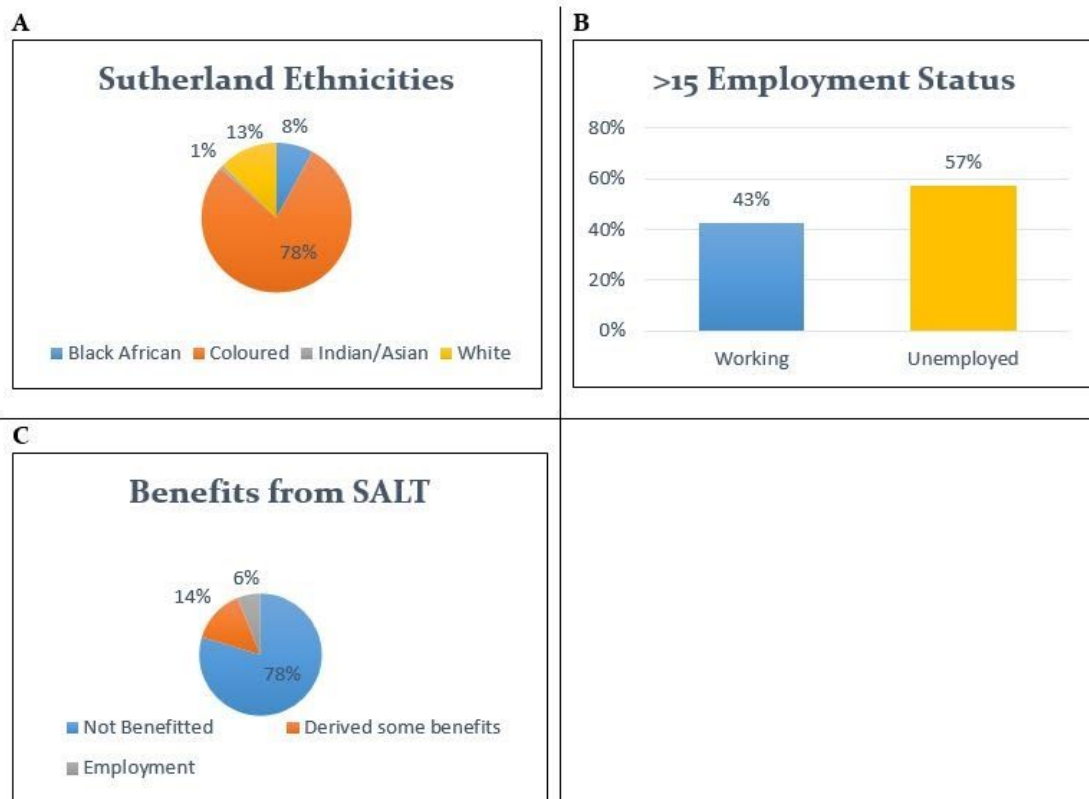
Sutherland’s Brief Socio-Economic Profile

Having understood some of the pertinent challenges/needs affecting Sutherland, it is important to put these within the context of the socio-economic profile of the town. The Karoo Hoogland Municipality’s Spatial Development Framework (2019) identifies Sutherland as an Astronomy and Tourism Node within the Northern Cape’s Provincial Spatial Development Framework due to the existence of the SALT observatory and the endowment of the region with clear night skies for stargazing.

This section presents some findings from a desktop research exercise on the socio-economic background of Sutherland. The exercise mainly relied on the survey findings of Vorster and Eigelaar-Meets (2019). Relevant data on pre- and post-establishment of SALT was not available in order to attempt to estimate the economic effect it has had on the Sutherland Community. Key variables that are presented here are i) Race, ii) Employment Levels and iii) whether the

community has benefited from the establishment of SALT. Information on ethnicities and employment status is presented here in order to present the opportunity/gap that astronomy can fill not only in Sutherland but elsewhere where observatories exist or where they will be set up.

