



**African indigenous astronomy of Batswana in Botswana
and South Africa**
MT Koitsiwe

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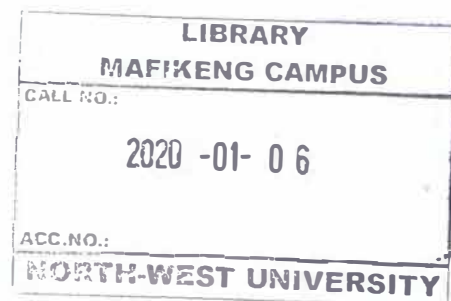
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at the North-West University

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DECLARATION

I, Motheo Koitsiwe, declare that the thesis for the Degree of Doctor of Philosophy in Indigenous Knowledge Systems (IKS) at the North-West University, hereby submitted, has not been previously submitted for a degree at this or any other university; it is my own work in design and execution and that all material herein contained has been duly acknowledged.

Motheo Koitsiwe

Signed:

Date:

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DEDICATION

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ABBREVIATIONS

AC-	African Cosmology
AI -	Appreciative Inquiry
AIR -	African Indigenous Researchers
ANC -	African National Congress
ASSA -	Astronomical Society of Southern Africa
ATR -	African Traditional Religion
AW -	African Worldviews
BBKTA-	Bakgatla -Baa- Kgafela Tribal Authority
BBT -	Big Bang Theory
CMB -	Cosmic Microwave Background
CMC -	Contemporary Maasai Cosmology
CRL -	Commission for the Promotion of Cultural, Religious and Linguistic Communities
CWA -	Contemporary Western Astrology
DST -	Department of Science and Technology
EWS -	Early Warning Signals / Systems
FAO -	Food and Agricultural Organisation
IAU -	International Astronomy Union
IK -	Indigenous Knowledge
IKS -	Indigenous Knowledge Systems
Langtag -	Language Plan Task Group
NASA -	National Aeronautics and Space Administration
NDM -	Natural Disaster Management
NLPF -	National Language Policy Framework
PANSALB -	Pan South African Language
CDE -	Education Centre for Development and Enterprise
SD -	Sustainable Development
THP -	Traditional Health Practitioners
UNISDR -	United Nations International Strategy for Disaster Reduction

GLOSSARY OF SETSWANA TERMS

Baitseanape - experts

Baitseanape ba kitso ya bolepa-dinaledi - indigenous astronomy experts

Baitseanape ba kitso ya tlhago - indigenous knowledge experts

Balemirui - agricultural society

Bogwera- initiation for boys

Bojale- initiation for girls

Bolepa-dinaledi - indigenous astronomy

Difaqane - crushing, scattering, forced dispersal, forced migration

Dikgoro - clans

Dinaledi - stars

Dinawa - beans

Go fetlha pula - ritual of rainmaking

Go tlhapisela lefatshe - land ceremony

Kakanyo - philosophy

Kgabo - monkey

Kgogamasigo - night dragger

Kgosi- king

Kgosikgolo - paramount leader

Kgosing, Morema, Tshukudu - - clans of Bakgatla -Baga- Kgafela

Mabodisa, Manamakgote - clans of Bakgatla -Baga- Kgafela

Kitso - knowledge

Kopadilalelo -venus

Lebelebele - millet

Letlhodi - small green beans

Lotlatlana - dusk, or early evening twilight

Maabanyane - the evening after sunset, towards night

Mabele - sorghum,

Magapu - melons

Mahube - reddish sky, i.e. early dawn

Masimo - field

Mma-Pula - mother of the rain

Mmopo - maize,

Moroka - rainmaker

Moso - sunrise

Mpho ya badimo - gift of god

Mpye - sweet reed

Naka - canopus

Phirimane - sunset

Pulanyana - little rain

Selemela - pleiades

Sereto - totem

Thapelo ya pula - rain prayer

ABSTRACT

Although astronomy is the oldest of all the sciences, African indigenous astronomy, especially of the Batswana has to date not received the attention it deserves from scholars and researchers. Nonetheless, there is scattered, disconnected documentation of aspects of this knowledge studied by scholars in a variety of disciplines. This study followed a case study approach to investigate African indigenous astronomy of Batswana in Botswana and South Africa. The research report in this thesis has focused on the African indigenous astronomy of Bakgatla -Baa- Kgafela in Mochudi (Botswana) and Moruleng (South Africa). The Bakgatla -Baa- Kgafela were chosen for this study due to fact that they share the same history, culture, tradition, totem and philosophy. However, due to historical and political developments they were separated by artificial borders, hence some are found in Botswana while others are in South Africa.

The study followed a qualitative approach and indigenous knowledge paradigm. The Afrocentric, phenomenography and appreciative enquiry theories were used as appropriate and relevant frameworks which underpinned this study. Research data was gathered from “*baitseanape ba kitso ya tlhago*’ or the IK experts by means of in-depth interviews, focus group discussions (using *Lekgotla* or indigenous talking circle strategy), narratives and document analysis. The data collected from the participants was analysed thematically.

The findings of the study revealed that, generally, the Bakgatla -Baa- Kgafela generally are rich with indigenous knowledge of the stars, moon and other constellations. This knowledge was used in agriculture, reproductive health, time calculation, calendar making, rainmaking and thanksgiving ceremonies and natural disaster management. Furthermore, oral traditions such as songs and poems were used as vehicles to transmit knowledge of indigenous astronomy using their local language to the young generations. The elders were and are the sources, custodians of this knowledge and used stories and mythology to teach the young about indigenous astronomy.

The evidence and examples provided in this study can be used to demonstrate that indigenous astronomy is relevant in modern times and can be interfaced with modern astronomy. Indigenous astronomy is not just in the minds of the elders, it is often hidden and expressed in the arts such as pottery making and architecture. Bakgatla used to make pottery and build traditional homestead with decorations of celestial bodies. However, this art is also fading away due to the fact that there are few elders in the community who possess this skills.

Within the study communities, there are heritage sites which have astronomical significance and needs to be restored and preserved. Astronomical heritage is also one of the themes which emerged in this research. In summation, the domination of Western knowledge marginalised the role of indigenous astronomy in the community. Despite this marginalisation, the Bakgatla -Baa- Kgafela in Mochudi and Moruleng, like other African tribal groups in South Africa preserved this knowledge and used it for their community's livelihood. Community members in the research were given the opportunity to express their knowledge of indigenous astronomy in their own Setswana language.

It is on the basis of the above findings that the following recommendations were made for the study: African indigenous astronomy is an interesting field which needs to be adequately documented, developed and promoted; African indigenous astronomy is part of indigenous knowledge systems was subjected to Western research methodologies and methods; there is a need to develop a critical mass of African indigenous researchers and scientists to conduct holistic indigenous research on African indigenous astronomy, building collaboration, partnerships and networks among relevant stakeholders is critical and finally the co-existence of African indigenous and modern astronomy should be encouraged.

Key words: Afrocentric, Batswana, indigenous knowledge systems, indigenous astronomy, constellations, celestial bodies, heritage, oral traditions, livelihoods, phenomenography.

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CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Majola (2012) observes that since time immemorial indigenous cultures in Africa had developed a wealth of indigenous astronomy, which can be found in myths, legends, poems, proverbs, songs and stories. Indigenous peoples have been developing complex knowledge systems of the cosmos for tens of thousands of years. These knowledge systems which seek to understand, explain the sun, moon, stars and other constellations are passed to posterity through oral tradition.

Holbrook (2016) argues that humans have the mutual relationship with the the sky. These relationships include practical things such as timekeeping, weather prediction, seasonal calendars for agricultural activities, and navigation; artistic inspiration such as songs, poems, myths, stories, paintings, sculptures and metaphysical beliefs such as celestial deities (Holbrook, 2016). Africans have used the stars for centuries, be it for navigation, agriculture, even story telling (Campbell, 2002).

Baki (2006) argues that, knowledge of the sky was once part of everyday life in most of African societies. In addition, the Canadian Heritage Information Network (2003) indicates that knowledge of the stars is found in many aspects of culture including storytelling, symbolism and religious traditions. In ancient times, indigenous astronomers used this knowledge to help guide the day to day affairs of their communities (Canadian Heritage Information Network, 2003).

The study of indigenous astronomical knowledge falls under the academic field of cultural astronomy (Nakata et al., 2014). Holbrook et al. (2008) state that Cultural Astronomy (CA) is the study of social understandings and applications of astronomical knowledge. The above is supported by Campion (2004) cultural astronomy is a recent discipline, defined only in the 1990s. It emerged out of the slightly less recent discipline of archaeoastronomy, the study of the astronomical alignment, orientation or symbolism embodied in (usually ancient) buildings and monuments.

Its antecedents may be traced back to the handful of enthusiasts who were fascinated by the Stonehenge's possible astronomical function. Allen (1993) points that it was customary for the ancient people to align their sacred monuments with precise solar, lunar and stellar positions. Campion (2004) points that cultural astronomy uses astronomical knowledge beliefs or theories, inspire and inform or influence social forms and ideologies, or any aspect of human behaviour.

However, this study does not use the term “cultural astronomy”, but instead the term “indigenous astronomy” or *bolepa-dinaledi* in Setswana to refer to astronomy of the indigenous communities such as Batswana due to the fact that this study is on the discipline of indigenous knowledge systems, not anthropology or African studies. Hence, the study argues that African indigenous astronomy focuses on the knowledge, skills and philosophies not the cultural practice of astronomy. The concept of indigenous astronomy include not only the buildings, monuments but a range of ideas, beliefs and understandings connected to the sky that may not be attached to a physical site (Bostwick & Bates, 2006; King, 1993 & Selin, 2000). African indigenous peoples developed myths, legends and stories (“Star Lore”) which was also a reflection of their way of life.

It is one of the argument of this study, that before the invention of sophisticated technologies such as the telescope, there were star lore in the ancient Egyptians, Ethiopians, the Akan, San, Zulu, Xhosa, Venda, Batswana and other Africans to name but a few with its own philosophical base. Bass (1990), Snedegar (2000) and Cuff (1997) relate how ancient African cultures had star lore / tradition about Pleiades, Sirius, Canopus and Sirius. Hence, African indigenous astronomy is a science in its own right.

Focusing on the African continent, scholars such as Holbrook (2009) argues that the origin stories in cosmologies is scattered throughout Africa. An example cited by Holbrook (2008) is that African woman studied the phases of the moon to keep track of their menses and fertility cycles, while modern astronomy is quite new and unpopular in most parts of the continent. The above mentioned example clearly shows that, cultural astronomy had a long and rich tradition in Africa and a far more extensive cultural impact (Holbrook, 2008). Campbell (2002) points that Africans have used the stars for centuries, be it for navigation, agriculture and storytelling.

Glegg (1986) the Batswana had greater understanding, holistic knowledge of, and relations with the night sky and their cosmology was been handed down by oral traditions. Ruggles (2005) posits that cosmology is a shared system of beliefs about the nature of the world as it is perceived by a group of people. Baki (2006) argues that most African societies have developed their unique indigenous astronomical knowledge. Glegg (1986) points that indigenous astronomical knowledge has over time been corrupted by ideas / thoughts brought from Europe.

Alcock (2010) adds that oral traditions describing animals in the sky, beliefs, linguistic terms of stars, moon, calendar and other events that make up the cosmic knowledge were well known among

the Batswana before the arrival of colonial masters and missionaries. Baki (2006) posits that, knowledge of the sky was once part of everyday life in most of African societies. However, there is a threat to indigenous astronomical knowledge due to the influences of modern, Western technology, industrialization and urbanization (Fabian, 2001).

In addition, Hamacher (2012) points that indigenous astronomy (*bolepa-dinaledi*) has been transmitted by indigenous knowledge experts (*baitseanape ba kitso ya setso*) or indigenous astronomers (*baitseanape ba bolepa-dinaledi*) in their local communities. Astronomical knowledge is generated by observing the changing positions of stars, the rising and setting position of the sun on the horizon and the monthly phases of the moon (Hamacher, 2012 & Sharp, 1993).

In this study, indigenous astronomy of Batswana (*bolepa-dinaledi jwa Batswana*) is a phenomenon that is explored from the point of view of the paradigm, epistemology, axiology, worldview, philosophy, cosmology and language of the Batswana. The above statement is supported by Nakata et al. (2012) that indigenous astronomical traditions are underpinned by a philosophy of knowledge that enables a different view of the place in which humans relate to the natural world. Baki (2006) indicates that most African societies have developed indigenous astronomical knowledge largely for understanding and predicting seasonal weather changes.

Many scholars including Glegg (1986) and Holbrook et al. (2008) argue that there are experts in local African societies who have a wealth of indigenous knowledge about the sky for purposes of addressing local challenges such as food insecurity, periodic natural phenomena such as droughts and floods. In this study the term African indigenous astronomy is used to describe the wealth of knowledge, worldview, language, cosmology and philosophy regarding the stars, moon, sun and other constellations among the Bakgatla -Baa- Kgafela in Mochudi (Botswana) and Moruleng (South Africa). Among the Batswana, the stars, the sun and the moon revolve around the Earth, which is flat (Clegg, 1986). Therefore, there is no surprise that the greater part of this indigenous astronomical knowledge was resident among the Indigenous Knowledge (IK) experts who could not read and write and this threatened its sustainability.

Wade (2015) argues that historical attempts to identify and characterize astronomical indigenous knowledge in sub-Saharan Africa are limited and assume the agreement that it is non-existent. Hence, it is one of the argument of this study that, thus today, there are few indigenous astronomy

experts (*baitseanape ba bolepa-dinaledi*), who are well knowledgeable in the area of indigenous astronomy among the Batswana and their knowledge is not well documented.

There is evidence that early missionaries, ethnographers and anthropologists wrote on Batswana knowledge of the sky which they loosely referred to as star lore or naked eye astronomy (Bass, 1990; Snedegar, 2000 & Cuff, 1997). Clegg (1986) indicates that those who have documented this knowledge have tended to focus only on the philosophical and religious aspect of it. There is very little and recent literature which provides the indigenous Setswana cosmology, epistemology, interpretation of the night sky, connection to ideas about local communities, their purpose, origin, worldview and astronomical heritage.

There are archaeological and ethnographic records of astronomical indigenous knowledge systems, however, research into these fields is still dominated by foreign interests with, in most instances, a disregard of the cultural and social perspectives (Wade, 2015). Alcock (2010) points that African celestial beliefs, with a few exceptions, have not received much academic attention in South Africa to date.

This study was an attempt to demonstrate that astronomy is not a new field among the Batswana and it also provides few examples from other African indigenous communities. It specifically focused on the Bakgatla -Baa- Kgafela in Mochudi (Botswana) and those that are found in Moruleng (South Africa). This study is aware of the fact that there are many Batswana people in South Africa, Botswana and Namibia. Over the years, the Bakgatla -Baa- Kgafela community attracted a lot of attention from academic and research institutions due to its complex, dynamic origin, rich history, heritage, culture, succession debates, internal conflicts, their role in *Difaqane* and Anglo Boer wars, its involvement in the struggle against apartheid (Makgala, 2009).

However, in this study the Bakgatla -Baa- Kgafela were selected because the researcher has developed a long relationship and engagement with this particular indigenous communities. The researcher has over the past years engaged with this particular community and discovered that they have a wealth of indigenous knowledge that needs to be preserved and promoted, especially indigenous astronomy. In addition, Bakgatla -Baa- Kgafela are an interesting community for any investigation especially in indigenous knowledge. Furthermore, Bakgatla -Baa- Kgafela share the same Batswana culture, heritage, traditions, history, cosmology and philosophical interests.

Schapera (1994) argues that the Bakgatla -Baa- Kgafela have and share a totem (*sereto*) which is called “*kgabo*” (monkey).

The chronology of *dikgosi* (kings) of Bakgatla -Baa- Kgafela was important for this study due to the fact that the prevailing literature demonstrated that some of the traditional leaders played a very significant role in rainmaking ceremonies (*go nesa pula*) working with rainmakers (*baroka*) who used their local indigenous astronomy in fulfilling such cultural and sacred activities. Some of *dikgosi* listed below include the paramount leader, Kgosi Lenchwe I (1875 - 1920); Kgosi Kgamanyane (1848 - 1874); Kgosi Molefi (1929 - 1936); Kgosi Lenchwe II (1963 - 2007); Kgosi Pilane (1996 to present), etc.



Figure 1. 1: Dikgosi tsa Bakgatla -Baa- Kgafela:

Picture by M Koitsiwe, Phuthadikobo museum, Mochudi, 14/02/2018

The totem or “*sereto*” of the Bakgatla -Baa- Kgafela is the blue monkey (*kgabo*), although they also had another totem, the ‘*kgabo ya mollo*’, or the ‘tip of the flame’, which they used when the Bakgatla were on the warpath. The above means that Bakgatla -Baa- Kgafela have a totem which is a monkey and have two symbolic meanings attached to it. The first one is the tip of the flame of the fire and the second one is the symbolic meaning of the monkey.

In addition, Kama (2018) points that totemic animal is determined by historical events. Many African communities were organised around totemic clans. The cultural and symbolic meaning of totems is found not only among the Bakgatla -Baa- Kgafela, but among many African indigenous communities. Kama (2018) argues that totemism reveals the idea according to which humans and animals are God’s creatures and share the same condition and divine essence through the Energy that impregnates them all.

Furthermore, Kama (2018) indicates that the spider is a totemic animal for the Bassa people of Cameroon, the well-known King Béhanzin of Danhomé (present Benin), was having the shark as totemic animal, the Abashambo clan has Intare (the lion) as their totem, the Ababandas have Impyisi (the hyena) as their totem, the elephant is a totem for the Batlhako ba Matutu in Tlhakong village, etc. The ancient Egyptian people comprised 42 totemic clans. The Banyarwanda people of Rwanda were from the beginning divided into 15 totemic clans and each clan was forbidding itself to eat its totemic animal (Kama, 2018).



**Figure 1. 2: “Sereto” Totem of Bakgatla -Baa- Kgafela:
Makgala (2009)**

In addition, the greater part of indigenous astronomy such as the skill and ritual of rainmaking (*go fetlha pula*) was known to be resident among few experts such as traditional leaders (Makgala, 2009). The Bakgatla -Baa- Kgafela were known to have rain makers (*baroka*) who performed their rituals in sacred rain enclosures (Schapera, 1930). These experts were resident in the five major *Dikgoro* or clans of Bakgatla -Baa- Kgafela which are *Kgosing*, *Morema*, *Tshukudu*, *Mabodisa* and *Manamakgote*. Bakgatla -Baa- Kgafela had rainmaking ceremonies and rain songs (Makgala, 2009).