Figure 2 Sutherland Socio-economic profile



Sources: Panel A - Census (2011), Panel B and C - Vorster and Eigelaar-Meets (2019)

The potential of astronomy in bringing different people together, based on common humanity is well acknowledged (visit e.g. [Universe Awareness](#) for more information). Hence, astronomy is a relevant science and recreation activity (for example, stargazing) in racially diverse communities. The study by Vorster and Eigelaar-Meets (2019) established that Sutherland is an ethnically diverse community as shown in Figure 2 (see Panel A). Given the importance of astro-tourism in employment creation¹¹, it is also pivotal to consider the levels of unemployment in Sutherland. Figure 2, Panel B shows that as at 2017, 57% of individuals in Vorster and Eigelaar-Meets (2019)'s sample were unemployed. While this is not a positive find, it shows the potential labour market supply that may be harnessed in the development of astro-tourism programs and projects in Sutherland. Also the Karoo Hoogland Municipality Integrated Development Plan (IDP) (2019), reveals that between 2004 and 2014, there had been a decrease of about 6% in Coloured unemployment (the major ethnic group in Sutherland) in

¹¹ Through the employment of tour guides, the creation of tourism-related businesses such as guesthouses, handcrafting, etc.

Karoo Hoogland (the municipality in which Sutherland falls into). Being a small town, Sutherland might not be able to absorb all the professionally qualified labour-force, but these individuals have an opportunity to migrate to other larger cities across South Africa. Hence, the majority of the unemployed in Sutherland would be unskilled workers, and they may require some training with regards to income generating projects that are related to astro tourism.

In terms of poverty, the Karoo Hoogland Municipality IDP (2019) states that there was a 24% decline in people living below the poverty line in the Karoo Hoogland Municipality in 2014 as compared to 2004. This is an important improvement, although the report does not show the specific figure for Sutherland. Such improvement, vis a vis high unemployment rates may be attributed to the positive effects of social grants.

4. Perceptions of the local community about the Observatory

Some of the interviewees believe that, before the inauguration of SALT, the observatory did not mean much to them. There was little to no interaction with the Sutherland inhabitants. It was not just a physical distance (the installations being about 15km away from the town of Sutherland), that existed between the observatory and the local communities, but also a symbolic barrier (astronomers versus locals). The observatory, telescopes and staff members were seen as *“the ones that are at the top.”* In this section we highlight the different stakeholders’ perceptions of the SAAO as noted during the interviews.

4.1 Educators’ Perceptions

With the advent of SALT and the implementation of the SALT Collateral Benefits Programme (SCBP) around 2006, the perception of the communities about the observatory has positively changed, specifically in terms of the town’s primary and secondary schools’ education programmes (sponsored by SAAO). According to the teachers and principals of the public primary and high schools, the Observatory has had a strong positive impact in motivating children to continue further studies and expanding their world view. For that reason, they highly value the presence of the SAAO and the support that it has given to them in different project activities.

4.2 Local Government’s Perceptions

On an institutional or more formal level, the Observatory is considered as a participant in intergovernmental meetings and forums. However, for the local government officials, the role of

the Observatory as an allied stakeholder in supporting and addressing Sutherland's needs and challenges¹² has not been very well defined.

4.3 Elderly SAAO Ex-Employees' Perceptions

For some of the women who directly worked in the past for the Observatory (e.g., cleaning and catering staff), this place gave them a sense of belonging and an opportunity to improve the quality of their lives "*the Observatory opened a new world for us, it gave us a place in society, an opportunity to not just live from hand to mouth*".

The fact that the Observatory has hired so many women, many of whom are local to Sutherland, is an excellent practice. In South Africa, more men are employed than women at all ages; on average, there are 14% less women in the labor market than men. According to the 2012 OECD Report¹³ on South Africa, women perform just over twice the amount of unpaid care labor at home than men, though their work is undervalued because it is not economically productive. Women's increased labor force participation is a way to improve women's decision making power in the household. In South Africa, 97% of domestic workers are women, whereas higher paying jobs with lower turnover rates are more heavily dominated by men. The fact that the gendered division of labor is being addressed by offering jobs to women at the Observatory is a good practice. It should be ensured that types of jobs within the Observatory each have gender equality, to ensure that women are not overwhelmingly occupying lower-paying positions (the authors of this document were unable to receive gender disaggregated data for types of work offered at the Observatory).

4.4 Families Living and Working on Site

For the local families living and working on site, the Observatory meant more than a way of having the possibility to access economic resources; it had a positive impact in terms of social factors as well. The experience of living there impacted positively on perceptions of and the relationship between the families and the Observatory. They felt for the first time that their work was being acknowledged. As shown the quotes below, the presence of local people living and working in the Observatory allowed cultural and social boundaries to be broken:

"The Observatory changed a lot in our lives, even our children were born and raised together in SALT".

"There was free transport for us and for our children (to Sutherland), our children and white children were playing together, and we brought up the kids in the same environment, although in the Town Centre the kids were separated".

¹² During the intergovernmental forum that the team attended, officials have asked the representatives of the Observatory to sign an agreement in order to formalize and assure the potential activities in which the Observatory can support them.

¹³ OECD South Africa, Closing the Gender Gap: Act Now (2012)

“I felt someone is making an effort, acknowledging my work and my husband’s work, we were so happy and excited because we were taken into account and new houses were built for us”.

4.5 Local Perceptions on Astro-tourism

Local communities did not perceive astro-tourism as a potential business activity for them since they do not benefit from it. This is because most of the Bed & Breakfast facilities (B&Bs) and other tourism-related businesses are white owned (yet Whites only constitute 13% of the town’s population). Locals indicated that they need assistance in learning administrative skills, and it was also noted that economic resources were an important requirement in the creation of small businesses for tourists. These perceptions are reflected in some quotes as follows:

“Tourists just come and go”; “Most of the guest houses are out of town”; “The tourists who come to visit don’t benefit us; they are just there¹⁴, not here”.

The last quote underlines the lack of connection between tourists and locals, and shows the absence of a sense of belonging and identification with SALT or its tourism activities on the part of the locals. Such feelings are potentially reinforced by the sociocultural division that is still one of the main challenges in Sutherland.

4.6 Relation between local communities and the Observatory

There has not been a clear mechanism or a specific guideline to create a relationship between the Observatory and local communities. According to testimonies gathered in the town, before 1994, non-white people had no access to the installations of the Observatory. After 1994, even though non-white Sutherlanders could now access the Observatory, the relationship between the two parties was distant until the advent of SALT. For the locals, SALT signifies the opening of the observatory to them, it represents the point where the observatory “*opened the gates for their community*”.

Despite the ‘access’ barrier that was perceived to be broken down by SAAO’s inauguration of SALT as discussed in the preceding paragraph; and despite SAAO’s outreach programs with the community and local schools; locals widely hold the perception that the observatory “*is something away from people*”. From the key informant interviews, this perceived distant relation may be explained by two main reasons: *i)* the popular barrier between the science/scientist (including scientific terminology) and ordinary people, and *ii)* the lack of interest and concern of the Observatory for the development of the town. The following quotes make these reasons explicit:

¹⁴ In reference to tourists spending their time either at fancy guesthouses or at the SALT site - not inside the community

“People are disappointed when they visit the Observatory. They don’t know about science, they prefer star gazing”.

“Astronomy is something too high for them” (teachers referring to some students/parents).

“Bring it to the street!” (referring to scientific astronomical concepts and terminologies).

“The Observatory is only interested in astronomy, they could support more young people”.

“The observatory is just an object for scientists to improve science, it is only for research purposes, there is no direct benefit to the people”.

As can be seen here, a large fraction of the population does not identify with the observatory or science (with the exception of some teachers, for whom the Observatory has “*put Sutherland on the map*” in terms of scientific interests). The Observatory is perceived as something that is out of the town, not part of it. “*Many people were born here, but have never been to the Observatory*” - were some of the sayings by the local people. This may explain the low¹⁵ level of participation of the local community in activities that promote astronomy at the Visitor Centre.