Bakgatla -Baa- Kgafela *ke balemirui* (they are an agricultural society) who relied on cattle herding and cultivation of land as main economic activities and later on they ventured into mining. In general subsistence farming was carried as a survival strategy (Bakgatla -Baa- Kgafela Traditional Authority Long Master Plan, 2014). Makgala (2009) states that families had their own *masimo* (field) where they cultivated *mabele* (sorghum), *mmopo* (maize), *magapu* (melons), *mpye* (sweet reed), *dinawa* (beans), *letlhodi* (small green beans), *lebelebele* (millet).

The above testimony shows that throughout human history the Bakgatla -Baa- Kgafela have looked to the sky to gather food; determine time and seasonal changes; establish an accurate calendar; and keep track of the menses and fertility cycles of woman (Clegg, 1986). Brief discussion on the history of Bakgatla -Baa- Kgafela will be in the methodology chapter. Britto (2013) indicates that since the beginning of his existence, man has always been interested in unravelling the mysteries of the night sky and the behaviour of celestial bodies. Nakata et al (2014) indicate that indigenous astronomical knowledge integrates many aspects of indigenous knowledge including seasonal calendars, navigation, food economics, human reproduction, ceremony and social structure.

The indigenous astronomy has not received much attention as a discipline in its own right and scholars such as Alcock (2010) also confirm this lack of research, documentation and academic focus on Indigenous astronomy to date. There is a need for innovative research ways of capturing, managing and disseminating indigenous astronomical knowledge for the benefit of indigenous communities.

The argument is that there is very little and often conflicting research on the subject matter, and it is a fact that the first recognised published journal on the indigenous knowledge of the sky in Southern Africa was by Hammond Tooke, in the late 1888. There are, however, several other scholars such as Fraser (1995), Warner (1996), Snedegar (2006) and others (not mentioned here) who have done extensive research and publishing on indigenous astronomical knowledge in Southern Africa and their work has opened the opportunity for further research.

The study is based on the following arguments: Firstly, *bolepa-dinaledi*, its origin, history, structure and philosophical underpinnings remains undocumented and it is facing danger of extinction. He (Alcock, 2010) further argues that it is regrettable that pertinent oral information on this subject has been allowed to simply wither away. The above statement is supported by Alcock (2010) that

sources of data on indigenous astronomy relied mainly on the old anthropological works and journal papers.

The study further argues that most of the existing research methods, theories and views on *bolepa-dinaledi* were conducted by foreign researchers using Western research philosophies, methodologies, perspectives and languages. Smith (1999) confirms that there is a need to decolonise research that is conducted among indigenous communities. This is also supported by scholars such as Chilisa (2012). There is a tendency among researchers to conduct research in African indigenous communities wearing Eurocentric lenses which are inappropriate.

Furthermore, the study agrees with Alcock (2010) that that not much can be done about this loss, except to accelerate efforts to engage with the local experts on indigenous astronomy, record and document, preserve what oral information still exists among them for posterity. Digital technologies offer avenues for preserving indigenous astronomical knowledge and making it accessible to future generations of indigenous people (Nakata et al., 2012).

In addition, the inadequate documentation of the Bakgatla -Baa- Kgafela knowledge of the night sky including the philosophies which underpins it is in danger of facing extinction due to challenges posed by the hegemony of Western astronomy. The above is statement is supported by Nakata and Langton (2005) that major efforts have been made to preserve indigenous knowledge and astronomy in accessible forms through recording and documenting traditional knowledge, enabling the retrieval of knowledge in memory and current practice, and identifying and retrieving previously documented knowledge stored in institutions.

Thirdly, the dominance of Western, modern science, theories and study of night sky, has created scepticism among policy makers and other stakeholders on the efficacy of the theories of African knowledge of the night sky. There is an existing body of knowledge of stars, moon, sun and other constellations among the Bakgatla -Baa- Kgafela (Alcock, 2010).

Throughout history, indigenous astronomy played a significant role in sustainable livelihood of communities especially in rainmaking rites, developing seasonal calendars, navigation, food economics, human reproduction, art, ceremony and social structure (Nakata et al, 2014). The custodians of this knowledge are local indigenous knowledge experts in the community and past down from generation to generation through oral forms.

Chabalala (2012) states that the early Bantu communities were proficient stargazers that demonstrated this knowledge with stone circles depicting major constellations. These stone clocks served to mark four cardinal directions, four seasons, solstices and equinoxes. Britto (2013) posits that naked-eye astronomical observations and calculations by ancient civilisations were used to develop their religious practices and integrate them into everyday life. In many regions of Africa, Botswana and South Africa in particular, indigenous astronomy still plays a pivotal role in daily practices (Snedegar, 2006 & Alcock, 2010).

The study argues that the Bakgatla -Baa- Kgafela are rich with local knowledge, theories of the night sky, used for understanding and predicting seasonal change for community socio-economic activities like hunting, gathering, farming, fishing, healing, human reproduction and rainmaking. The greater part of this indigenous knowledge was resident among the IK experts and this threatened its sustainability.

Astronomical knowledge was transmitted to successive generations through oral and material traditions, including story, song, dance, artefacts, rock art, stone arrangements, ceremony, and everyday social practices (Johnson, 1998, 2004). Wade (2015) states that within the relatively unknown cosmology of indigenous knowledge systems of southern Africa, archaeological information, oral traditions, rituals and rock-art have provided a deeper perspective of specific astronomical data. The body of this thesis is encapsulated in eight chapters which include the literature review, philosophical frameworks, methodology, empirical findings, and discussion of findings conclusion and recommendations of the study. The following section discusses the problem statement.

1.2 Problem statement

Part of the problem statement guiding this study is that African indigenous astronomy of Batswana is a thin area of research, facing extinction due to lack of interest and desertion by researchers. Snedegar (2000) indicates that it is curious then, that Africa south of the Sahara is the cultural area least explored with respect to its astronomical traditions. The study also coincide with Warner (1996) that it is misleading to say that little research has been conducted on African indigenous astronomy, such research is scattered, peripheral, of small concern to Africanists in general while being relatively neglected by historians of astronomy.

Wade (2016) argues that in the prevailing literature very little exists regarding research into astronomical aspects in sub-Saharan Africa and specifically amongst the Bantu-speaking oral traditions, indigenous knowledge, pre-Bantu and other non-San sources of information and ethnography. Historical attempts to identify and characterize astronomical indigenous knowledge in sub-Saharan Africa are limited and infer the consensus that it is non-existent (Wade, 2016). This study argues that colonial, pre-colonial research in this domain is questionable and fail to provide a contextual and holistic perspective.

The study argues that indigenous astronomy of Bakgatla -Baa- Kgafela in Botswana and South Africa has not received much attention as a subject of research. There are a number of scholars such as Alcock (2010) who also confirm this lack of research, documentation and academic focus on indigenous astronomy to date. Hence, in order to address this problem there is a need for in-depth interviews with the elders who are the custodians and sources of this knowledge to ensure proper documentation and preservation of this knowledge. Through an in-depth study of the astronomical knowledge from Africa by means of analysing the oral traditions, archaeology, ethnography, rock-art and research into structures, new data can be revealed that these aspects do exist but need to be understood in terms of their relationship contexts as opposed to purely natural descriptions (Wade, 2009).

Besides the UNESCO program to identify African astronomy (Wade, 2009), since the 1990's the primary concern has been to identify astronomical aspects in the archaeological record in sub-Saharan Africa due to the hiatus that exists regarding indigenous astronomical knowledge (Snedegar, 1999 & Holbrook, 1998). It is less well known to modern scholarship that pre-colonial Africans also viewed the sky as a natural resource just as available for exploitation as were the Earth's animal, vegetable and mineral resources.

However, there is few or limited research and institutions of higher learning conducting in-depth research in this area. In addition, there are actually very few indigenous experts, who are active and reliable sources of this knowledge up to date and this makes it to be unrecognised and devalued.

Most of this knowledge lies with the elders, who have no formal education, have acquired this knowledge over the years and transmitted it from one generation through oral traditions. Systematic approach towards the documentation, preservation and prototion of African indigenous astronomy is significant in order to ensure that it does not face extinction.

The argument is that there is evidence of wealth of astronomical heritage and tradition among the Batswana, however, it is endangered due to lack of preservation and documentation strategies. This is supported by Snedegar (2007) that scholarship on astronomical traditions of Africans peoples is another area which is largely unexplored. Furthermore, the preliminary research has provided very early African astronomical structures found to date such as at Namoratunga, Nabta and Great Zimbabwe which have cosmic or celestial references which could prove of immense value to astronomy, geoinformatics and possibly environmental studies as they represent the only known hard evidence relating to non-literate temporal sources (Wade 2009; Wade et al., 2014 & Malville et al., 1998).

In addition, there is very sporadic studies that have documented the meaning and value which the indigenous communities attach to African indigenous astronomy, especially from an Afrocentric philosophical and indigenous ontological paradigm. This study argues that valuable indigenous astronomy of Batswana is in danger of extinction, has not been properly documented and harnessed to fit into the current scientific framework. As a result there is a general lack of information and understanding of this knowledge and also not sufficient efforts to mainstream into the benefits of the indigenous community and wider modern scientific astronomy.

Mbiti (1989) points that one of the dominating attitudes in this early period was the assumption that African knowledge systems, beliefs, knowledge about the sky, cultural characteristics and even foods were borrowed from the outside world. The above statement is supported by Bodunrin (1985); Hountondji (1983) and Oluoch Imbo (1998), who argue that this led to all kinds of theories and explanations to prove that Africans did not have knowledge, thought patterns and philosophy prior to arrival of missionaries.

Placide Tempels, the European missionary, elected to help and in his controversial book, *Bantu Philosophy*, sought to create Africa's own philosophy as proof that Africa has its own peculiar identity and thought system (Wright, 1984 & Kwasi, 1989, 1995). Therefore, some of the philosophies that underpins this study is Afrocentricity, African indigenous paradigm and ontology which proves that indigenous astronomy should not be dominated by ideas, thought patterns underpinned by Western cosmology, ontology, epistemology and modern astronomy. Johnson (1998) much of the social organization and daily practices of indigenous communities are based on their astronomical knowledge. The above is supported by Hamacher and Norris (2011) that

indigenous communities were using the sun, moon, and stars for predictive purposes to guide navigation, time keeping, seasonal calendars, hunting, fishing, and gathering.

It is against the backdrop that the study argues that the investigation on the wealth of knowledge, thinking, epistemology, ontology and philosophies on African indigenous astronomy of Batswana especially among Bakgatla -Baa- Kgafela in Mochudi (Botswana) and Moruleng (South Africa) is fundamental not just for research and academic significance but also as one of the strategy of redressing the injustices of the past, rekindle dignity of indigenous communities and towards African renaissance.

As indicated earlier, part of the problem statement guiding this study is that, there is lack of adequate enquiry, documentation, accessible literature of African indigenous astronomy of Batswana in Botswana and South Africa. This challenge is not only unique to Bakgatla -Baa- Kgafela in Botswana and South Africa, but also among various indigenous communities around the world. Hence, Gary (2013) argues that today, indigenous astronomical knowledge system among the Gwich'in of arctic Alaska and Canada is even more endangered than language itself. Modern technology has replaced every aspect in which astronomy was utilized, leading to the disuse and loss of traditional astronomy knowledge (Gary, 2013).

Holbrook (1998) argues that indigenous European, Arabic and American astronomies have been the focus of many scholars over the last century, but there has been a lack of scholarship on indigenous astronomy. For Africa, in general, almost no astronomical indigenous knowledge systems exists in the literature other than the recently uncovered exploration of theories and discoveries explained by mediaeval African Muslim scholars in the Arabic manuscripts of Timbuktu in West Africa. The above view is supported by Medupe (2012) who argues that the perception that African astronomy only became scientific when settlers arrived in the Cape and erected an observatory in 1820 is an incomplete story.

O'Donoghue and Neluvhalani (2002) point out that the oversight and marginalisation of indigenous wisdom, ways of knowing and doing things is not just a thing of the past, but is also happening today. In addition, this study challenges such limited perceptions about indigenous astronomy. In order to address the above challenge, greater awareness, especially among the young generation, including advocacy and mobilisation of various stakeholders should be encouraged for the

preservation, development of indigenous astronomy and its value to enrich reining knowledge paradigms.

Furthermore, most of the research conducted on indigenous astronomy has been carried out by foreign researchers using Western research methodologies, paradigms, philosophical frameworks, cultural perspectives and languages. These researchers had little understanding about the cosmology, ontology, language, culture, oral traditions, paradigm, and ways of knowing and socio-cultural protocols of conducting research among African indigenous communities.

The above is supported by Snedegar (2000) that lack of focus on African astronomy has been compounded by other difficulties, including the methodological inadequacies. Most of the data was compiled by Europeans during the time of colonialism and subjugation of indigenous communities. Some collected data on astronomical traditions was collected by missionaries with the agenda of spreading the gospel of Jesus and white hegemony.

Chilisa (2012) argues that it is essential for research methodologies to be decolonised and the use of local language and methods, such as narratives, to be prioritised in indigenous research. The limitations of earlier efforts to represent African knowledge systems were clearly articulated by Mudimbe (1988) who pointed out that in considering African ways of knowing, Western interpreters as well as African analysts have been using categories and conceptual systems which depend on Western epistemological order.

Indigenous astronomy will only gain currency if it is systematically documented using local languages, philosophical frameworks and observation of socio - cultural protocols of doing research in local communities. This knowledge needs to be well packaged and its contribution to understanding of modern astronomy be critically analysed. There is a fundamental need to investigate the challenges and prospects of the promotion and development of *bolepa-dinaledi*.

This will assist to determine the commonalities and differences between the philosophical paradigms that underpins indigenous and western astronomy. Nakata et al. (2014) a key problem has been how to re-present this knowledge in ways that denote its local context, its historical journey through archives and the disciplines, and its onward use and engagements according to indigenous protocols of knowledge management.

Examples of African indigenous astronomy could be found in the prevailing literature, for instance, there is a distinct possibility that the ruin called the Great Enclosure, radiocarbon dated to have been built between the 11th and 15th centuries, as well as the Hilltop Ruins (Huffman & Vogel, 1991) may have been associated with alignments of planets, specific stars, constellations, solstices, and or lunar sightings within the Zimbabwe complex.

Various cultural groups, possibly descendant from the Zimbabwe Cultural Complex (Huffman, 2011) such as the people now referred to as the North Basotho, Venda, Shona, Lemba, Lovedu, Karanga and Tsonga-Shangaan - demonstrate a legacy of knowledge of certain stars as agricultural markers and calendars (Aveni, 1993; Holbrook, 1998 & Snedegar, 1995).

In a nutshell, this study agrees with numerous scholars such as Snedegar (1997) that there is evidence of rich indigenous astronomical knowledge of the Southern African peoples. There is rich oral tradition such as poems, songs, riddles, heritage sites, artifacts associated with indigenous astronomy. The challenge is that this knowledge is facing extinction, due to the fact that it lies with the elders who are the organic intellectuals, cannot read, and write.

African indigenous astronomy has survived many years of colonial and imperial hegemony. To date this knowledge is poorly documented, endangered and often negated by researchers. This study agrees with Matomela (2005) who has made a pioneering effort to record the oral isiXhosa folk astronomy and he concluded that much more work needs to be done in this time consuming research. It is vital to conduct future research on African architectural structures and its astronomical significance in order to reveal the cosmology of African built environment as well as the value of astronomical heritage and its future in the new era of astronomy. The following section provides the aim of the study.

1.3 Aim of the study

The overall aim was to document, promote and preserve *bolepa-dinaledi* of Bakgatla -Baa- Kgafela in Mochudi and Moruleng. To achieve this aim the study examined the following specific objectives:

1.4 Specific objectives of the study

- To document and analyse the nature and types of African indigenous astronomy in the selected study communities.

- To describe the value, meaning and importance which the selected communities attach to African indigenous astronomy.
- To examine the scientific and artistic significance connected to African indigenous astronomy.
- To analyse the challenges and prospects of African indigenous astronomy among Batswana.

1.5 Research questions

- What is the nature and types of African indigenous astronomy found in the selected study communities?
- What is value, meaning and importance which the selected communities attach to African indigenous astronomy?
- Is there any scientific and artistic significance connected to African indigenous astronomy found in the selected study communities?
- What are the challenges and prospects of African indigenous astronomy among Batswana?

1.6 Rationale of the study

Studies of indigenous South African astronomy include broad overviews and compiling information found in historical records and early ethnographies including (Alcock, 2014; Bleek & Lloyd, 2001, 2007 & Snedegar, 1997). From the preliminary literature carried in this field of study, it has been realized that it is misleading to argue that there is limited literature on, and documentation of African indigenous astronomy of Batswana. However, there is recognised evidence that there is sporadic, awkward and disorganised research in this area. Africa has not been overlooked in the cultural astronomy literature (e.g. Aveni, 1993), but active research remains focused on Europe and the Americas.

From humble beginnings, as a youth I grew up in the marginalised, *Tlhakong* also known as *Motsitle* or *Mabeskraal* village located in the Moses Kotane West Municipality, Bokone Bophirima Province (South Africa). The totem of Batlhako is *tlou* (elephant). There is a proverb in Setswana that says *tlou ga e sitwe ke moralo* which means that we all have to take responsibility and transcend all forms of destitute. From early childhood, I developed great enthusiasm to explore and have a greater understanding about knowledge of the sun, moon, stars, planets and other constellations from the perspective of Batswana.

One of the major rationale for this study was that, during my childhood, I discovered that in my community, most IK experts (*baitseanape ba kitso ya tlhago*) did not have formal qualification but had a wealth of knowledge of the sky and stories about cosmology. Koitsiwe (2013) argues that during the apartheid era, this knowledge had not been adequately documented, especially from the perspective of the community members.

Bolepa-dinaledi was often transmitted orally using local language to posterity. It is recognised that the use of oral traditions to transmit indigenous astronomy was not only a common practice among the Batswana, this was also practiced in other indigenous communities globally. For instance, community elders, including my late grandmother Mmamodiagane Tladinyane, used to call the youths in the evening around ‘*leiso*’ (fire place) and narrate stories, proverbs, riddles, sing songs using local language about the sky. This process and approach was called *maitiso* which normally is the evening gathering around *leiso* where the elders who are knowledgeable in indigenous knowledge and celestial phenomenon engage with the youths.



Figure 1.3: “Leiso” Fire Place:

Picture by M Koitsiwe, Mphebotho museum, Moruleng, 22/03/2017

Mmamodiagane Tladinyane, an elderly woman from my village, Tlhakong, told us how they used to understand, predict seasonal weather changes and track time using their local knowledge of astronomy. In my own African indigenous worldview, Mmamodiagane was an embodiment of excellence due to the fact that she had knowledge of astronomy even though she did not study hard core mathematics and was not a student of quantum physics. She was one of the elders in the community who were knowledgeable on indigenous astronomy even though they did not have sophisticated instruments such as telescopes.

They had acquired informally, prior knowledge about indigenous astronomy which was significant in their daily lives. Stories of the sun, moon, planets, and constellations occupy a significant place in the oral traditions of Aboriginal Australians. This was first described by Stanbridge (1857) and noted by many other authors (e.g. Mountford, 1976; Norris & Norris 2009). The focus of most of these works is on the correspondence between constellations, and events or characters in traditional Aboriginal oral traditions.

One of the foremost rationale for this study was scholarly or the desire to know more African indigenous astronomy of Batswana. Research in *bolepa-dinaledi* is a scholarly activity and have recently gained currency among scholars in South Africa, Botswana and around the world for academic or research purposes. Holbrook (2016), through the National Research Foundation (NRF), the South African government has financially supported the disciplines of Indigenous Knowledge Systems and Astronomy. Hence, other countries such as Botswana can learn from South African in terms of the challenges and benefits of promoting this knowledge.

According to National Research Foundation (2015), IKS and Astronomy” is listed as one of the focus areas covered by their Indigenous Knowledge Systems ring fenced funding instrument. Therefore, the study was conducted not only in order to enhance my intellectual capacity, to understand, document, encourage, and advance *bolepa-dinaledi* of Bakgatla -Baa- Kgafela in South Africa and Botswana. This study was also a strategy to provide evidence that *bolepa-dinaledi* is a science that was well known and practiced by the Batswana since the time of *Lowe*.

In addition, my enthusiasm was based on the fact that *bolepa-dinaledi* is locally available, cost effective, based on culture, thinking, traditions, language, cosmology, philosophy, beliefs, and local knowledge systems and used in daily activities of the Bakgatla -Baa- Kgafela. Much of the social organization and daily practices of indigenous communities are based on their astronomical knowledge (Johnson, 1998). This includes using the sun, moon, and stars for predictive purposes to guide navigation, time keeping, seasonal calendars, hunting, fishing, and gathering (Hamacher & Norris, 2011).

Breuts (1955) records that the names and significance of the stars have largely been forgotten since the decline in the importance of traditional initiation, and Willoughby, in his much earlier study (1928) did not give details of specific Setswana cosmological bodies. Further, the rationale to undertake this study is reinforced by Medupe and Holbrooke`s (2008) argument that African

indigenous astronomy is not fully utilised. Therefore, this research intends to also revisit the current literature on indigenous astronomy using our indigenous approaches and how this can be used in the community.

The above reasons provided basis for rationale of the study and considerable emphasis is placed on investigating *bolepa-dinaledi* among the Bakgatla -Baa- Kgafela in Mochudi (Botswana) and Moruleng (South Africa). This will be complimented by analysing how this knowledge can be used in community and to further the understanding and contribution to the new era of astronomy. It is a fact and evident that most of the selected communities in the study do not have access to modern astronomy and use of sophisticated equipment such as telescopes. Therefore, to advance the study of *bolepa-dinaledi*, more funding, research students, collaborations and recognition of experts of this knowledge is fundamental.

The following section is a discussion on the significance or benefits of the study in terms of the community, policy and research. This was important for the study, due to the fact that there is evidence that previous research has often exploited indigenous communities as subjects of research. Indigenous experts are not acknowledged as credible, reliable sources of information including the fact that they are often left behind due to lack of model for access equal benefit sharing whether monetary on non-monetary when there is prospects of commercialization of their knowledge. Hence, the researcher had an intellectual desire not only to explore and document *bolepa-dinaledi* and be awarded a PhD certificate, but at the same time was very much concerned with regard to how the IK experts and the Bakgatla -Baa- Kgafela will benefit from this study.

1.7 Significance of the study

This study falls in the broader realm of indigenous astronomy which has deep historical roots but remains a new endeavor in South Africa (Holbrook, 2016). Indigenous African astronomical beliefs and uses of astronomical knowledge need to be explored and recognized (Baki, 2007). This sets the tone for a significant study in *bolepa-dinaledi* that seeks to provide additional information on how this knowledge can be accessed, packaged and used for further understanding of modern astronomy. Nakata et al. (2014) argue that by engaging the many different aspects of indigenous astronomical knowledge, we are provided with insights into the complexity and diversity of indigenous knowledge systems.

This study will contribute new knowledge to the current discourse on the role of indigenous astronomy and its underlying philosophies in policy formulation. This work or idea is original and it will contribute to new knowledge production with regard to the promotion and development of indigenous astronomy and the role played by “*baitseanape ba kitso ya tlhago*” (IK experts) in the community. The data generated may as well enrich research on indigenous astronomy and strengthen the appreciation of the experts of this knowledge. Eventually it will be much easier for local communities in South Africa and Botswana to come up with strategies to promote and develop indigenous astronomy.

The support of the South African government shows the importance and the role of indigenous astronomy in the community and is an opportunity that can place South Africa on the map to perform world-class astronomy research. Upon completion of the study, information collected will be shared with the selected local communities, North - West University and University of Botswana, National Research Foundation, Department of Education and other relevant partners. For instance, African indigenous astronomy of Batswana can be exhibited at Phuthadikobo Museum (Mochudi, Botswana) and Mphebotho Museum (Moruleng, South Africa) for educating the community and awareness raising.

Once the value of indigenous astronomical knowledge is recognised, and is seen as an intrinsic part of African culture, it might be possible to use this to secure funding for the development of astronomy from the various Africa governments (Baki, 2007). In the final analysis, the study will hopefully stimulate further research among scholars from various disciplines and academic backgrounds to discuss how *bolepa-dinaledi* is juxtaposed with modern astronomy. The following section provides the concluding remarks of chapter one.

1.8 Conclusion

This chapter demonstrated the wealth and intrinsic value of African indigenous astronomy among Batswana. Similar to other parts of Africa, this knowledge is held by the IK experts who are mostly elders and this knowledge is seldom documented. It stands in danger of being lost as the sources and custodians, the elders are passing with time. This research overview serves as an introductory chapter to this study. Background information has been given concerning the indigenous astronomy and its dilemma.

The statement of the problem, aim and objective including the rationale and significance of the study highlighted the fact that indigenous astronomy is part of the way of life of indigenous communities. This necessitates creating awareness not only among the community members, but also among government and other relevant stakeholders so that appropriate measures, strategies and policies can be developed for the successful promotion of African cultural astronomy. The following section provides the division of chapters followed by chapter two, which discusses in detail previous work or research conducted in this domain.

1.9 Division of chapters

This study is divided into eight chapters.

Chapter One: Introduction, problem statement and objectives of the study. This chapter also provides the rationale as to why this study was conducted from the beginning and significance of the study in terms of the benefits to the study communities, research and education and policy.

Chapter Two: Literature review. The chapter provides the definition of key terms in the study, it also provides the conceptual framework of the phenomena *bolepa-dinaledi*. It deals with the debates related to the quest for demystifying and decolonizing research methodologies and methods, it also discusses the role of indigenous languages in decolonizing research. Some of the sub sections in this chapter includes the names, types and meaning of stars according to the Batswana. This chapter is not just about exercise of reviewing past, relevant literature and reinventing the work of other researchers, it identifies and single out possible gaps and suggest practical ways of how this thesis will address some of them.

Chapter Three: Philosophical frameworks of the study is discussed in detail in chapter three. The chapter shows that the study of philosophy is not a new phenomenon in Africa. The relevant philosophies discussed in this chapter includes Afrocentric, appreciative and phenomegraphy.

Chapter Four: This chapter provides the research methodology chosen for this study. In this chapter, the design, study sample, methods of data collection, brief historical background of the study communities, ethical consideration and data analysis is discussed.

Chapter Five: The chapter discusses the nature and types of African indigenous astronomy found in the study communities. It also discusses the value, meaning and the importance which the

selected communities attach to indigenous astronomy. This chapter covers objective one and two of this thesis.

Chapter Six: In this chapter the artistic and scientific significance connected to indigenous astronomy found in the selected study communities is discussed and analysed. This chapter covers third objective of this thesis.

Chapter Seven: The chapter provides the challenges and prospects of indigenous astronomy of the Batswana which is the fourth and last objective of this thesis.

Chapter Eight: This is the final chapter of the thesis, it provides the conclusion and recommendations that emanates from the study.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Bless et al. (2013) agree that doing literature review is the basic homework and it is fundamental in conducting research. Kim (2015) points that doing a careful and thorough literature review is essential, it is an indication that the researcher has done his / her homework and it is a way of telling the reader that the basics of research has not been neglected. The above statement is supported by Chilisa (2012) that literature review is not just done for its own sake, but to familiarize the researcher with the developments in the area of research, to identify the gaps in knowledge, discover connections and contradictions. Kim (2015) adds that it is also done to sharpen the research focus, avoid incidental plagiarism and to create a rapport with your audience.

In this chapter a survey of credible published sources, scholarly books and research articles that appeared relevant to the study are considered and vigilantly reviewed. Conceptualization and operationalization of terms is also an important aspect of literature review. The significance of literature review and gaps identified from previous research are highlighted in areas such as indigenous astronomy. The following section provides the importance of the conceptual framework in African indigenous astronomy research.

2.2 A conceptual framework of the study

Conceptual frameworks are also known as theoretical or epistemological or research frameworks (Kovach, 2009). In this study conceptual framework is defined as a network, or “a plane,” of interlinked concepts that together provide a comprehensive understanding of a phenomenon or phenomena (Jabareen, 2009). Researchers have a task of applying conceptual frameworks that demonstrate the theoretical and practical underpinnings of their research, and if successful, these frameworks illustrates “the thinking” behind “the doing” (Kovach, 2009). In carrying out research on African indigenous astronomy, a decolonizing perspective, with regard to the use, meaning of conceptual frameworks is fundamental.

In this study a conceptual framework is not merely a collection of concepts but, rather, a construct in which each concept plays an integral role. According to Miles and Huberman (1994), a conceptual framework “lays out the key factors, constructs, or variables, and presumes relationships among them”. To discourage loose usage of the term conceptual framework, I propose basing conceptual frameworks not on variable or factors but on concepts alone.

A comprehensive review of literature on African indigenous astronomy reveals lack of comprehensive conceptual framework on the phenomena that is centred in the local knowledge, language, worldview and cosmology. Estrada (2005) an indigenous scholar of the Mayan ancestry uses the *Ceiba*, or Tree of Life, as a conceptual research framework. This is a representation that both honours Mayan cosmology and gives visual form to the thought behind the research design. When initially considering a conceptual framework for this study, I considered the holistic approach that takes into consideration the Batswana cosmology, worldview based on oral traditions and their understanding of the sky (*bolepa-dinaledi*).

The conceptual framework in this study provides a holistic understanding of *bolepa-dinaledi*. It is centred on the relation between culture and knowledge, worldview, philosophy, ontology, cosmology, language and the indigenous astronomy of Bakgatla -Baa- Kgafela in Mochudi (Botswana) and Moruleng (South Africa). The ontological assumptions relate to knowledge of the “way things are,” “the nature of reality,” “real” existence, and “real” action (Guba & Lincoln, 1994).

The epistemological assumptions relate to “how things really are” and “how things really work” in an assumed reality. The methodological assumptions relate to the process of building the conceptual framework and assessing what it can tell us about the “real” world. Buendia (2003) contends that conceptual systems traditionally utilized in Western higher education are culturally and racially loaded mechanisms that privileged European epistemological thought. Buenda (2003) argues that the result is the imposition of a logic that has created particular types of coherencies in categorizing and explaining the real.

Kovach (2009) states that the rationale for explicit representation of one’s conceptual framework is that it provides insight into a researcher’s beliefs about knowledge production, in general and how those beliefs will impact the study or research project. The content and form of conceptual framework itself assists in illustrating the researchers’ standpoint, thus giving a reader insight into the interpretative lens that influences the research (Kovach, 2009). The conceptual framework in research aim to help us understand phenomena rather than to predict them.

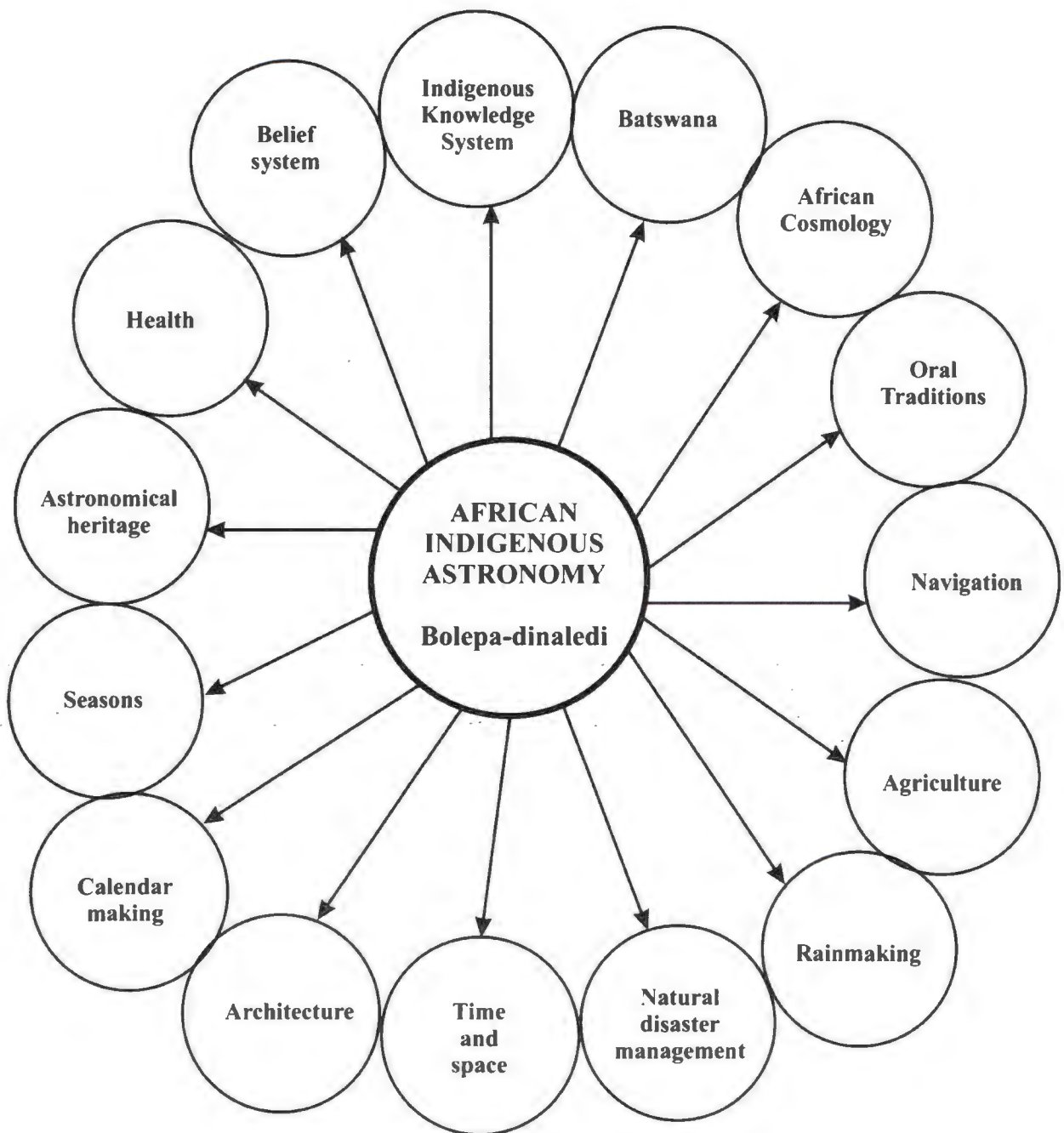


Figure 2. 1: Conceptual framework: The phenomena of *bolepa-dinaledi*

2.3 Definitions, examples and debates on indigenous knowledge systems

2.3.1 Defining the indigenous peoples

Historically, there has been not a single way to define the term “indigenous”. Indigenous societies are found in every inhabited climate zone and continent of the world (Douglas, 1999; Deepak & Shrivastava, 2008). The adjective “indigenous” was historically used to describe animals and plant origins. During the late twentieth century, the term indigenous people began to be used to describe a legal category in indigenous law created in international and national legislations; it refers to culturally distinct groups affected by colonization (Hitchcock & Vinding, 2004).

Smith (1999), the term “indigenous” is problematic in that it appears to collectivize many distinct populations whose experiences under imperialism have been vastly different. It is often used to refer to “First Peoples”, “Native Peoples”, “First Nations”, “People of the Land”, “Aboriginals” “Fourth World Peoples”. The study argues that these terms have their own unique worldviews, however, they will not be used in this study. Anaya (2004) says indigenous refers broadly to the living descendants of reinvasion inhabitants of lands now dominated by others.

In international context, the term ‘indigenous’ is understood (mostly by Europeans) as being similar or synonym to ‘traditional’, ‘aboriginal’, ‘vernacular’, ‘African’, ‘Black’, and ‘native American’ (Loubser, 2005). This study agrees with Smith (1999) that some of these terms defines the colonial relationship (coloniser and colonized), hence they are problematic. For many of the world’s indigenous peoples there are prior terms for which they have named themselves.

The use of the term peoples in association with the indigenous is derived from the 19th century anthropological and ethnographic disciplines that Merriam-Webster Dictionary defines as “a body of persons that are united by a common culture, tradition, or sense of kinship, which typically have common language, institutions, beliefs, and often constitute a politically organized group” (Von Lewinski, 2004).

Indigenous peoples is a relatively recent term which emerged in the 1970’s out of the struggles primarily of the American Indian Movement (AIM) and the Canadian Indian Brotherhood (CIB). Wilmer (1993) it is a term that internalizes the experiences, the issues and struggles of some of the world’s colonized peoples. It is also used as a word of recognizing that there are real differences between indigenous peoples (Burger, 1990).

The term has enabled the collective voices of colonised people to be expressed strategically in the international arena (Smith, 1999). It has also been the umbrella enabling communities and peoples, to come together, transcending their own colonised context, experiences, in order to learn, shape, plan, organize and struggle collectively for self-determination on a global and local stages (Smith, 1999). Thus the word indigenous belongs to a network of peoples.

They share experiences as peoples who have been subjected to colonization of their lands and culture, denial of their sovereignty, by a colonizing society that has come to dominate and determine the quality and shape of their lives, even after it has formally pulled out (Smith, 1999). As Wilmer (1993) has put it, indigenous peoples represent the unfinished business of decolonization.