5. The Economic Effect of the SALT Observatory on the Sutherland community

Determining the economic effect of an intervention on a community is a rigorous exercise. Such analysis relies on the availability of pre and post intervention time series data for both control and treated observations. To deal with the problem of endogeneity, the baseline conditions should preferably be the same in both treated (Sutherland) and control groups (sister towns of Williston and Fraserburg for example), and good sample size is needed. Given the unavailability of a sample of annual data at the household level for Sutherland and a ‘similar’ sister town in the pre and post intervention periods, this report is unable to carry out causal analysis of the effect of SALT on the Sutherland economy. The report descriptively presents the findings on the economic effect of SALT on the local community based on the findings from the qualitative discussions and stakeholder perspectives (see Table 1), but also relying on desktop research.

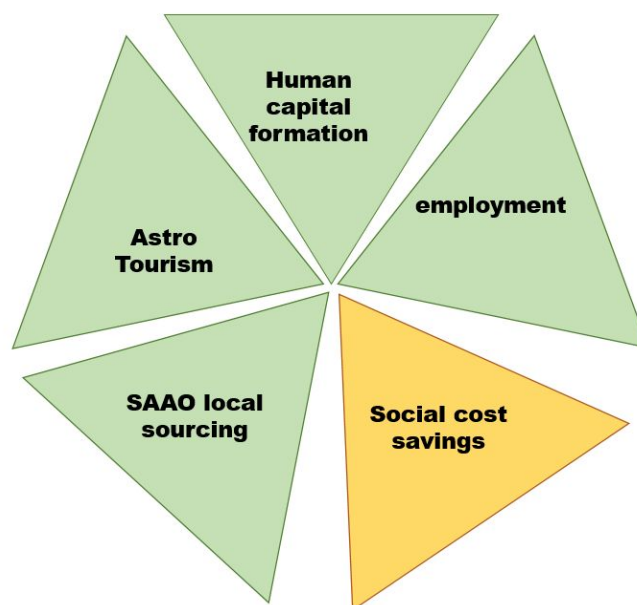
To start off, the findings from Vorster and Eigelaar-Meets (2019) suggest that the majority of the respondents had not benefited from the observatory while a combined 20% indicated that they had derived some benefits from the SALT observatory and alluded that the observatory had provided employment for a member of their family, as shown in Figure 2, Panel C.

The discussions with the various stakeholders acknowledged that the SALT telescope had resulted in a plethora of benefits for the local community. These benefits are summarised as i) employment, ii) human capital formation, iii) local business development through astro-tourism

¹⁵ Insights drawn from discussion with Visitor Centre staff

and iv) local business development through local sourcing by SAAO. It did not appear like benefit number v) – social costs ¹⁶savings was being realised. These benefits are shown in Figure 3.

Figure 3: Economic benefits from SALT Telescope



Source: Authors' own illustration

5.1 Astro-Tourism

The most prominent benefit of the SALT telescope has been the establishment and reinforcement of the astro-tourism industry in the town. Whereas only a few hundred people visited the town in a year prior to the establishment of SALT, interviews with the SAAO Visitor Centre officials revealed that around 12000 people now visit the town annually.

5.2 Human Capital Formation

The SALT Collateral Benefits Program (SCBP) was established to achieve human capital development (SALT Annual Report, 2017). The SAAO has been instrumental in assisting the primary and secondary school in many ways (including financially). The observatory has also conducted motivational sessions and put in place mentoring programs to positively affect scholar mindset in the past. While such motivational programs have not really recorded

¹⁶ Government spends a significant amount of money rehabilitating and treating citizens (including youths) from alcohol and drug abuse. Apart from that, the costs of crime, injuries and accidents that are related to alcoholism and drugs are very high. Such social costs may also include the opportunity costs of teenage pregnancies, for instance. Where young people form astronomy clubs (for example) and actively take part in positive activities, they spend less time engaged in negative activities - thereby reducing the costs that government, communities and society in general have to bear.

overwhelming interest and participation by the youths (as came out in the interviews and focus group discussions), it still remains an important aspect of positively building a learning and development character that should then feed into human capital formation for the future. SAAO has also provided a community centre that houses a computer lab with high speed internet. Although the visitor rates are not very high, the lab supports learning, job searching and entrepreneurship since it acts as an information gateway through providing access to the internet at zero cost to the community. Lastly, the SCBP has provided university bursaries to brilliant students, thereby ensuring that some students will not only obtain better jobs and incomes, but may also use their knowledge to power the development of Sutherland itself. Hence, the role played by the SALT observatory is important from a human capital perspective.