James Anaya, former Special Rapporteur on the Rights of Indigenous Peoples, has defined indigenous peoples as "living descendants of pre-invasion inhabitants of lands now dominated by others. They are culturally distinct groups that find themselves engulfed by other settler societies born of forces of empire and conquest" (Anaya, 2004). Any given people, cultural group or community may be described as indigenous in reference to some particular region or location that they see as their traditional native land claim (Blaser et al., 2004). The term 'indigenous' people refers to a specific group of people occupying a certain geographic area for many generations.

Douglas (1999); Deepak and Anshu (2008) argue that indigenous peoples may be settled in a given region (sedentary) or exhibit a nomadic lifestyle across a large territory, but they are generally historically associated with a specific territory on which they depend. Indigenous peoples are found in Africa, Asia, Europa, etc. and their rights are often violated around the world.

Indigenous peoples, also known as first peoples, aboriginal peoples or native peoples, are cultural groups who are the original inhabitants of a given region, in contrast to groups that have settled, occupied or colonized the area more recently. Douglas (1999) argues that groups are usually described as indigenous when they maintain traditions or other aspects of an early culture that is associated with a given region. They possess, practice and protect a total sum of knowledge and skills constitutive of their meaning, belief systems, livelihood constructions and expression that distinguish them from other groups (Dondolo, 2005).

Bartholomew and Levi (2003) the United Nations has issued a Declaration on the Rights of Indigenous Peoples (UNDRIP) to guide member-state national policies to the collective rights of indigenous people, such as culture, identity, language and access to employment, health, education and natural resources. Many indigenous populations have since undergone a dramatic decline and even extinction, and remain threatened in many parts of the world.

Some have also been assimilated by other populations or have undergone many other changes (Von Lewinski, 2004). In many other respects, the transformation of culture of indigenous groups is ongoing, and includes permanent loss of knowledge. Culture, heritage, language, loss of lands, encroachment on traditional territories, and disruption in traditional lifeways due to contamination and pollution of waters and lands (Hitchcock & Vinding, 2004).

This study argues that the term of indigenous provides some challenges. Firstly, it denotes indigenous peoples as uncivilized and this way of thinking emanated from early as European colonial expansion. The denigration and marginalization of indigenous peoples and their ways of thinking, knowledge systems, cosmology and worldview still continue in certain societies driven by neoliberal ideas such as globalization and capitalism.

Secondly, the term indigenous has been co-opted politically by the descendants of settlers who lay claim to an indigenous identity through their occupation and settlement of land over several generations or simply being born in that place, though they tend not to show up at indigenous peoples meeting nor form alliance that support the self determination of the peoples whose forebears once occupied the land that they have tamed and upon which they have settled (Smith, 1999).

Nor do they struggle as a society for the survival of the indigenous languages, cultures and knowledges. Their linguistic and cultural homeland is somewhere else, their cultural loyalty is to some places, and their power, their privilege, and their history are all vested in the legacy as colonizers (Smith, 1999). The following sub-section provides a brief definition of indigenous knowledge.

2.3.2 Conceptualizing the term indigenous knowledge.

Nakata (2002) points that the whole area of indigenous knowledge is a contentious one. From what constitute: “indigenous” to whose interest are being served by the documentation of such knowledge there lies a string of contradictions, of sectoral interests, of local and global politics, of ignorance, and of hope for the future. Horsthemke (2004), indigenous knowledge is a relatively recent buzz phrase that amongst other things constitute part of the challenge to Western education.

It is only in recent years that it gained conceptual and discursive currency and there have been countless published papers, articles, reports on this concept with the emphasise on its role to sustainable development (Horsthemke, 2004). Indigenous Knowledge (IK) has become the accepted term to include the beliefs and understandings of non-western people acquired through long-term association with a place (Dei et al., 2000). It refers to the unique knowledge that has been developed in the local setting by a particular culture as they solved their survival challenges and sought for meaning in life.

Horsthemke (2004) it generally taken to cover local, traditional, non-western beliefs, practices and world views and often referred to as alternative, non-formal or informal way or forms of knowledge. Steiner (2008), indigenous knowledge is a body of knowledge built up by a group of people living in close contact with nature. Langhill (1999) had a similar definition as he defined indigenous knowledge as the knowledge possessed by the original inhabitants of an area.

It is a term that is used to describe the knowledge systems developed by a community as opposed to the scientific knowledge that is generally referred to as ‘modern’ knowledge (Ajibade, 2003). Indigenous Knowledge is generally local knowledge or community knowledge that is different from Western Knowledge Systems (WKS). IK are knowledges of experienced and relationship that speak of lived, material and cosmological concerns. IK is holistic, not compartmentalized and is part of peoples culture, traditions and language.

The above statement is supported by Peter (2000) that it is knowledge based on the social, physical and spiritual understandings which have informed the people’s survival and contributed to their sense of being in the world. African Indigenous Knowledge Systems (AIKS) emphasize the importance of a harmonious “interrelationship and interdependence of all phenomena” (Hoppers, 2005) be it biological, physical, social, cultural or spiritual.

The World Bank (2004) correctly states that IK is the local knowledge that is unique to a culture or society. Dei (2004) states that Indigenous Knowledge (IK) refers to the unique, traditional, local knowledge existing within and developed around the specific conditions of a community, indigenous to a particular geographic area, covering all aspects of life including management of natural environment upon which their livelihoods and survival depends.

Kamara (2008) posits that it is the knowledge which developed over centuries of observation on how to adapt to local conditions. Mapara (2009) states that indigenous peoples in Zimbabwe developed traditional ways of weather forecasting in order to plan their activities such as harvesting of crops. The World Bank (2004) correctly states that Indigenous Knowledge (IK) encompasses the skills, innovations, experiences and insights of people in their respective local communities, accumulated over and applied to maintain or improve their livelihoods.

In South Africa, official definitions of Indigenous Knowledge appear in the 2014 IKS Bill (Pandor, 2015): “Indigenous Knowledge” means tangible and intangible aspects of the whole body of knowledge that has been held, used, refined and transmitted by the indigenous communities collectively or as individual custodians of such knowledge as part of expressing their cultural identity.

The study agree with authors such as Gloria and Corsiglia (2001); Dei et al. (2000); Le Grange (2007); Sillitoe (2009) and Johnston (2005) that Indigenous Knowledge is often used interchangeably with terms like, “community knowledge”, “local knowledge”, ‘folk knowledge’, ‘people’s knowledge’, ‘traditional wisdom’ or ‘traditional science’ Traditional Ecological Knowledge (TEK), Indigenous People’s Knowledge (IPK), and even ‘folk knowledge’. In short IKS are those forms of knowledge that the people of the formerly colonised countries survived on before the advent of colonialism (Mapara, 2009).

Indigenous knowledge is called “*kitso ya tlhago*” (Setswana), “*Ulwazi le sintu*” (isiZulu), “*Ndivho yapo*” (TshiVenda), “*Ilwazi lendabuko*” (isiNdebele), “*Lwati lwe sintu*” (siSwati), “*Inheemse kennis*” (Afrikaans) and “*Ruzivo rwechivanhu*” (Shona). Despite the different nomenclatures and semantics, however, there is arguably enough overlap between the various terminologies and definitions of the concept to provide a holistic, cultural as opposed to the academic understanding of the term. Communities that practice indigenous knowledge encourage indigenous creativity and innovation to address their challenges.

Bates et al. (2009) indicate that this knowledge is passed from generation to generation, usually by word of mouth and cultural rituals, and has been the basis for agriculture, food preparation, health care, education, conservation and the wide range of other activities that sustain societies in many parts of the world. Hence, the study argues that IK is stored in the rich oral traditions and was transmitted by the elders using formal, informal or non-formal ways.

However, formal education systems have disrupted the practical everyday life aspects of Indigenous Knowledge and ways of learning, replacing them with abstract knowledge and academic ways of learning (World Bank, 2004). Le Grange (2007); Sillitoe (2009) and Johnston (2005) argue that today, there is a grave risk that much indigenous knowledge is being lost and, along with it, valuable knowledge about ways of living sustainably.

Drawing upon a growing literature in the field, it is arguable that Indigenous Knowledge can be traced back to the origins of human beings, however, at the same time, it is a relatively recent phenomenon. The above statement is supported by scholars such as Nel (2008); Hountondji (2002); Kazemi et al. (2003) argue that although African Indigenous Knowledge Systems (AIKS) have existed for thousands of years, their concept and practice began to emerge in the science spheres only three decades ago.

However, the above debates suggest that indigenous knowledge is a panacea and it is just a critic or opposite of the Western Knowledge System (WKS). Authors such as Agrawal (1995); Peter (2000); Dei et al. (2000) agree that while scientific knowledge is needed to solve the problems, science alone is often not sufficient and indigenous knowledge may make a useful contribution. Hence, this study argues that the fact that indigenous cultures and peoples had survived for centuries is a testimony that they had scientific knowledge of how to harness their environmental resources to meet their daily needs.

Hoopers (2002) state that the focus of Indigenous Knowledge is on the reclamation of cultural or traditional heritage; decolonisation of mind; recognition and acknowledgement of self-determining development; protection against further colonisation; and legitimisation or validation of indigenous practices and worldviews. Hence, it is important to demystify indigenous knowledge that it is not a term that is about witchcraft, superstitious belief systems or about traditional music drums and sticks. Indigenous knowledge systems is also not to be associated as rural knowledge which is not appropriate or relevant in modern times.

Having said this, indigenous knowledge is considered as not just knowledge that is confined to rural settings, but can also be found in semi-urban and urban areas. Indigenous knowledge is skills, practices, technologies and the knowhow of local people in a particular environment. Furthermore, indigenous knowledge is not just about the use of indigenous flora and fauna, it is about the science and technologies of indigenous communities and how they used it for sustainable livelihood. Indigenous knowledge is holistic, relational and spiritual and it originated from multiple sources, including traditional teachings, empirical observations and revelations (Castellano, 2000).

Brokensha et al. (1980) indicate that traditional knowledge is built on the historic experiences of a people and adapts to social, economic, environmental, spiritual and political change. Alavi and Leidner (1999), the term knowledge system is used to give expression to the processing of knowledge. It is indicative of a particular worldview with regard to meaning and functions of knowledge.

Pandor (2015), Indigenous Knowledge Systems (IKS) " refers to a combination of knowledge systems encompassing technology, cosmology, spiritual, social, economic and philosophical learning, or educational, legal and governance systems which manifest as indigenous cultural expressions. Indigenous knowledge systems are a body of knowledge, or bodies of knowledge of the indigenous people of particular geographical areas that they have survived on for a very long time (Mapara, 2009). In this study IKS is defined as local knowledge that is unique to a given culture or society. They are knowledge forms that have failed to die despite the racial and colonial onslaught that they have suffered at the hands of Western imperialism and arrogance.

Indigenous knowledge systems are forms of knowledge that have originated locally and naturally (Altieri, 1995). According to Ermine (cited in Hammersmith, 2007), they are linked to the communities that produce them. IKS refers to " a total of knowledge and practices, whether explicit or implicit, used in the management of socio-economic, ecological and spiritual facets of life (Hoppers, 2005), stored in the collective memory and communicated orally among members of the community and to the future generations (through, stories, myth, songs, etc).

Indigenous peoples throughout the world have sustained their unique ways of knowing and associated knowledge systems for millennia, even while undergoing major social upheavals as a result of transformative forces beyond their control (Harrison, 2001). The basis of this is that

indigenous ways of knowing is the community practices involved in the production and distribution of their material needs of life.

Sobel (2004) points out that the depth of African indigenous ways of knowing is rooted in the long inhabitation of a particular place and offers lessons that can benefit everyone, from the educator to the scientist, as we search for more satisfying and sustainable solutions to issues such as climate change and health. Indigenous peoples used their natural knowledge to deal with the effects of hazardous climatic conditions such as floods, drought, etc.

They did not rely on expert, scientific advises, they used local knowledge to mitigate and adapt to the hazardous climatic conditions. The above is supported by Mafongoya and Ajayi (2017) who argue that in recent years, the knowledge of local and indigenous people, often referred to as indigenous knowledge has been increasingly recognised as an important source of climate knowledge and adaptation strategies.

Indigenous knowledge has also brought innovations in knowledge of medicine and health. For instance, this led to the recognition of traditional healers or alternative medical practitioners in Zimbabwe in 1980 (Mapara, 2009). In South Africa, this also led to the recognition of traditional healers and the launch of the Traditional Health Practitioners Act of 2001. IK should not be seen as static, rigid, or repetitive of traditions that are unable to incorporate innovations (Guchteneireet al, 2010). Mafongoya and Ajayi (2017), it is a flexible entity due to its diverse and experimental nature and can easily integrate skills and insights from other knowledge systems. The following section provides a discussion on IKS and sustainable development.

2.3.3 The role of indigenous knowledge in sustainable development

In recent years most development practitioners and policy makers have now recognised the value of participatory approaches in decision-making for sustainable development (Posey, 1995). IK has proven to be cost effective, locally available and provide the basis for local decision-making. IKS for ecological zones, agriculture, aquaculture, forests, grassland and game management, to mention a few areas, are far more complicated than previously assumed (Posey, 1995).

Furthermore, this knowledge offers new models for development that are both ecologically and socially sound. Hence, it is a well-known fact that development projects that work with, and through IK, have advantages over projects that operate outside them. Grenier (1998) indicates that

incorporating Indigenous Knowledge in development projects and management plans gives them legitimacy and credibility in the eyes of the local communities as beneficiaries. This approach increases cultural pride and thus motivation to solve local problems with local ingenuity and resources.

Grenier (1998) indicates that incorporating Indigenous Knowledge in development projects and management plans gives them legitimacy and credibility in the eyes of the local communities as beneficiaries. This approach increases cultural pride and thus motivation to solve local problems with local ingenuity and resources. Brundtland (1987) defines sustainable development as “development that meets the needs of the present generation without compromising the ability of future generations to meet theirs”. Most IK disappears due to the invasion of foreign teachings and development concepts that promise development goals or solutions, but are not sustainable (Mafongoya & Ajayi, 2017).

In the reviewed literature, there is an emphasis on incorporation of indigenous knowledge into strategies of application (e. g United Nations Development Programme (UNDP); Civil Society Organizations and Participation Programme (CSOPP), 1995) or for scientific validation (World Bank, n.d), or further research (Morolo, 2002), or for developing foundations for sustainable development. Indigenous knowledge (IK) systems are considered as social capital for the poor (Mafongoya & Ajayi, 2017). They are the main asset to ensure survival, to produce food and secure livelihoods. Indigenous Knowledge provides the basis for problem-solving strategies for local communities, especially the poor. The study argues that it represents an important component of global knowledge on sustainable development issues.

Davies and Ebbe (1995) state that Indigenous Knowledge is an underutilised resource and marginalised in the development process. Learning from Indigenous Knowledge, by investigating first what local communities know and have, can improve understanding of local conditions and provide a productive context for activities designed to help communities. This is known as “building on the indigenous”.

Larson (1998) indicates that sharing indigenous knowledge within and across communities can help enhance cross-cultural understanding and promote the cultural dimension of development. Most importantly, investing in the exchange of indigenous knowledge and its integration into the

sustainable development programmes can help to bring cost effective solutions for indigenous communities.

Flavier (1995) and Grenier (1998) support this view by stating that a country's ability to build on and mobilise knowledge systems, available among its people for development, is as essential as the availability of physical and financial resources. It is on the basis of this consideration that increasing number of countries, including South Africa, is developing Indigenous Knowledge Systems policy as part of their sustainable development policy programmes.

The critical strength of IK is its ability to see the interrelations of disciplines, and integrate them meaningfully. This holistic perspective and the resultant synergies show higher levels of developmental impact, adaptability and sustainability than western, modern knowledge (Mafongoya & Ajayi, 2017). IK is a very good source of readily available practices that are useful for identifying appropriate policies to respond to climate change. The following section is about the meaning of astronomy.

2.3.4 The meaning and history of astronomy

Mack (1987) states that astronomy is the oldest of all the sciences. Astronomy is the scientific study of the moon, stars, sun, and other constellations using equipments such as telescopes. To the ancient man the night time was a frightening experience and he used to protect himself and allay his fears by staying close to an open fire (Mack, 1987). During the later part of the medieval period, astronomy was treated as the foundation upon which astrology could operate (Pedersen, 1993). Greene (2004) defines astronomy as a branch of science dedicated to the study of the motions and nature of celestial bodies, like planets, stars and galaxies.

Redd (2017), in the curriculum for K - 4 students, NASA defines astronomy as simply "the study of stars, planets and space". Redd further argues that astronomy and astrology were historically associated, but astrology is not a science and is no longer recognised as having any relation to astronomy. Another important aspect is that most of the literature reviewed fails to recognise the fact that astronomy is not just a pure scientific and academic study, but it is also related to the study of cosmology and it is often referred to as astrophysics, not just a belief or interpretation of cosmic and terrestrial events such as in astrology. In addition, although astronomy is an oldest science, but it is not a new discipline in Africa.

Cosmology is one of the related subjects to astronomy, but is a different field of study that is focussed on investigating the universe as a whole. On the other hand, astrophysics involves the study of the physics of astronomy and concentrates on the behaviour, properties and motion of objects out there (Redd, 2017). Since modern astronomy is related to the use of physics, mathematics and scientific equipment, it could actually be called astrophysics.

In some cases, as in the introductory textbook *“The Physical Universe”* by Frank Shu (1982), astronomy may be used to describe the qualitative study of the subject. Astrophysics, on the other hand, is used to describe the physics oriented version of the subject. Based on the above, most of the scientific researchers in the field of astronomy are actually white professionals who have physics, rather than astronomy, degrees or background. There are, however, a growing number of professional astronomers publishing their research work on astronomy and astrophysics in leading and internationally accredited journals.

Moreover, another challenge or shortfall of the above academic definitions of astronomy, from various scholars, is that it fails to provide evidence of an actual relation between culture, cosmology and astronomy. Every culture in the world (American, Chinese, Indian, and African) has for many years developed their own unique way and systematic knowledge about the sun, moon, stars and other terrestrial bodies. This means that astronomy is part of people’s culture, traditions, belief systems and worldviews.

In addition, the definition on astronomy gives a false impression that astronomy in Africa came with colonisers and imperialist who often promote the stereotype that original Africans never had any prior knowledge of the night sky. The above definition rubber stamps the misconception that the invention of sophisticated equipment, such as the telescope, propelled astronomy into a modern science. The above definition greatly fails to acknowledge the fact that culture influences people to develop ideas, knowledge and innovations that lead to development.

The point emphasised here is that although the Greeks, Babylonians and Europeans played a critical role in revolutionising astronomy, through modern inventions such as the telescope and modern equipment for studying the night sky, it is equally important and fundamental to ensure that recognition and acknowledgement be given without fear or favour to ancient cultures around the world, including Africa, which contributed to the study, research and development of modern

astronomy and other sciences. Nowadays, astronomy is regarded as one of the fields in natural sciences.

It is equally important that modern scientists and astronomers acknowledge the fact that the study of the moon, sun, stars and other celestial objects is one of the oldest sciences in the history of humankind. There is evidence of astronomical practices and artefacts in ancient Greek, China, India and also Africa. Africa has very credible historical evidence of astronomy like that found in Egypt, Timbuktu in Mali and the Nubian monuments.

Before the invention of telescope, the night sky was already being explored in places such as Africa, Mesopotamia, China, Greece, India and Central America. The literature review and debates around indigenous knowledge and cultural astronomy reveal that Europeans previously believed that there had been no astronomical observation in pre-colonial Middle Ages sub-Saharan Africa, but modern discoveries show otherwise (Holbrook et al., 2008).

McKissack et al. (1995) argue that a wealth of evidence of astronomy has been found at the Great Ruins of Zimbabwe, Timbuktu in West Africa and Stonehenge. It is important to note that this thesis is not interested in the modern study of astronomy, astrology or the validity of the horoscope (the Western tradition or belief system that the stars, moon, sun and other terrestrial bodies influence their lives).

On the other hand, African indigenous communities have their own beliefs about how the sun, moon, stars and other terrestrial bodies have a direct link to their lives. The point emphasised here is that Western colonialism and education did not only impose foreign political administrations on African indigenous communities, but also the Western belief in the sun, moon and other celestial bodies. This has to a certain extent had negative implications on the development and promotion of African indigenous belief systems and knowledge about the moon, sun and stars.

The current education system should, therefore, equally promote and embrace both Western and African belief about the stars, moon, sun and other terrestrial bodies. No belief or knowledge is superior or should be allowed to dominate another in the current global knowledge economy. This approach will address the concern raised by indigenous knowledge experts that African indigenous knowledge of the sky and their underlying beliefs and philosophies are being undermined in the

education system. The following section provides the IKS policy and African indigenous astronomy.

2.3.5 The IKS policy and African indigenous astronomy

Astronomical Society of Southern Africa (2006), the astronomical observations done by the Portuguese and Dutch tended to marginalise African indigenous astronomy as primitive and unscientific. Very little research is being done on the indigenous astronomical knowledge of past and present South African cultures (Holbrook, 2016).

Based on the above, the discussion on the Indigenous Knowledge Systems Policy in South Africa is important due to the fact that colonial powers used brutal policies and devious methods to subjugate the African people. It is the argument of this study that these policies and methods included consistent inferiorization of indigenous cultures, and concerted efforts to erase existing systems of knowledge and their replacement with Western-driven belief and knowledge systems.

Such pre-mediated policies were successfully culminated in, on one hand, the absolute submission of the communities and stigmatization of their knowledge systems with the consequence that most of the communities were trapped in the design of perpetuating their own subjugation (Progler, 1999). Therefore, the Western domination of knowledge and marginalization of African systems of knowledge continue to be an academic challenge that calls for a comprehensive evaluation, rigorous planning and watchful implementation of policies that ensure the recognition and provisions of space for the local in the existing political, economic, cultural, and pedagogical domains (Zezeza, 2006).

Holbrook (2016) argues that through the National Research Foundation, the South African government has financially supported the disciplines of Indigenous Knowledge Systems and Astronomy. These large financial commitments indicate the importance of these areas of research and scholarship to South Africans. Therefore, the study argues that the advancement and promotion of indigenous astronomical knowledge in South Africa and Botswana needs to be supported by development of policies and injection of financial resources.

The Indigenous knowledge systems policy in South Africa was adopted by cabinet in November 2004. According to the former Minister of the Department of Science and Technology, Honourable

Mosibudi Mangena (2004), the Indigenous knowledge systems policy forms an important milestone in the efforts to recognise, affirm, develop, promote and protect Indigenous knowledge systems in South Africa. The policy proposes the integration of Indigenous knowledge systems in the arenas of education, commerce, agriculture, the sciences, law, languages, arts, social sciences and health in South Africa.

The statement by the former minister suggests that at political level, the national government of South Africa led by the African National Congress (ANC), has taken a policy position to actually ensure that there is redress especially with regard to the mainstream and development of African heritage, languages, culture, arts and especially indigenous knowledge. However, this poses fundamental challenges and prospects which need to be researched.

The Indigenous knowledge systems policy provides an enabling framework to stimulate and strengthen its contribution to social, economic and knowledge development in South Africa. Le Grange (2007) adds that Indigenous Knowledge has always been and continues to be the primary factor in the survival and welfare of the majority of South Africans. South Africa, with its great variety of cultures and ancient sky lore, provides an ideal backdrop to examine and unearth indigenous astronomical knowledge that has largely remained undocumented and marginalised in the education system.

The post-apartheid government in South Africa, through the National Research Foundation (NRF), put emphasis on the promotion and development of African astronomy including indigenous knowledge systems. It is on the basis of the above that in spite of the fact that the post-apartheid government in South Africa put emphasis on promoting astronomy and indigenous knowledge systems, by channelling ring fenced research funds through the NRF, there are still limited commented efforts to promote indigenous astronomy.

Recently as part of addressing the the injustices of the past the President of South Africa, Cyril Ramaphosa has signed the IKS Act in August 2019. The IKS Act seeks to protect, promote, develop and manage IKS. Chapter five of the IKS is about Recognition of Prior Learning (RPL), hence the Act can be used as an instrument to promote and recognise prior knowledge of indigenous astronomy experts. The following section is about cosmology

2.3.6 The definition and history of cosmology

Holbrook (2009) defines cosmology as a system of belief that seeks to describe or explain the origin and structure of the universe. She (Holbrook) further indicates that a cosmology attempts to establish an ordered, harmonious framework that integrates time, space, the planet, stars and other celestial phenomena. In modern industrial societies, cosmology seeks to explain the universe through astronomy and mathematics. In so called primitive societies, cosmologies help to explain the relationship of human beings and the rest of the universe and therefore closely tied to religious beliefs and practices (Holbrook, 2009).

NASA (2011) indicates that cosmology is a colossal or massive field and has made enormous progress as an area of fundamental research in the last several decades (Smeenk, 2012). The term cosmology (from the Greek word *kosmos* (world) and *logia* (knowledge or science)) is the study of the origin, evolution and eventual fate of the universe (Hille, 2016). The term cosmology was first used in English in 1656 in Thomas Blount's *Glossographia* (Norriss, 2014) and in 1731 after having been taken taken up in Latin by the German philosopher Christian Wolff, in *Cosmologia Generalis* (Jean-Pierre, 2008). It is also commonly known as the science of the cosmos.

Cosmology is the scientific study of the large scale properties of the universe as a whole. It endeavours to use the scientific method to understand the origin, evolution and ultimate fate of the entire Universe (WMAP Science Team, 2011). Cosmology may be said to have gone through three major phases, each associated with a single major figure like Aristotle, Newton and Einstein (McMullin, 1993).

Literature reviewed on the origin of cosmology, argues that the ancient Greeks were the first to attempt to give a reasoned account of the cosmos. However, this study argues that African indigenous astronomy also had wealthy of knowledge of the cosmos. One of the commonly known cosmic theory is the Big Bang Theory.

However, Greek philosophers Aristarchus of Samos, Aristotle, and Ptolemy proposed different cosmological theories. The Big Bang Theory (BBT) is the prevailing cosmological model for the universe (Overbye, 2017) from the earliest known periods through its subsequent large-scale evolution (Silk, 2009 & Singh, 2005). The model describes how the universe expanded from a very high-density and high-temperature state and offers a comprehensive explanation for a broad range

of phenomena, including the abundance of light elements, the Cosmic Microwave Background (CMB), large scale structure and Hubble's law (Wright, 2009).

Cosmology and philosophy came into existence together in the Greek-speaking world of the sixth century BC when some daring minds sought a 'reasoned account' of the origins and nature of the universe (Leslie, 1990, Zinkernagel, 2002, Rugh & Zinkernagel, 2002). McMullin (1993, 1994) argues that prior to 1965 research in cosmology had a strikingly philosophical tone, with debates focusing explicitly on scientific method and the aims and scope of cosmology.

Cosmology confronts a number of questions dear to the hearts of philosophers of science: the limits of scientific explanation, the nature of physical laws, and different types of under determination, for example (Roberto, 2000 & McMullin, 1993). There is an opportunity for philosophers to make fruitful contributions to debates in cosmology and to consider the ramifications of new ideas in cosmology for other areas of philosophy and foundations of physics (Isham, 1993 & McMullin, 1993).

There are different kinds of cosmology such as the physical and mythological cosmology. The study argues that many different ancient cultures including the Batswana developed mythology based upon the cosmos. Indigenous communities have a mutual relationship with the events in the sky, with the terrestrial and spiritual world and from the Western scientific point of view this are imaginary and fantastical. What is happening in the sky it also has intimate connection with actions and occurrences in the realm of human actions. The following section provides a discussion on the definition and some specific examples of African cosmology.

2.3.7 The definition and examples of African cosmology

African cosmology can be defined as the conception of the origin and nature of the universe. The study argues that there are stories of African cosmologies in the African continent. In so called primitive societies, cosmologies help to explain the relationship of human beings and the rest of the universe and therefore closely tied to religious beliefs and practices (Holbrook, 2009). The concept of African cosmology is promoted by various scholars in Africa including Professor Mathole Motshekga at the Kara Heritage Institute in Pretoria, South Africa. Celestial bodies of significance in this concept include the Sun, the Moon, the Pleiades, Sirius, Canopus, Regulus, Orion's Belt, the Southern Cross, Mercury and Venus (Kara Heritage Institute website, accessed on the 18th of March 2017. See: <http://www.kara.co.za>).

Among various traditional African tribes, the concept of God loosely translated as *modimo* and ancestors or *badimo* is colonial and imperial. In African spirituality, the appropriate terms to be used should be deities and divinity. This means that African scholars need to shift from using terms which are colonial and have an element of subjugation. For example, human beings have a mutual relation with the cosmos and deities is invoked in times of rainfall, drought, good harvests and outbreak of diseases. Matters pertaining to their life are interconnected to deities, divinity, nature and other relations (living or dead). Sow (1980) explains that this indivisible cosmic whole can be theoretically distinguished, namely macro, meso and micro-cosmos though blending together in everyday lives of people.

Sow (1980), the macro - cosmos is the area of activity and existence where divinity is experienced. This is the area where most traditional African people interact and experience deities in their human functioning. Traditional African people experience and communicate with deities in the fields when growing crops, when looking after their animals and in times of happiness and sadness. Divinity is not limited to Sunday services in churches, though there are sacred places for various communities where deities is invoked through some special rituals. For example, in times of drought when cows are dying, a Maasai leader will go to this sacred place to offer sacrifices to the deity for the drought to end.

Meso - cosmos is the sphere where ancestors, malignant spirits and sorcerers are encountered and experienced (Sow, 1980). It is the world of animals and human beings, forests, bushes, trees, rivers, wind, rain, darkness and light. Hammond-Tooke (1989), spirits of the departed ancestors are believed to look after the best interest of their descendants and at the same time can also send them illness and misfortune when they are moved to wrath. Today people communicate and relate to ancestors through anniversary celebrations of their deceased members, tomb stone services and other activities like "*mpho ya badimo*" or gift of God among *Basotho* speaking people.

The Micro - cosmos is regarded by Sow (1980) as the level where the individual is seen to exist within the context of the collective. This individual existence nevertheless, does not rest on the principle of individual survival enshrined in the theory of evolution of Western perspective. Every human being has relatives, living or dead. Every human being encounters and experiences nature in some way; rain, trees, and the like. No one is an island of himself or herself. As the Batswana and Basotho say '*motho ke motho ka batho ba bangwe*' (I am because we are) which means a person exists because others exist.

The collective existence of the individual gives room for individuality. This individuality is manifested in the use of names unique to the individual in the family and not collective family names as Mbiti (1969) points out. Among the Basotho people, surnames or family names are not normally used to address the individuals; instead they are used when collective existence of the individual in a particular tribe, clan or extended family is referred to. The following provides a brief discussion on cosmology of Batswana.

2.3.8 An overview of Batswana cosmology

Among the Batswana cosmological and spiritual beliefs are thus central to the daily life and practice and not reserved for special religious places or rites (Denbow & Thebe, 2006). Nyang (1980) indicates that Africa was, and still is, rich in cosmological ideas. Africa's traditional cosmology is diverse, but behind this diversity lies the core of shared beliefs which spread across the continent (Nyang, 1980). The study argues that the Batswana, like many other African indigenous peoples have a mutual relationship with and a wealthy knowledge of the cosmos.

In order to transmit this knowledge to posterity, they developed songs, stories, proverbs, myths about their own understanding of the concept of man, god, the physical universe, the stars, moon and other constellations. The above statement is supported by Glegg (1986) that among the Batswana the knowledge of cosmology has been handed down orally from one generation to the other. The study argues that indigenous astronomical knowledge was passed down orally from one generation to another before the advent of Europeans. In so called primitive societies, cosmologies help to explain the relationship of human beings and the rest of the universe and therefore closely tied to religious beliefs and practices (Holbrook, 2009).

In the cosmological world of traditional African man, certain ideas have always held sway over men's minds (Nyang, 1980). The ideas of a deity who rules over creation was accepted by many, if not most African peoples. In fact, African pioneers in the field of traditional African religion, including Professor John Mbiti, have noted that this African knowledge of God is expressed in proverbs, short statements, prayers, names, stories, myths and religious ceremonies (Mbiti, 1970).

Glegg (1986) further argues that over time the Setswana cosmology has been corrupted by ideas brought from Europe to the extent that it is frequently difficult to extract those ideas which predate missionary activity. Those who have recorded traditional Batswana beliefs have tended to concentrate on philosophical and religious aspects (see, for example: Schapera, 1971). Very little of

the Setswana interpretation of the physical universe has ever been written down and, of that which has, detail which goes beyond philosophical ideas in often inconsistent and incorrect (Glegg, 1986).

However, there is a growing passion of African researchers with an interest in drawing attention to the African indigenous cosmology among Africa`s indigenous communities. This means that a substantial body of established scholarly written texts from a Eurocentric perspective is now directly challenged and contested. In a nutshell, the relationship between religion, cosmology and everyday life thus involves complex and often contradictory cultural synthesis and transformation of religion, health and psychology (Denbow & Thebe, 2006). The following section is a brief discussion on Batswana deities and creation myths.

2.3.9 The Batswana creation myths and indigenous astronomy

Batswana, like any other African indigenous communities have their own narratives about the deities and creation mythology regarding human evolution and the universe. These myths have helped them, like other nations, through the ages to understand the world around them and to make sense of things around them (Setiloane, 1986).

Religious ideas affect in many fundamental ways how people in Botswana perceive themselves, their relationship with their families, friends, neighbours and their interpretation of daily events (Denbow & Thebe, 2006). It is evident that these myths have shaped the worldview of Batswana as Africans. The implication here, is that myths form part and parcel of human culture. And such myths have been passed from one generation to the other through the ages by the Africans, whose history and way of life was never documented (Setiloane, 1986).

Udefi (2012) posits that man from the pre - historic times has been grappling with some perennial and perplexing problems like the origin of the world, man and things as well as the question of existence. The responses to these are usually encapsulated in the stories, narratives and cosmogonic myths of the people or culture group (Udefi, 2012).

There are several definitions of the term myths. Madu (1996) states that the term myth is derived from the Greek *mythos*, meaning 'word' or 'story'. Lenardon and Morford (2003) states that myth, 'the word myth comes from the Greek word *muthos*, which means "word," "speech," "tale," or "story," and that is essentially what a myth is: a story.' Lenardon and Morford further states that a

myth is a comprehensive term for stories primarily concerned with the gods and humankind's relations with them.

Lodge (1972) looks at myth as 'an ancient story about gods and heroes created to express beliefs or explain natural events.' In addition, Mercatente (1988) defined myth as a traditional story, orally passed on from one generation to the next, believed to be literally true by the culture that produced it, about gods and goddesses, heroes, heroines, and other real and fantastic creatures, taking place in primeval or remote times. Myth is a vehicle conveying a certain fact or a certain basic truth about man's experience in his encounter with the created order and with regard to man's relation to the supra-sensible world (Idowu, 1976).

Malinowski (1922), myths are like songs and fairy tales which are owned by certain sub clans. According to him, it is a rule that a myth will be best known in its locality, that is, known with all the details and free from any adulterations or not quite genuine additions and fusions. In the same vein, Okpewho (1983a & 1983b) defines "myth as a set of ideas about man and his environment". What unites the above definitions is that myth is concerned with the traditional tales of a people, gods, nature and the universe (Oruka, 1972). Thus myths are used to express the views of the people concerning the existence of man, gods, universe, their fears and aspirations in life (Udefi, 2012).

Creation myths are simply the stories told about how things began without particular emphasis on theories or how things developed into structures that are present today (Holbrook, 2009). According to Womack (2005) a creation myth or cosmogonic myth is a symbolic narrative of how the world began and how people first came to inhabit it. A creation myth (or creation story) is a cultural, traditional or religious myth which describes the earliest beginnings of the present world (Leeming & Leeming, 1994).

Creation myths are the most common form of myth, usually developing first in oral traditions, and are found throughout human culture (Leeming & Leeming, 1994). A creation myth is usually regarded by those who subscribe to it as conveying profound truths, although not necessarily in a historical or literal sense (Leeming & Leeming, 2009). They are commonly, although not always, considered cosmogonical myths - that is they describe the ordering of the cosmos from a state of chaos or amorphousness (Leeming & Leeming, 2009).

Leeming (2010) indicates that there are number of creations myths in Africa, for example the Ancient Egyptian creation myths are the ancient Egyptian accounts of the creation of the world. The Pyramid Texts, tomb wall decorations and writings, dating back to the Old Kingdom (2780 - 2250 B.C.E) have given us most of our information regarding early Egyptian creation myths (Leeming, 2010). These myths also form the earliest religious compilations in the world (Hart, 2004). The ancient Egyptians had many creator gods and associated legends.

Thus the world or more specifically Egypt was created in diverse ways according to different parts of the country (Seton - Williams, 1999). This study agrees with sholars such as (Alcock, 2010) who argues that detailed information is seldom available on the primary African deities in South Africa. Diverse African indigenous cultures including the Batswana developed theology and concepts of deities over their history.