5.3 Employment

Many of SALT's employees in Sutherland are from the local community. This is a direct economic benefit given that these employees are active participants in the local economy in various ways. Additionally, the observatory has created a number of business opportunities, particularly in the accommodation [Bed and Breakfast (B&Bs)]. Sutherland now hosts several of these establishments, and these contribute positively to the local economy since they also provide employment opportunities for the local community. For example, the number of B&Bs in the town has grown from two in 1998 to about 60 nowadays, including 18 guest farms. This increase, which is largely due to the implementation of the observatory and the SCBP, generates revenue and boosts the socioeconomic development of the town. Having more people employed in Sutherland raises the local demand for goods and services and the domino/multiplier effect can attract more investment and business expansion to meet the growth in the demand for goods and services.

5.4 SAAO local sourcing

SAAO spends millions of South African Rands every year to maintain the SALT observatory. This is an important opportunity that local businesses could benefit from by acting as vendors for the different goods and services that the observatory requires on a yearly basis. It was not immediately clear from the Sutherland visit to what extent this has been happening on the ground but this is an important avenue through which the local economy can benefit, stimulating more investment and growth.

5.5 Social cost savings

Astronomical events, astro-tourism exhibitions (festivals), mentoring and educative opportunities (including the provision of the computer lab in the community centre) should all play a role in making youths and adults alike aware of other positive opportunities outside the usual day to day life that people are accustomed to. By spending more time reading and seeing other opportunities outside Sutherland and outside South Africa; learning more about other cultures; and acquiring general knowledge across a broad range of topics (including contraception

methods, the downside of alcohol and drug abuse), youths may end up indulging less in negative behaviours (the same as participation in local positive activities and events). This then results in reduced cases of teenage pregnancies, drug related illnesses, injury and death. The result of reduced illnesses, violence and mortality is a thriving community through saving on the opportunity costs of lives cut short and saving on the direct costs of rehabilitation and the direct costs of medical care for the victims. An observatory like SALT should assist in this regard, but this has been a missed opportunity in Sutherland since there is not a lot of interest and participation in positive events and activities especially amongst youths.

6. Conclusions and Recommendations

The discussion in this report leaves very little doubt that the presence of SALT (along with the SCBP) has impacted positively on local development in Sutherland. The report brings out the importance of “bottom-up” approaches in the conceptualization and implementation of astronomy for development projects. It came out in the discussions that astronomy remained out of reach as an elite science, which emphasizes the need to make astronomy accessible to lay people if they are to benefit from it. It is important to realise that the OAD, SAAO, SALT and others’ understanding of development might be quite removed from the understanding at the local community level. Hence this study investigated and gathered important insights into community perceptions regarding accessibility of astronomy, benefits resulting from the presence of SALT, and whether the Observatory had done enough, among a host of other far ranging issues. From the discussions, it is evident that there have been a number of benefits derived from SALT by the Sutherland community, including astro-tourism, human capital formation, employment, SAAO local sourcing, and social cost savings (to a lesser extent) as discussed in the report. From the study by Vorster and Eigelaar-Meets (2019), it is evident that the Sutherland community has directly (some) and indirectly (the entire community) benefited economically from the presence of SALT. Direct benefits include employment income for the few who have been fortunate and qualified enough to be employed by SAAO, revenue from astro-tourism related economic activity (for B&Bs for example). Indirect benefits may include benefits of better life and career choices in the future on the part of the learners due to the various exposure projects that SALT had sponsored. The benefits of the computer equipped and free internet Community Centre can also not be overemphasized.