There is no universally accepted consensus on what a deity is, O ' Brien (2009) and concepts of deities vary considerably across cultures. Parri (1971) states that the term "deity or god or its equivalent in other languages" has a bewildering range of meanings and significance. A deity is typically conceptualized as a supernatural or divine concept, manifesting in ideas and knowledge, in a form that combines excellence in some or all aspects, wrestling with weakness and questions in other aspects, heroic in outlook and actions, yet tied up with emotions and desires (Gupta, 2012).

A deity is a supernatural being considered divine or sacred (O ' Brien, 2009). A deity can be defined as "a god or goddess", or anything revered as divine (Angus, 2010). Scott (2005) states that a deity is "a being with powers greater than those of ordinary humans, but who interacts with humans, positively or negatively, in ways that carry humans to new levels of consciousness, beyond the grounded preoccupations of ordinary life (Scott, 2005).

The study further agrees with (Alcock, 2010) that a second problem is that the teachings of the missionaries were often in conflict with traditional religious beliefs. One result has been that any real knowledge of the creator has virtually died out, or has become confused with the Christian God (Alcock, 2010). Hammond-Tooke (1993) confirmed that the concept of a 'Supreme Being' or 'High God' who was closely associated with the sky was not well developed in long established African thought.

Denbow and Thebe (2006) indicate that like the air one breathes, religious cosmology and a belief that the ancestors (*badimo*) participate in the daily affairs of the living are part of the taken for granted matrix within which life is lived and understood. It has been noted that the intimate presence of God (*Modimo*) and ancestors (*badimo*) is reflected at every point of life. The concept of good, bad fortunes, illness, drought, floods, appearance of certain stars and astronomical events lies in the interpersonal, communal and spiritual relationships with the ancestors and god.

The principal God (*Modimo*) had a special relationship with the ancestors (*badimo*). Missionaries such as Robert Moffat who affiliated with the London Missionary Society (LMS) loosely translated the term of *badimo* as devils who possessed people during spiritual and healing ceremonies. The study argues that there was biased translation and misunderstanding of African Traditional Religion (ATR), African Worldviews (AW) and African Cosmology (AC) of the Batswana and this is evident in widespread publications and missionary records.

Literature reviewed also indicated that the Batswana had knowledge and beliefs, practices using their own language about the deities, divinity and the sky (*loapi*). In monotheistic thought, God is believed to be the Supreme Being and the principal object of faith (Bordwell, 2002). The concept of God, as described by theologians, includes the idea of omniscience (all-knowing), omnipotence (unlimited power), omnipresence (present everywhere).

The indigenous belief system of Batswana was centred on the deities, who was regarded as the Creator of all things, and the person responsible for all human destiny. He controlled human destiny by sending different weather, in order to indicate through winds, hail, heat, rain (or its absence), and death, his discontent with some departure from tradition and from the proper Tswana order of things. Thus, particularly significant events were acts of deities or, in the case of death, could also be signs of witchcraft and, therefore, of human envy and greed.

The above version is supported by (Schapera, 1979) that "*Lowe*", according to the Batswana, was the creator of all things and the 'moulder' of destiny. He was vaguely associated with the weather, and punished those who failed to observe the customs by sending heat, wind or hail, and by withholding rain. Deities was very distant from everything, although the ancestral spirits could, at times, be implored to intercede with him (Alcock, 2010).

Breutz (1969) in discussing the Basotho and Batswana in general, stated that ideas and concepts concerning the sky and the sun, as well as the origins thereof, were of very minor significance. It was occasionally said that the sky god, Modimo, created the sky and the Earth, although such beliefs may have been due to the influence of the missionaries. It was more often maintained that Modimo had nothing to do with this aspect of creation.

Breutz (1969) was of the opinion that the word *Modimo* (meaning 'the one up above') was originally a taboo word, which should not be used by commoners and seldom by kings. The term *Modimo*, as per Breutz, was popularised by the missionaries. The Basotho and Batswana probably once had a different name altogether for this deity (Breutz, 1969). Brown (1921) briefly mentions some legendary being of 'long ago' known as Bila. There was also a dim and distant past, sometimes described as 'the time before Cose'. The latter being (Cose) appears to have been a 'mythical controller of the destinies of men', or 'the weaver of the web of life'.

In a nutshell, the study argues that the relationship between the concept of religion or spirituality, cosmology, worldview and astronomy are complex among the Batswana. As a result the conceptual fields of African thought, and cosmology do not always fit well in the categories familiar to westerners. In addition, the study argues that the concept of God and ancestors which is loosely translated as *Modimo* and *badimo* is colonial and imperial.

Batswana do not have such concepts, and this were used by missionaries as part of the gospel and strategy to destroy African spirituality. The study argues that the concept of deity and divinity is appropriate and relevant when discussion about African belief systems. The creation myths of Matsieng and its astronomical and cosmological significance among the Batswana is discussed in the following section.

2.3.10 The astronomical significance of Matsieng

The study argues that there are numerous version about the indigenous creation myths of Matsieng. Matsieng is a Setswana name which according to the version by (Van Der Ryst et al., 2004) he was known as the great hunter and ancestor of Basotho and Batswana cultural groups. Another version of Matsieng by local legends indicate that he was a one legged giant other versions says he had two legs. All these versions explains the origin of Matsieng who was followed by his people and animals.

According to credible reviewed literature, Matsieng is a designated creation site in south east Botswana, near the city of Gaborone and was declared a national monument in 1997. The site is a 30 minute drive from downtown Gaborone north on A1, about 10 km past the village of Rasesa. Matsieng is known among the Batswana as a creation site where life began. It is known also for its rock art, or petroglyphs, called the Matsieng Footprints.

The site is littered with depressions, or holes, thought to have been formed as volcanic (Van Der Ryst et al., 2004). They fill with rainwater, and are sometimes used by local peoples still today for water collection. There are two deeper cavities on the site; around the north east one is where most of the rock art is found (Walker, 1997). Most of the site is littered with carved footprints, both human and animal, but there are also a few profile depictions of common African animals, such as giraffes. The outlines of footprints were crafted by pecking, a form of engraving, by ancient peoples (Van Der Ryst et al., 2004). Matsieng may have once been used as a ritual site for many peoples due to its role in local folktales.

It shares its name with a character in African origin stories, Matsieng the great hunter (Van Der Ryst et al., 2004). Another version of Matsieng is that he was a one legged giant other versions says he had two legs. The site contains up to 117 engravings and three natural rock-holes, (Chippindale & Nash, 2004), (Matsieng Footprints, 2010) dating back between 3,000 to 10,000 years (Walker, 1997). Van Der Ryst et al. (2004) argue that no one knows exactly what the Matsieng site was used for in the past, though many believe it served as a ceremonial site for 'rainmaking'. Up until recently, the site was used by local peoples. They would bring their animals for a drink from the rainwater collecting holes.

Today it is used as a ritual site, where local peoples conduct ceremonies to bring the seasonal rains. (Van Der Ryst et al., 2004). Although no longer used as a watering hole, the petroglyphs were damaged by herding practices and are still battered by the elements (Walker, 1997). The Basotho-Tswana had several creation stories which were primarily variants of each other (Miller, 1979). One version is that both wild animals and man emerged from a waterhole. A waterhole or water hole is a depression in the ground in which water can collect. (<https://en.wikipedia.org/wiki/Waterhole>).

This waterhole is believed to be at *Lowe (Loë or Matsieng)*, near Mochudi, north east of Gaborone in Botswana. A photograph of the waterhole can be seen in Cohen (2015). The above version is supported by Cohen (2015) that *Matsieng* is one of the well-known creation sites" in southern

Africa another one is the Cradle of Humankind (Maropeng) in South Africa. *Matsieng* is known among the Batswana as a creation site where life began.

The Batswana believe that life began when *Matsieng* emerged from a hole in the ground. *Matsieng* is considered to be one of the ancestors of the Basotho-Tswana people (Cohen, 2015). He was supposedly followed by his people and animals while the rocks were still “wet” and soft; and their feet sank into them, creating “footprints” in the rock floor which have been preserved since then due to the rocks eventually hardening (Cohen, 2015).

Rock engravings also known as *petroglyphics* are the main attraction of the *Matsieng* footprints site and the animal and human “footprints” are actually engravings created by the ancestors of the modern San people during the Late Stone Age (Cohen, 2015). These *petroglyphics* are in the form of footprints shaped like the letter U, with dots representing animal tracks typically felines. Despite the interpretation of archeologists that the engravings are a form of rock art, the legend of *Matsieng* is still respected to this day (Cohen, 2015).

The site is associated with the creation myth which attempts to explain cosmology, which is the science of the origin and development of the universe and Maria (personel who was in charge at *Matsieng*) pointed out that the symbolism of celestial bodies as represented in the photograph shown below perhaps of planets and solar systems (Cohen, 2015). The cosmological and astronomical significance of *Matsieng* to the Batswana is very important in this study.

It provides evidence of the knowledge of cosmology and astronomy among the Batswana and its significance in their daily lives. Two large holes which retain water throughout the year depending on rainfall conditions are found at *Matsieng* in addition to the footprints (Cohen, 2015). Water holes and caves are sacred to the San people especially for the purposes of rainmaking. It has not been established at this time whether the holes are natural or volcanic.

According to the legends of *Matsieng* as illustrated by Alcock (2010), the wild animals came out in great numbers first, and remained at the entrance to the hole or cave for a long time, making many tracks (spoor). Man, following after the animals, promptly obliterated these tracks with his own (which can still be seen in the rock today). An addition to the story is that man, when first in the cave, used his hands to hold up the roof of the cave, in case the roof collapsed. When man left the cave, he held up the sky, fearing that the sky would fall down (like the roof of the cave). Only later

did man, tiring of holding up the sky with his hands, learn that the sky would not collapse. Another version is that man first sprang from a wetland or swamp with many reeds. A related description of creation events is briefly outlined in Setiloane (1998).

This study argues that there are very few, credible studies that have probed the meanings and importance that the Batswana people place on their cosmologies. Tswana cosmology has descriptive and purposive elements. Glegg (1986) explanations of the workings of nature, however, are not sought; indeed, God's creation is not to be questioned. Glegg (1986), celestial events, however, are used, as in other traditions, to note the passage of time, to predict events on earth, and to find direction.

The study further argues that the Batswana also had their own understanding, beliefs and knowledge about the physical universe (*lefatshe*). The word universe derives from the Old French word *univers*, which in turn derives from the Latin word *universum*. The Universe is all of space and time (spacetime) and its contents (Zeilik & Stephen, 1998) which includes planets, moons, stars, galaxies, the contents of intergalactic space and all matter and energy (Merriam-Webster Dictionary, 2012). While the size of the entire Universe is still unknown, (Greene, 2011) it is possible to measure the observable universe.

Very little of the indigenous Setswana interpretation of the physical universe has ever been written down and, of that which has, detail which goes beyond philosophical ideas in often inconsistent and incorrect (Glegg, 1986). Glegg (1986), the Batswana universe is geocentric; the stars, sun and moon revolve round the earth which is flat. This knowledge about the physical universe formed an integral part of the Batswana culture and traditions since the time of "Lowe". The following section provides a brief summary of African creation myths as one way to illustrate that it is not only the Batswana who practiced such things, but this is evident in majority of African indigenous communities with astronomical and cosmological significance.

2.3.11 Brief exploration of African creation mythologies

The following section provides a summary on selected cases of African creation myths among the amaZulu, amaXhosa, amaSwatii, and TshiVenda people of Southern Africa and Mande people of West Africa. As indicated earlier, this is not far-fetched but is used to support the argument made in the above section about the astronomical and cosmological significance of creation myths of Batswana. The argument here is that, creation myths has a relation to the people's worldview,

religion / spirituality, astronomical and commocentric views. For instance, some of the African indigenous communities trace their origins from the cosmos. Hence, they developed stories, songs, proverbs and mythologies about their origins.

Firstly, amaZulu are a Bantu cultural group of Southern Africa found mainly in the province of KwaZulu-Natal. Small numbers also live in Zimbabwe, Zambia, Tanzania and Mozambique. The word *izulu* means 'heaven, the sky, climate, weather, rain or lightning' (Dent & Nyembezi, 1979). A thought-provoking discussion on the whole concept of an original Zulu 'god' is to be found in Hexham (1981) and Govender (2011) who indicates that the Zulu also had taboos which they transmitted from generations through oral traditions.

AmaZulu like any other African cultural groups such as the Batswana above, have various version with regard to creation myth. The study argues that there is lot of literature and scholars who wrote about the history, culture, traditions including cosmology of amaZulu. One of the prominent scholars, Berglund (1989) posits that the creation myth of the amaZulu involved the descent or lowering from the sky of the first man and later the first woman. A reed was used to sever their physical links (a cord) to heaven. Alcock (2010) points that this event explains how the people came to be known as the *amaZulu*, because they were from the sky (i.e. heaven).

The Zulu were thus of divine origin (Berglund, 1989). Dent & Nyembezi (1979) point that another isiZulu word of relevance which indicates the cosmic relation they had with the sky and universe is *isibhakabhaka* meaning 'the firmament' or sky. Berglund (1989) adds that among amaZulu, the sky was regarded with high esteem and respect since there was a belief that it a dwelling place for heaven and the deity, hence, people were taught not to disrespect it. It was also said that the *uhlanga* (*ohlangeni*) was the spot where the black people and the white people originated from (*dabuka'd*) (Ngidi alias Magambukazi: a Zulu informant cited in Webb & Wright, 2001).

Miller (1979) indicates that the amaZulu believed in the concept of the creator known as uMvelinqangi or Mvelangqangi (referred to 'the one who first made his appearance). It is thought that he emerged from the reeds (*uhlanga*). Reed is a common name for several tall, grass-like plants of wetlands. The study argues that there are several names used among amaZulu to refer to the creator of people and all things on earth such as *iNkosi uHlanga* or 'the king of the reeds'.

It is also believed that the creator did not only create human beings and animals, he is also the creator of heaven itself as well as the sun and the moon (Miller, 1979). This study also argues that there are numerous slightly different version of the creator among amaZulu such as Mbiti (1970). Lugg (1975) described the Supreme Being as uMvelinqangi ('the first spirit') and uSimakade ('the eternal one'). The amaZulu creator, as per Hammond-Tooke (1993), was Mvelangqangi or 'the first to emerge'.

Another name for the creator among amaZulu was uNkulunkulu ('the old, old one'), also known as 'the great, great one who created all things, however, he was not worshipped (Krige, 1950). However, scholars such as Webb and Wright, 1986, citing Ndukwana (amaZulu informant cited in) is that some of the concept such as Unkulunkulu was not common among amaZulu until the advent of Christianity.

Hammond-Tooke (1993) as well as Eiselen and Schapera (1966) likewise referred to a further god, the King of [in] the Sky (*iNkosi pezulu*) who brought storms, caused rain and thunder, and who used lightning to kill anyone who offended him. An alternative name is Heaven or the Lord of Heaven (Krige, 1950). Berglund (1989) referred to this deity as the Lord of the Sky (*iNkosi yaphezulu*; *iNkosi yezulu*, or *iNkosi*), also known as uMvelinqangi. Modern isiZulu, as per Berglund, may use the name Lord of Lords or *iNkosi yamaKhosi*. In a nutshell, a primary source on the religious beliefs of the Zulu is (Callaway, 1870).

Secondly, according to amaXhosa creator or Supreme Being was known as uDali (Dali), uThixo (Tixo) or uQamata / Qamata or Qwamata / Qamatha (Miller, 1979; Eiselen and Schapera, 1966; Soga, 1931). AmaXhosa once believed that all people and all forms of animal life were brought forth by the creator from a subterranean cavern situated 'in a land in which the sun rises' (Hammond-Tooke, 1993 & Peires, 1989). The site of origin was a wetland overgrown by reeds, which concealed the entrance to a huge cavern in the centre of the Earth (Peires, 1989). This place was the *uHlanga*, isiXhosa concept which encompasses both the creator and the source of creation.

A similar notion was related by Mabona (2004) where the Sun, the Moon and everything else was said to have come from a cavern which was thought to be on the horizon between the sea and the sky. Hodgson (1984) states that the term *uHlanga* was also used to describe the creator as the ultimate source of all power, and was sometimes identified with lightning. Hodgson (1982) point that the King or Lord of the Sky or *iNkosi yezulu*, similarly, was at times linked to lightning, which

kills. This deity also sends rain, but will withhold rain if he is angry or irritated. Another name for the Supreme Being was *iZulu* or 'the sky'. The Supreme Being resided in a place in the sky not far above the clouds (Hodgson, 1982).

Hodgson (1982) described such beliefs as a 'nature religion' in which creation and destruction go hand in hand as in nature itself. Mabona (2004) refers to the King of the Sky as *iNkosi*, due to his supposed power over cosmic phenomena including the Sun, the Moon, the stars, lightning and rain. Note that Hodgson (1982), citing oral evidence, indicates that Qamata was the *original* name for the Xhosa deity. The term Qamata, as per Hodgson (1982), is definitely of Khoisan origin. According to Zenani (1972) the first Xhosa human being came into existence 'naturally'.

The first man, Tshawe, sired the first children who were the origins of all the isiXhosa-speaking people. Another version cited by Hodgson (1982) is that the original amaXhosa man and his wife descended in remote times through a window on to the Earth. A related version of the myth is that the first people, who had tails, came down from the sky on the filaments of a spider (Mabona, 2004). The filaments are also said to be the means by which the first being went up to the sky, after becoming disenchanted with mankind. The filaments likewise enabled the sky people to go up and down between heaven and Earth. Mabona speculated that the filaments could well be associated with the concept of life and death.

The Great One was referred to as Unkhulukhulu or less commonly as Qamata, in that part of the Transkei discussed by Broster (1967). Other spellings of this name are uNkulunkulu and Nkulunkulu (Hodgson, 1982). Another Xhosa term for the original creator who produced the existing things is uMvelinqangi meaning 'the first born' (Hodgson, 1982).

Thirdly, the detached supreme being of the amaSwazi was Mkhulumqande who created the Earth and everything that lives and grows there (Marwick, 1940). His footprints can be seen in certain rocks which were not quite solid when he walked on these rocks. This version is more similar to the creation myths of Matsieng in Botswana.

Fourthly, amaNdebele in South Africa are divided into two groups, the Northern and Southern amaNdebele. A third group, amaNdebele of Zimbabwe, are the descendants of Mzilikazi kaMashobane, the king of the Matabele (amaNdebele) and his followers (Skhosana, 2009). The Northern isiNdebele term for the creator is *muhloli*, while the Southern isiNdebele refer to it as

umdali. The name for 'God' is *uZimu* (Southern isiNdebele) and *mudimu* (Northern isiNdebele) (Skhosana, 2009).

Fifthly, the remote and detached Venda creator and sky god (Raluvhimba), who was linked with the beginning of the world, resided somewhere in the heavens (Stayt, 1931). His name is derived from the word *luvhimba* meaning 'eagle' or 'the bird that soars aloft'. This being was connected with all astronomical and physical phenomena and travelled through the sky as a shooting star (meteor), or as the rumbling of thunder (*muvumo*).

Stayt (1931) indicated that the Venda had a very real concept of Raluvhimba moving through the sky, and using the stars, the wind and the rain as his instruments. Any natural event which troubled the people was a manifestation of the creator. Raluvhimba was associated with thunder, lightning, floods, prolonged droughts, comets, meteors, earthquakes, outbreaks of pests and epidemics. There was a relationship between Raluvhimba and the king (*khosi* or *musanda*), where Raluvhimba was the grandfather or *makhulu*, and the king was his grandchild (*muduhulu*).

Raluvhimba was identified with Mwarí or Nwáli. Mwarí was the Shona god who revealed himself via an oracle (the priesthood) to supplicants at Mbvumela in the Matobo (Matoba) Hills in the (then) Rhodesia (Zimbabwe). Another Venda deity, vaguely linked to the creation, was Khuswane or Khuzwane, although his origins have been lost in the mists of time. It is believed that the (seemingly) human footprints found in rocks at sites such as Mphephu, Luvhimbi and Mutale were made by Khuswane in the days when the rocks were still soft. The rocks in these areas have numerous impressions which resemble human and animal tracks (Stayt, 1931).

Furthermore, the Mandé creation myth one of the traditional creation myth in West Africa. The Mande speaking people are found in West Africa and they include the Dogon (Mali), Bamana (Mali), Malinke (Mali, Guinea, Guinea Bissau, Sierra Leone, Senegal, and Ivory Coast), Mandinka (Gambia) and Mande (Burkina Faso). Leeming and Leeming (1994) point that the creator God among the Mande is known as *Mangala*. Holbrook (2009) posits that the Mande people of West Africa have a creation myth that begins with a cosmic seed. The creation myth of Mande people is expressed in detail by authors such as (Dieterlen, 1957; Griaule & Dieterlen, 1951 & Petterson, 1956).

In conclusion, the Fang (Cameroon), the Bushango (DRC), Yoruba (Nigeria) had their own creation myths which were transmitted from one generation through oral tradition. The Basotho also trace their origins to the cosmos. They have a believe that their ancestors originate from the heavens. The cosmic knowledge and the idea of tracing the origin from the heavens is not only unique to the Basotho, various Africans people traced and belived that they come from the heavens such as the Zulu (people of heavens). In addition, the Bakalanga (people of the sun) found in Northern Botswana also trace their genesis to the cosmos, they also developed their own creation myths and deities. The following section discusses indigenous astronomy and belief systems.

2.3.12 African indigenous astronomy and belief systems

In pre-history societies, astronomy played a significant part in spiritual matters and belief systems for setting the dates of festivals, rainmaking ceremonies and determining the hours of the night. People applied their knowledge of the sky to determine the dates for spiritual festivals, rituals and sacred ceremonies. The study of the sun, moon, stars and other celestial bodies was intertwined and integrated into spirituality and belief systems of the African indigenous people.

Dobek (2013) posits that in Egypt the sun was the god “RA”, the constellation of Orion was attributed to “Osiris” - the god of the afterlife - and the constellation Sirius was attributed to the goddess “Isis”. Dobek (2013) adds that in ancient Egypt there was a belief that the rulers of ancient Egypt (the Pharaohs) turned into stars after they died and passed into the afterlife.

There is little doubt that the great Egyptian buildings were based on knowledge about the stars. As Shuttleworth (2010) states, the Great Pyramid is aligned with the cardinal points and many of the temples are aligned along the axis of the rising midwinter sun, signifying to Egyptians that they should prepare for planting in spring. Shuttleworth (2010) further indicates that the Great Pyramid of Giza is filled with astronomical significance, based largely upon religious beliefs but with its roots in astrological phenomena.

The worship of the planets, stars, moon, sun and other terrestrial bodies can be traced to the beginning of the existence of mankind and not only in Africa, but throughout various cultures in the world such as the ancient native American people, Greece, Babylon, China and India. Many Mayan (500 BC) temples were oriented to align with solar solstices, equinoxes and zenith passages (Barnhart, 2013).

Aveni (1993), Stonehenge on the Salisbury plain in England was a place of worship of the gods of nature, sun and moon. Ruggles (1989) explains that Stonehenge is oriented towards the midsummer sunrise and midwinter sunset, to mark a ritual taking place in the ring of stones. Medupe et al (2008) points out that in the Islamic world, research in astronomy was driven by two main religious practices: firstly, the requirement for Muslims to pray facing Mecca and also orient their mosques in the direction of Mecca; and secondly, the need to determine the proper times for prayers at sunrise, noon, afternoon, sunset and evening.

Islamic astronomers had understood trigonometry and this enabled them to address issues such as tracking time for prayers. The value of trigonometry was first discovered by ancient Egyptians and Babylonians, but was developed into a branch of mathematics by the ancient Greeks (Adamek et al., 2005). King (1986) and Saliba (2000), medieval Islamic astronomers also improved on the astrolabe, an instrument that was used to predict positions of stars and planets.

There is evidence that the northern circumpolar stars were associated with darkness, death and the underworld of the dead in ancient religions (Makemson, 1954). The indigenous astronomy of ancient civilization was closely related to religious practices and as such formed part of their everyday life. Fitzgerald (1951) concurs with Makemson (1954) and Britto (2013) that as agriculture developed the need to keep accurate time led to more careful tracking of the positions of the sun, moon, stars and planets, resulting in their deification when they become inextricably linked with the means of survival.

Aveni (1993) also indicates the worship of planets in ancient Babylon, where the pantheon was made up of Saturn, Jupiter, Mars, the Sun, Venus, Mercury and the Moon. Aveni (1993) further argues that special ceremonies indicate that the sun and the moon were the main gods among the indigenous cultures of Africa. The Ngas in Nigeria considered the moon a gentle, yet powerful, force and as such has to be worshipped. In contrast, the Batammailba of Togo believed that the sun is the creator.

Aveni (1993) argues that there is also some evidence that the moon related to ancestral worship in Africa, in reference to attributing death to the waxing and waning of the moon. Astronomical details were incorporated into the religion, spiritual life and belief systems of ancient peoples all over the world. Ancient peoples applied their knowledge of the stars, moon, sun and other terrestrial bodies to determine the accurate time for religious festivals, rituals and ceremonies. They simply used the

cycles of the sun, moon and planets to keep track of time. The following section discusses African indigenous worldview and astronomy.

2.3.13 African indigenous worldview and astronomy

The historiography of African indigenous worldview from the pre-colonial, colonial and postcolonial era and its connection or link to African indigenous astronomy is important discourse. Historiography is the study of the methods of historians in developing history as an academic discipline, and by extension is anybody of historical work on a particular subject (Appleby et al., 1994 & Michael, 1999).

The study argues that thousands of years before the advent of colonialism and imperialism, African societies had their own unique knowledge, philosophy, language, languaging, oral traditions and outlook about the world. Their outlook of the world was not compartmentalized, but was unique and based on spirituality and the principle of holism.

African Indigenous Worldview (AIW), African Traditional Worldview (ATW) or African Worldview (AW) are often regarded as synonymous or tantamount. African indigenous worldview has stood the test of time, survived the onslaught and domination of Western Worldview. African indigenous worldview is still very much alive and there are many common elements in the worldviews of African societies.

Barker (1999) defines worldview as the way a person tends to understand his or her relationship with social institutions, nature, objects, other people and spirituality. Makwe (1985) defines these African worldviews as an abstraction that encompasses 'holism' of African society. The philosophy of these worldviews as indicated by Makwe (1985); Ivey and Meyer (2008) is 'holism'. It has an approach that focuses on the whole living organism. There exists a number of cultural worldviews within our settings (Mpofu, 2006). To understand this existence, the power of speech, culture, orality among others are key in helping us understand African worldviews.

The concept of worldviews has been described as mental lenses that are entrenched ways of perceiving the world (Olsen et al., 1992). Hart (2010) points that worldviews are cognitive, perceptual, and affective maps that people continuously use to make sense of the social landscape and to find their ways to whatever goals they seek. They are developed throughout a person's lifetime through socialization and social interaction (Hart, 2010). It also has been suggested that in

any society there is a dominant worldview that is held by most members of that society (Olsen et al., 1992).

Nwala (1985) describes a worldview as the basic belief a people may have about their origin, nature of the universe and life existence. In general terms a worldview refers to various beliefs, practices, systems of ideas, opinions and conceptions of nature that human beings develop in order to understand nature and the world at large. Worldviews differ according to culture. Ken (2002) provides a more concise and precise definition when he states that a worldview is an intellectual perspective on the world or universe.

The study argues that African indigenous astronomy of Batswana is informed and underpinned by the African worldview, philosophy and theories and cannot be analysed using Eurocentric and Western lenses. African Indigenous Researchers (AIR) needs to wear African lenses, use African worldviews to analyse African settings. Serequeberhan (1991) asserts that all cultures deal with the same philosophical issues, which are universal.

In African people's worldviews of societal and cosmological relationships, there is a strong understanding of respect for self, other people, and all of nature, especially the land, trees and the water (Mbiti, 1969). The African worldviews look at existence from the point of view of cultures and social structures which make up communities. A communal ideology and unique worldview exists between and among African people. This common thread is inherent in most African cultures and customs despite the impact of Westernisation (Mpofu, 2006).

From these worldviews, knowledge is not necessarily based on what is researched and verified. The experience of the individual acquired from others and passed down from elder members of the community is more valued. Makwe (1985) defines these African worldviews as 'an abstraction which encompasses the total way of life of the African society. It is a psychological reality referring to shared constructs, shared patterns of belief, feeling and knowledge which members of the group that subscribe to this reality carry in their minds as a guide for conduct and the definition of reality'. Starr (1989) provides evidence of the sub-Saharan astronomical mythology and Aveni (1993) talks about Africa's socialised astronomy, while Snedegar (2000) shows that there is a wealth of indigenous astronomical practices and belief systems in Africa south of the Sahara. These brief examples serve as a proof that there is a wealth of information embedded in the field of astronomy

in Africa that needs to be explored, recognised and valued by mainstream research institutions and the education system.

There is evidence provided in previous research that ancient Africans were proficient stargazers, in which knowledge of the stellar formed part of their cosmology and worldview. Even more provocatively, the South African astronomy of Batswana, amaXhosa, amaSwati, amaZulu and other cultural groups plays a fundamental role in their daily community activities. This knowledge and practices form part of their philosophy, worldview, cosmology, mythology and religious belief systems.

Houtondji (1983) posits that the concept of philosophy has become the object of focus not only in terms of its relevance to contemporary Africa, but also, indeed, in its meaning and nature as a universal concept. Mbiti (1989) argues that African philosophy only begun to be studied properly, as an academic discipline in its own right, at the beginning of the twentieth century. African philosophy refers to the understanding, mental attitudes, logic and perceptions behind the manner in which African people think, act or speak in different situations of life (Mbiti, 1989). African cosmology is also connected to African indigenous astronomy, philosophy and worldview.

However, they are contrasted in that while the former is concerned with the universe in its entirety, the latter deals with celestial objects such as stars, planets and galaxies. Cosmology is the discipline that deals with the nature of the universe as a whole. Roos (2003) explains that cosmologists seek to understand the origin, evolution, structure and ultimate fate of the universe at large as well as the natural laws that keep it in order. Katerine and Hawley (1998) and Hetherington (1993) argue that modern cosmology is dominated by the Big Bang theory, which links observational astronomy and physics.

The Igbo cosmogony or ontology is rooted in the belief that the universe is comprised of various beings, which are interrelated (Chukwuezi, 2008). There is an interrelationship among human beings on earth, spiritual beings and finally the creator or supernatural being. The indigenous communities such as the Igbo, aborigines and others believe in the dynamic interaction and mutual relationship among these forces and beings.

The activities of the human, social, economic, political and technological are the concern of humans as well as the gods and the universe (Kalu, 1978). The cosmological worldview tends to be

validated by the various lifecycles of the Igbo, from birth to death. Chukwuezi (2008) posits that among the Igbo various rites of passage were sanctioned and related to the cosmological worldview that involved various ceremonies right from birth, the naming of a child, initiation to boyhood / girlhood, manhood / widowhood, and marriage to death.

Among African indigenous communities, it is predominantly the elderly who possess knowledge of the stars and other constellations. They are the IK experts who used their knowledge for sustainable community livelihood. However, concerns have been raised among indigenous scholars that the identification of “IK experts”, such as elders, is not simply a matter of chronological age.

It is a function of the respect accorded to individuals in the community who exemplify the accumulated knowledge, experience, expertise, values, life ways of the local culture and who possess the wisdom, the know-how and willingness to pass their knowledge on for posterity. IK experts serve as the philosophers, the organic traditional intellectuals or barefoot professors and visionaries of a cultural community what Gramsci (1971) defines as an organic intellectual. Furthermore, astronomy is not a new phenomenon in Africa and it possesses a well-documented history. What follows is the section that deals with the quest for demystifying and decolonizing research methodologies especially when it comes to indigenous astronomy and indigenous knowledge systems in general.

2.3.14 The decolonization of research methodologies

Elabor-Idemudia (2002) ask that how is it possible to decolonise research in/on the Western developing countries to ensure that the people’s human conditions is not constructed through Western hegemony and ideology?. In all parts of the world, researchers are addressing the legacy of colonialism and imperialism in research (Seehawer, 2018). Hart (2010) supports the above idea and points that the world of research is going through tremendous changes.

Past critiques of the social sciences focused primarily on the identity of the researcher and his or her relationship with the ‘subject’ Indigenous person, but over time more sophisticated and practical approaches have emerged related to participant-focused methodologies and design (Putt, 2013). More specifically, past research involving Indigenous people has been criticised as inherently biased and disempowering (Henry et al., 2004). Hence, the study argues that the quest for decolonization of research methodologies, methods and approaches is a genuine one.

There are a number of scholars who have challenged and criticised Western epistemologies, methodologies and methods, and they include Linda Smith, a Maori researcher who wrote a book called “Decolonizing Methodologies”. The book shows how Western research was used as tool of colonialism and imperialism and disregard indigenous methods. Another scholar is Shawn Wilson who is from Canada and wrote a book called “Research is Ceremony”: “Indigenous Research Methods”. His emphasise was on the research paradigm applied by indigenous researchers in Canada.

On the other hand, Margaret Kovach also wrote a book “Indigenous Methodologies: Characteristics, Conversations, and Contexts” came out in 2009. In her book, she explains and discusses in context important topics related to ethics, methods and epistemologies. Bagele Chilisa from the University of Botswana, wrote a ground breaking book published in 2012 called “Indigenous Research Methodologies”.

The list of authors provided here is not exhaustive, but just a sample of some of the critical authors and text based on the idea of decolonizing research methodologies, methods, etc. Donna Mertens, Bagele Chilisa and Fiona Cram also edited a collection called “Indigenous Pathways into Social Research: Voices of a New Generation” (2013). This is a collection of indigenous researchers from all over the world interrogating issues on indigenous methodologies and its prospects in indigenous research.

The study argues that the quest for demystifying and decolonising research methods and methodology is not new. Chiumbu (2017) argues that Anti-colonial, activist and grassroots research methods emerged in Latin America in the 1970s. Great work in this area has also been conducted in Australia, New Zealand and Canada, especially on research with indigenous communities. In South Africa, scholars such as Archie Mafeje (2000), Sabelo Ndlovu - Gatsheni (2013) and Relebohile Molestane (2015) have engaged with this issue from varied disciplinary perspectives. Indigenous communities have long experienced subjugation and domination by researchers and the quest for decolonizing research is a global struggle. Hence, the study argues that the gap between Western research methodologies and indigenous methodologies needs to be bridged and work towards reconciliation and redress.

Indigenous communities and researchers have voiced a variety of concerns with “research as usual” and emphasized the value of true partnerships, including decolonizing research to instil a balance

between Indigenous and Western frameworks and methods (Walters et al., 2009; Smith, 1999 & Rigney, 1999). Decolonizing research is a process for conducting research with Indigenous communities that places Indigenous voices and epistemologies in the centre of the research process (Smith, 1999; Swadener & Mutua, 2008).

Chiumbu (2017) posits that over the past few years debates on decolonisation have dominated scholarly deliberations. Coloniality and decoloniality are concepts that are being used by a wide range of scholars, artists, and social activists in the Americas and increasingly in Africa, Asia, Australia, and Europe (Chiumbu, 2017). This quest for decolonisation has been called the ‘decolonial turn’ which is rooted in struggles against racism, imperialism, apartheid, etc (see Maldonado-Torres, 2006 for an elaboration of this concept).

The process of decolonization requires new, critically evaluated methodologies and new, ethically and culturally acceptable approaches to the study of indigenous issues (Porsanger, 2004). Addressing indigenous scholars, Smith (1999) emphasizes that the decolonization of research methods is “about centring our concepts and worldviews and then coming to know and understand theory and research from our own perspectives and for our own purposes”.

The study argues that the interests of indigenous peoples and their perspectives in research must be prioritized. Decolonization of research theories, develop indigenous methodologies and use indigenous epistemology needs to be an agenda of indigenous scholars. Porsanger (2004) argues that this whole process allows indigenous research to break free from the frames of Western epistemologies, which are in most cases very different from the indigenous ones and are, indeed, suited to Western academic thought, but which are nevertheless foreign to indigenous ways of thinking.

Western academic research, which has usually been aimed at solving “indigenous problems” or searching for answers to a series of questions about indigenous peoples, has given power and control to the non-indigenous world because over the past few centuries this research has been affiliated to the interests of a particular (academic) group, or individuals, who have been almost exclusively nonindigenous (Cook-Lynn 1997; Bishop & Glynn 1999; Mihesuah, 1998; Harvey, 2003).

Academic and political careers, economic and professional gain, the profitable use of indigenous territories, natural resources and indigenous knowledge: these are just some of the benefits the non-indigenous world has obtained with the help of research on indigenous issues (Porsanger, 2004). This research has disempowered indigenous peoples who have long been used merely as passive objects of Western research (Smith, 1999).

The study argues in support of Smith (1999) that since colonial and post-colonial era, indigenous peoples have been subjected to research methodologies and methods that devalue them as objects, subjects and sources of information. Most research often takes away knowledge and fails to plough back to the indigenous people. Looking at Western research from an academic perspective, collecting information about indigenous peoples may be seen as a contribution to the body of knowledge. Looked at from an indigenous perspective, however, collecting information may be termed 'stealing', because the stolen knowledge has been used to benefit the people who stole it.