For a community as challenged socio-economically as Sutherland, many of the intended outcomes of the SAAO outreach programs fail to reach fruition. The town faces problems such as school dropouts, teenage pregnancies, alcoholism, poor student motivation, poor road networks, low literacy rates, shortage of business development skills and racial discord among others. Astronomy alone cannot solve all these problems, but it can certainly make a positive contribution in helping address these issues.

However, the research established that there was rather low participation by locals in astronomy related activities partly due to the economic hardship (for instance one requires a vehicle to

travel up to the Observatory) but also due to perceptions of astronomy. Perceptions are an important part of the report. The educators and elderly women who took part in the discussions had very positive perceptions about the Observatory since “SALT put the town on the map”, and since the observatory had provided employment opportunities for some of them. The feedback from the municipal officers was that they did value the relationship with SAAO, although the scope and mandate of that relationship was not well-defined.

6.1 Recommendations

From the findings presented in the report, a number of recommendations can be proffered. The recommendations speak to different aspects specifically A) general recommendations, B) improving relations between the observatory and the community, C) managing computer labs and similar facilities, D) managing Visitor Centres, E) contributing to education and health and F) better impacting the economy. These six areas are delved into in more detail in the Appendix. Only selected good practices that every observatory may generally need to take into account are presented here.

6.2 Good General Practices

1. **Creating job opportunities and supporting local education** - Almost every interviewee appreciated the job opportunities created through the Observatory’s presence and the support provided to the local education system were highly praised.
2. **Designing an astro-tourism programme** - One way to ensure that the presence of tourists directly benefits the local communities is to initiate homestay programmes. Not only can this directly generate revenues for the disadvantaged families¹⁷ of the Sutherland communities, it is also one of the best ways of ensuring a cultural exchange between locals and tourists.
3. **Supporting the community in times of need** - The high school teachers whom we interviewed were highly appreciative of the outreach to the school. Not only was the financial support in light of the school burning down well-received, but also creating new facilities such as the Computer Laboratory and in regularly bringing students to the observatory. All these were noted as good practices.
4. **Free access to facilities** - Given the high level of poverty in the town, free admission to the observatory for Sutherland residents, especially school learners, is a great way to make it more accessible to its residents.
5. **Assist local students participate in science festivals¹⁸** - The efforts made by the observatory to facilitate the participation of school children in Science Festivals was highly appreciated, although this unfortunately has been suspended probably due to high costs.

¹⁷ See section II.1 of [this OAD document](#) outlining guidelines on how to improve the impact of observatories on socio-economic development.

¹⁸ SAAO facilitated the participation of high scholars at Eskom Expo for science projects

6. **Provision of Scholarships** - scholarships given to young people to attend University were highly appreciated.
7. **Identifying and Supporting Community Needs** - Support of schools' needs: improving science labs, donating books and tools (e.g., scientific calculators), hiring extra teachers, etc. was also viewed in a positive light.
8. **Exchange programs, excursions** - local and international visits to Open days at Universities such as UCT and UWC, etc.
9. **Host Festivals** - For example, Kite festivals and '[Sutherland reflections](#)'

7. Future Research

Future work to understand the effects of the SALT telescope may rely on pre- and post-2005 census microdata. The informal exercise conducted by the OAD fellows represent only a "tip of the iceberg", and more rigorous data collection may reveal deeper connections, meanings and perceptions. Better still, the study by Vorster and Eigelaar-Meets (2019) has provided important information on the subject - thus rendering another qualitative survey/data collection exercise in the short term not too essential.

References

Census (2011)

Karoo Hoogland Municipality Integrated Development Plan (IDP) (2019)

Karoo Hoogland Municipality's Spatial Development Framework (2019)

Vorster J and Eigelaar-Meets I (2019), Sutherland: Socio-economic characteristics, Cosmopolitan Karoo Research Report

OECD South Africa, Closing the Gender Gap: Act Now (2012)

Appendix: Expanded Recommendations Matrix

A. General Recommendations

1. Strengthen the cohesion between the observatory and the local community. Many members of the local community have spent their entire lives in Sutherland without visiting the observatory/SALT telescope. One way to overcome this would be for SALT to provide regular transportation between Sutherland and the observatory campus. This could be one, two or more trips a week (depending on need and where it is possible logistically), operating both for day and evening trips.
 - a. The observatory already has a series of transportation vehicles; besides the cost of petrol and vehicle maintenance, this would simply require an employee (or small cycle of employees) to provide the transportation. Tours are already free for Sutherland residents. Alternatively, a member of the community could be hired, if the van(s) could be kept in Sutherland.
 - b. In light of the comments from the interviews conducted, a family-centered approach would be most beneficial. Many young learners are not receiving career support from their parents, many of whom are unaware of STEM or astronomy-related career opportunities. One way to address this would be for families to come up together, and for a part of the tour/visit they break into groups (parents and children) where they receive age-appropriate information about the careers available in STEM or astronomy.
 - c. The teachers we interviewed indicated that bringing the students to SALT was a great experience for the children when it would happen, but that a lack of funding made it unfeasible in recent years. The feasibility of this recommendation should be looked into further, given SALT's current funding situation.
2. It was established during the site interview that students are often unaware of the opportunities that lie beyond Sutherland, and that within the town, they see limited career options for themselves. We recommend that a one-on-one mentor system be established between members of the observatory and local children. One way this could be implemented is by requesting affiliates of SALT/SAAO (based out of Sutherland, but also potentially in Cape Town) to dedicate ~2-4 hours a week to work individually with a high school student in town. If the student is interested in astronomy, perhaps they could start on a small research project; alternatively, if the student holds other interests, the mentor could ask around within their network to help them meet professionals in their field of interest. The mentor could provide homework help, assistance with college applications and finding bursaries (generally establishing a post-graduation plan), and working alongside the student in elucidating where their passions lie. This could be done remotely by having video calls in the Community Development Centre or Sutherland High School's Computer Lab, or through WhatsApp messages, but periodically entail physically meeting somewhere. As a result, the high school students that are being mentored could take on some small responsibility to the primary school students. The high school teachers mentioned that it would be nice to form some cohesion between

the primary and secondary school and this could be one way of doing it if there's interest and it's feasible in the class schedule.

3. One point of discussion in the Intergovernmental Forum was that there is no ambulance located within Sutherland, but rather has to be brought in from a neighboring town from the municipality (either of which are quite far away) on an as-needed basis. Given that the SAAO has an ambulance for the observatory, it would be beneficial to look into the possibility of Sutherland using the SAAO/SALT's ambulance when needed, or to have the SAAO/SALT's ambulance be based out of the town rather than at the observatory campus.
4. Free admission to the observatory and observatory tours for Sutherland residents is an excellent way to make it more accessible. We recommend that this be publicly or more actively advertised, online and in the form of flyers around the town. However, the issue remains that most residents lack transportation to and from the observatory campus; see Recommendation A1.
5. Disaggregation of observatory-related data is essential. For future observatories, data should be taken on the number of businesses and employment opportunities in the community, disaggregated by race and gender. During the construction of the observatory and once it is established, the number of jobs within the observatory and in the community should be tracked and the employees should be disaggregated by race and gender. Data should be taken on the number of new opportunities, such as bed and breakfasts, in said disaggregated manor.

B. Improving the relations with the local communities

A better way of improving the relation of the SAAO with the local communities of the town of Sutherland would be to:

1. Reinforce the participation of the Observatory in inter-institutional forums and local meetings. This would imply signing an agreement with the intergovernmental forum and creating a participatory activity plan not just with institutions but with local leaders (in correlation with the Integrated Development Plan to link national, provincial, and local levels).
2. Organise informal stargazing with locals (including not just children and teenagers, but adults too) and visits to the observatory at night. Make available free transport to visit the Observatory and the use of telescopes.
3. Guarantee transparency in any job selection recruitment process to avoid any kind of judgment and negative feelings of locals towards the person that will be recruited.
4. Make sure that any kind of donation or relation with the community is done through the science engagement department. This is a way of showing transparency and avoiding any private potential privilege for some people.
5. Establish an evaluation process of any activity that the Observatory develops with the community (Visitors Centre, outreach and educational activities, participatory plan, etc.).

C. Managing computer labs and similar infrastructure

To optimise the impact of the Community Centre and similar public computer labs that are offered to the local communities, observatories could:

1. Offer basic computer learning courses (these could be done by people working in the Observatory or exchange university students).
2. Work towards improving the relation and contact between the manager (or person in charge of the centre) and the young users, by assigning a role of facilitator to the manager. This will better the usage of the centre, which is currently not being used the way it was supposed to be.
3. Not charge for the first printings, if these are related to school homework, research, further studies or CVs.
4. Perhaps implement Chess competitions in schools since playing computer Chess is an important attraction to teenagers.

D. Managing Visitor Centre(s)

The observatory could:

1. Use the Visitor Centre as an information centre about the social challenges of the communities of Sutherland and as a connecting link between potential volunteers, or to offer exchange experiences to tourists in the town and in local guest houses.
2. Explain or advertise to tourists that buying handcrafts is a way to support the socio-economic development of the local communities.
3. Allocate a percentage of the entrance fees of the Visitor Centre for a communitarian fund (for example for hiring a social worker).

E. Contributing to education and health

Taking into account the feedback received during the different interviews and from observations, it is believed that the observatory could work towards:

1. Supporting social work in Sutherland, Child Protection Unit and the Development of Social Department in Sutherland (in the case there exists one).
2. Assisting responsible stakeholders (such as Department of Education) to implement basic education training to adults.
3. Implementing mentorship and training programmes for small business, assuring their continuity or any local need (previously coordinated in a communitarian meeting). Volunteers or staff from the observatory could be involved in these activities.
4. Support interventions to individually following up children that are regularly missing school, monitoring children respectively in their last year of Elementary and High School. Include parents in educational monitoring activities (special evening's events, adapt the activities to schedules and needs of parents).
5. Support programs to improve sexual and reproductive health education, promoting free access to contraceptive methods.

F. To Better impact Local Development

F1. Making the Telescope a business – the interactions with various stakeholders revealed that the success of astro-tourism business relies on effective marketing and other business strategies. Therefore, although the telescope is not a profit seeking venture – there are some aspects that need to be taken care of – in this case effective marketing so that people are aware of its existence.

F2. Steering away from “isolation” approach – it is very important to note that the telescope/observatory will not function in isolation. Things such as infrastructure as well as coordination amongst different stakeholders are important aspects that need consideration.

Box 1: Sutherland Roads Case Study

The interviews revealed that only the roads that feed Sutherland from the Western Cape Province are tarred. Roads out of Sutherland into other Northern Cape areas such as Fraserburg and Williston towns are not paved. From the discussions, it emerged that the absence of tarred roads connecting to other places other than the Western Cape Province is an important constraint because people who do not own off-road vehicles find it difficult to visit Sutherland and enjoy the tourism it has to offer.

As discussed in Box 1, roads are an important catalyst that is required to ensure the success of astro-tourism. When requisite infrastructure is in place, it creates a ripple or multiplier effect in the economy. For example, building paved roads in Sutherland will have the multiplier effect in that some people may choose Sutherland as part of their route as they go to other places. Although they may be passing through Sutherland, they may end up purchasing refreshments and also deciding to experience some of the astro-tourism attractions in the town.

F3. Smart partnerships – related to (F2) above, smart partnerships are important in ensuring the success of astro-tourism. In Sutherland, it emerged that there is a mutually beneficial relationship between the SAAO observatory and some local private actors. For example, when seats for the SAAO telescope tours are filled, people attempting to register for the tours late may be referred to a privately owned planetarium in the town. This emphasises the important role played by smart partnerships. The success of the astro-tourism project hence hinges on partnerships with the local municipality, private players among other stakeholders in order to optimise the utilisation of capacity and retain business in the area for mutual benefit.