Smith (1999) posits that "research" is one of the dirtiest word in the indigenous world's vocabulary' and described its inextricable links to 'European imperialism and colonialism. Despite the calls for indigenisation after the end of Apartheid in 1994, methodologies in African research contexts still tend to be based on so-called Western epistemology (Keane et al., 2017). Only recently, methodological decolonisation is starting to be adapted to the sub-Saharan African context (Chilisa, 2012; Keane, 2004, 2006 & Khupe, 2014). Hart (2010) adds that research need to be research from an Indigenous stance, namely radical Indigenism.

Many critiques have centred on the theory of knowledges known as empiricism. Positivism takes a position which is derived from empiricism. Stathis and Martin (2010) indicate that in philosophy, empiricism is a theory that states that knowledge comes only or primarily from sensory experience. Forrest and Kaufmann (2008), empiricism emphasises the role of empirical evidence in the formation of ideas, over the idea of innate ideas or traditions.

However, empiricists may argue that traditions (or customs) arise due to relations of previous sense experiences (Loeb, 1981). Empiricism, often used by natural scientists, says that "knowledge is based on experience" and that "knowledge is tentative and probabilistic, subject to continued revision and falsification" (Shelley, 2006). Empirical research, including experiments and validated measurement tools, guides the scientific method.

Some of the proponents and extremists of empiricism includes Persian philosopher Avicenna, Sir Francis Bacon, members of the British Empiricism school John Locke, George Berkeley and David Hume. From an indigenous perspective, Western research is more that research that is located in a positivist paradigm. It is research which brings to bear, on any study of indigenous peoples, a cultural orientation, a set of values, a different conceptualization of such thing as time, space and subjectivity, different competing theories of knowledge, highly specialised forms of language and structure of power (Smith, 1999).

The epistemic decolonial turn is thus a project that aims to “epistemologically transcend, decolonize the Western canon and epistemology.” (Grosfoguel, 2007). However, as Mignolo (2011) reminds us, decolonial turn is a not a new phenomenon, not least in Africa. It can be traced to thinkers of liberation like Aime Ceasaire, Amilcar Cabral, Franz Fanon, Cheikh Anta Diop, Kwame Nkrumah, Walter Rodney, Thomas Sankara, Steve Biko, to name but a few.

The term ‘Coloniality’ in simple terms refers to the ‘continuity of colonial forms of domination after the end of colonial administration’ (Grosfoguel, 2007 & Maldonado-Torres, 2007). Coloniality exists in the realms of power, knowledge and being. Coloniality of knowledge refers to the manner in which Eurocentric knowledge systems are privileged over other knowledges and epistemes (Mignolo, 2007).

Oelofsen (2015) points that decolonisation is the change that colonised countries go through when they become politically independent from their former colonisers. However, the study argues that decolonisation is not just about political independence, it is also about economic, cultural, spiritual and intellectual independence. Smith (1999) argues that decolonisation does not mean a complete rejection of all so-called Western theory or knowledge, but a coming to know through the perspective of the researched. This includes following local ethics protocol, employing data collection methods that build on the epistemologies of the research participants and an agenda that contributes to their own purposes. It is a process which engages with imperialism and colonialism at multiple levels (Smith, 1999).

Research is, therefore not an innocent or distant academic exercise but an activity that has something at stake and that occurs in a set of political and social conditions (Smith, 1999). The above is supported by Denzin, Lincoln and Smith (2008) that in the colonial context, research becomes an objective way of representing the dark skinned other to the white world. There is

evidence that during research reports compiled by anthropologists and archaeologists were incorporated in colonizing strategies to control, dominate and subjugate the “other”. Suziki (1998) and Rain (1999) question the western scientific quest for objectivity in research in indigenous communities.

Chilisa (2012), research is systematic, i.e. it is the adoption of a strategy or a set of principles to study an issue of interest. She further indicates that it usually starts with the identification of an area of interest for the study; a review of literature; the choice of research design or strategy, sampling procedure and instruments of data collection; the analysis; and interpretation and reporting of findings.

There has recently been a growing awareness internationally of the critical role of using indigenous methodologies and decolonize research. Furthermore, there are a growing number of indigenous researchers coming from indigenous communities. Smith (ibid) further states that some methodologies regard the values, beliefs, ways of knowing and customs of communities as barriers to research or exotic customs with which researchers need to be familiar with in order to carry out research without causing an offence.

In the past and recently, research on indigenous knowledge has been carried out by non-indigenous researchers using Western theories, languages and epistemologies that have no relation and inappropriate with regard to conducting research among indigenous people. Te Awekotuku (1991) argues that research is the gathering of data not for its own sake, but for its use with a variety of applications. It is about power, control and taking away knowledge without acknowledging the original sources. However, there is a growing international community of indigenous scholars advocating for indigenous researcher, indigenous research protocols and indigenous methodologies.

The study argues that the Bakgatla -Baa- Kgafela in South Africa and Botswana, like other indigenous groups in Africa, and the world at large, have had first-hand experience of such disempowerment of researchers who have taken their knowledge and claimed it as their own. This is an experience common amongst indigenous and colonised peoples, as explained by Memmi (1965): The memory which is assigned him is certainly not that of his people. The history which he is taught him is not his own. He and his lands are non-entities or referenced to what he is not.

Ntsoane (2002) in defence of new methodology that is linked with grassroots states that as long as the tools and instruments of research, including the types of research posed, are not worked out together with the indigenous communities themselves, the problem of understanding endogenous knowledge will persist. Indigenous researchers should be encouraged to form and work within networks designed for the exploration and implementation of new methods of gaining knowledge from their own communities, as well as to provide guidelines ensuring the preservation of endogenous and the respect of its experts.

In the final analysis, indigenous knowledge has the capacity to play a critical role in the articulation of indigenous research methodologies (Chilisa, 2012). Indigenous knowledge can play a fundamental role in decolonising the understanding and the application of the concept research. Indigenous peoples need to develop their own indigenous researchers who can carry out research on indigenous knowledge by means of indigenous languages, indigenous methodologies, indigenous theories and epistemologies that are appropriate and relevant.

Indigenous researchers have a noble task of redeveloping their own epistemological and philosophical frameworks that underpin their research in indigenous knowledge. Maori culture and values have, for instance, been used to craft Kaupapa Maori and Whanaungata theoretical frameworks and methodologies (Bishop, 2008 & Smith, 1999). Chilisa (2012) asserts that indigenous knowledge-driven research can enable research to be carried out in a respectful, ethical ways that are useful and beneficial to the indigenous communities.

The philosophy of Africanity privileges Africa as a starting point of subjectivity. Mafeje (2000) has called this *endogeneity* which is a scholarship grounded in and driven by the affirmation of African experiences and an intellectual standpoint derived from a rootedness in the African conditions. Mbembe (2015) decolonisation “is not about closing the door to European or other traditions. It is about defining clearly what the centre is”. So it’s not ignoring Western knowledge, but it is about re-centring Africa and its experiences.

The study argues that it is fundamental that we develop a critical mass of indigenous researchers who are fearless of epistemic disobedience, as Mignolo (2009) states. We need to design methods that speak to our realities, methods that are participative, interactive and emancipatory, and of course ethical. Mafeje (2000) advocated for combative methodology, which by its very nature is

disobedient. The following section provides the role of indigenous languages in decolonizing research.

2.3.15 The role of indigenous languages in decolonisation of research

Doing research in local indigenous communities can presents a number of challenges especially when foreign languages are applied. This research does not encourage the use colonial languages such as English in doing qualitative enquiry in local communities. Otherwise, it encourages researchers to creative conducive conditions for local people who might often be illiterate, and one of way of dealing with this is using their local language.

Ngugi wa Thiongo (1993) states that indigenous languages are crucial because it is through language that people formulate their thoughts. Ngugi wa Thiongo (1993) argues that indigenous languages are our common heritage. Using indigenous languages in conducting research in indigenous knowledge is a method of decolonization. The fundamental role of indigenous languages in Indigenous Knowledge and indigenous astronomy research is the one that has occupied one of the most obscure positions in the national agenda of many African states.

Little attention has been paid to the strategic and practical empowerment of indigenous languages and the fear of their extinction is rising. Anchimbe (2006) indicates that African indigenous languages including Setswana are facing a predicament of extinction in the wake of globalisation due to the empowerment of other languages of colonisation, imperialism, industrialisation, technology and international currency.

Battiste et al (2000), Macedo (1999) and Smith (1999) argue that since European colonisation, Indigenous Knowledge systems, associated language systems, communication systems and other indigenous forms of meaning construction have not been validated or legitimised by the Western academy or its formal schooling system.

The European colonisation of Africa generated linguistic problems, such as socio-cultural dichotomy of mixed or undefined identity and the redefinition of the roles of African indigenous languages, which basically isolates them to a range of narrow, indigenous, home and cultural functions of no real impact to the nation state (Robinson, 1996).

Cajete (2000) argues that despite the persistence of colonial and neo-colonial ideologies that devalue and marginalise Indigenous Knowledge, as a lesser form of knowledge construction, indigenous epistemologies have remained at the heart of counter hegemony narratives of resistance enabling the survival of indigenous peoples' cultural heritage. This is based on the fact that systems of knowing cannot be separated from language, as the medium of communicating ideas and belief systems.

Language expresses the uniqueness of a group's worldview, traditions and way of life. Sidney (2000) elaborates that interaction between the education of indigenous students and Western educational systems marginalised indigenous languages, indigenous ways of knowing, including pedagogies and epistemologies, in the name of civilisation and development. In Cameroon, as Anchimbe (2006) explains, the official languages of English and French dictate the standard for all education-related jobs, government employment, the media and education and thereby continuously marginalising indigenous languages.

English and French represent the technological, economical and global world, while the indigenous languages are local vernacular, some of which carry with them degrees of derogation. The imposition of these foreign systems of knowing's impact led to the marginalisation of indigenous languages in the education systems of Africa. African knowledge systems, indigenous astronomy captured in indigenous languages reflect peoples relationships and connection to the cosmos, universe, natural and cultural environments.

Indigenous language and knowledge are indispensably part of African indigenous identity and it needs to be integrated it into the education system. These languages convey a sense of identity, responsibility and of spiritual relationship to the universe. Despite language being at the heart of indigenous culture and knowledge retention, colonialism, other forms of imperialism and globalisation contributed to the marginalisation of indigenous languages, which are essential for promoting indigenous ways of knowing as well as knowledge about the stars and other constellations.

Indigenous peoples, especially elders, believe that without language, the wealth of knowledge of the sky and its essence will be lost - especially if it is not mainstreamed into education systems. They (indigenous peoples) consider language the most fundamental way through which cultural information and ways of knowing such as indigenous astronomy are communicated and preserved.

Settee (2008) indicates that language's important relationship to knowledge and the survival of a culture requires that any discussion of Indigenous Knowledge systems must include language retention. The imposition of foreign languages has caused the loss of indigenous knowledge systems and indigenous astronomy.

Settee (2008) indicates that it is important that both community-based and higher learning institutions, with the support of communities and governments, work together to preserve the cultural diversity of indigenous communities through the support of indigenous languages. This can be achieved by valuing African indigenous languages and communication systems at mainstream universities and schools.

Many governments in Africa, including South Africa and Botswana, have introduced a number of laws and legislation in favour of indigenous languages, but they have not been actively involved in their promotion. Adoption of indigenous languages in the school curriculum is still a pipedream and they have no state-recognised roles.

This neglect speaks for itself and eloquently explains why indigenous languages are not a priority to many governments. As part of the redress of the language injustices of the past, Echu (1999) and Alobwede (1998) argue that the standardisation, alphabetisation, teaching and research of indigenous languages in schools and higher institutions of learning are essential. The radical shift of indigenous languages from a derogatory position and mainstreaming them into the economy and education system is a necessity and should be prioritised.

After the new democratic government was established in South Africa, a number of initiatives were undertaken with regard to language development and promotion, which include the Pan South African Language Board Act (59/1995) (PANSALB); Language Plan Task Group (Langtag); the Commission for the Promotion of Cultural, Religious and Linguistic Communities (CRL Commission); the National Language Policy Framework; the Language in Education Policy; the Norms and Standards of Language Policy (which regulates language policy in schools); the Language Policy of Higher Education (which regulates language policy in higher institutions); and the Constitution that recognises the right for every individual to speak, write and read his or her own language.

Notwithstanding a plethora of enabling legislation and policies in language promotion, it seems as if the predicament of indigenous languages is growing deeper. The predicament of indigenous languages in South Africa was summarised by the Sunday Times (2004) as follows: “We find that our 10 year old democracy has been the greatest enemy of indigenous languages. All the lofty pronouncements made in the early days of transition seem to have been thrown out of the window and the authorities have paid token attention to the issue”.

The work of government is conducted virtually in English and the language of our cultural diverse parliament is almost exclusively English. Many senior politicians stay away from African language radio stations, presumably because they perceive those audiences as not sophisticated enough. Universities are battling to keep African language departments open as student numbers dwindle. Books publishing in indigenous languages are on its deathbed and the use of these languages among native speakers is becoming unfashionable. The memory which is assigned him is certainly not that of his people. The history which he is taught him is not his own. He and his lands are non-entities or referenced to what he is not.

In South Africa, Botswana and throughout the African continent at large there is lack of commitment by various governments to the systematic implementation of language policies. Pennycook (2000) and Ricento (2000) point out that language policy and planning, after all, are contextually determined and its implementation should be evaluated by taking into account relevant social, cultural and economic interests.

The above is supported by Kaplan and Baldauf (1997) that language planning activities fits the top down model of people with power and authority that makes language-related decisions with little or no consultation with the ultimate learners or users. It could be concluded from the above that a retrospective view of our decade of democracy offers a window of opportunity to reflect back and take a stock of the successes and challenges of language policy development and implementation, especially in the context of Indigenous Knowledge Systems. The following section provides a summary of research on indigenous astronomy of Batswana.

2.3.16 A synopsis of research on Batswana indigenous astronomy

In this study the term “Indigenous Astronomy” will be used to refer to an explicit, distinctive, creative or original knowledge, beliefs, philosophy, worldview and interpretation of sun, moon, stars, constellations and the physical universe among the African communities in particular.

However, other examples of indigenous astronomy from other parts of the world will also be used in this study.

It is used to reflect the sky knowledge and wisdom of the Batswana and its significance and relevance. Indigenous astronomy is a combination of two words “indigenous” and “astronomy” which have been a point of debate among scholars and researchers in international forums, conferences and workshops. The two words have been conceptually and operationally defined in the above section, hence they will not be repeatedly defined in this section.

The interpretation of the physical universe was based on their indigenous knowledge and was more important to the study communities thousands of years ago. Medupe (2012), for many years, Africans used their knowledge of the night sky in their daily lives and through their interactions with Islam West Africans and studied mathematical astronomy in their schools. Indigenous astronomy is one of the oldest, however quite a negated, new phenomenon in the academic and research. Most of the literature on Setswana interpretation of the universe is very out dated and written by foreing researchers with no holistic understanding of Batswana cosmology.

One of the first recognised published journal on indigenous knowledge of the sky in Southern Africa was by Hammond Tooke, in the late 1888. There are, however, several other scholars such as Casalis (1861), (Kuper, 1944), Warner (1996) and Snedegar (2006). Many scholars, such as Senkintu et al (1956) and Aveni (1993), have recently written extensively about African star lore, especially among the Zulu and Batswana cultures of Southern Africa. Casalis (1861) relates how the Southern Basotho and Batswana viewed the sun as male and moon as female.

For it is interesting to observe gaps in the literature that this documented work tended to concentrate on the philosophical and religious aspects of this knowledge. In fact, this old literature on Indigenous astronomy compromisingly describes it as a meagre star lore, naked eye or folk astronomy with no space in modern astronomy. Contrary to this, the study argues that, it is not just philosophical, but a science in its own right which is holistic and encompasses some knowledge of astrology, archaeoastronomy including cultural astronomy. The artistic, scientific, pedagogical significance of this knowledge has often been ignored.

In South Africa, the teaching and learning of astronomy has historically formed part of the geography curriculum at both primary and high school levels. However, despite this intended

provision for a good grounding in basic astronomy at school level, many students finish school with very weak background knowledge in this area (Atwood & Atwood, 1996; Moseloane & Stanton, 2005; Kelfkens & Lelliott, 2006).

In the context of this thesis, the basic understanding of astronomy should be able to build on the cultural and indigenous understanding of the concept of astronomy, to make it relevant and appropriate to the majority students who come from a background based in traditional cultures. Moreover, in South Africa, recent research into the state of science and mathematics education by the Centre for Development and Enterprise (CDE), described the poor performance and participation in mathematics and science as a national crisis, with the effects being most evident in respect of African learners (Reddy, 2006 & CDE, 2004).

The consequence of the findings of research, as that conducted by CDE, implies that if there are no African students who are being effectively and professionally exposed to mathematics and science, it will also mean that South Africa will lack in increasing percentages, the number of original African astronomy experts who are not just acknowledged locally, but internationally reckoned. This thesis argues as such that projects like the Square Kilometre Array (SKA) will not be driven or benefit the majority of African students, especially in South Africa, based on its poor performance in mathematics and science.

International research in astronomy education has indicated that indigenous astronomy has not become part of the learner's body of knowledge in formal education system. The weak background knowledge encountered by the students in various fields such as astronomy, science and mathematics may thus be ascribed to inappropriate or inadequate teaching at school level. This is especially the case in South Africa, where the apartheid regime left a negative legacy that is likely to have an impact for generations to come.

Jegade (1998) posits that science education research in international multicultural situations has suggested that conceptual difficulties could be related to the idea that the learner's understanding of any new meaning is strongly influenced and determined by prior knowledge that is in turn determined by cultural beliefs, traditions and customs governed by a worldview.

It has thus been suggested that in traditional societies, cultural beliefs can impede the construction of scientific concepts. It has even been suggested that traditional cultural understandings can result

in scientific explanations being seen as a “pack of lies” (Abimbola, 1977). Bailey and Slater (2003) argue that much research has been conducted internationally in the rapidly growing field of astronomy education. However, there is still much desired when it comes to the systematic, empirical research in African indigenous astronomy.

While the fairly recent review of research in astronomy education by Bailey and Slater (2003) contains no reference to research in Setswana astronomy education in Africa at all, there have been some studies in African cosmology that have appeared in the “Science Education Literature”, notably those by Ogunniyi (1987, 1996). However, these have focused on issues of worldview related to learning in science, rather than investigating misconceptions or interventions specifically related to astronomy education. The following section is about the knowledge and significance of stars among the Batswana.

2.3.17 The knowledge and significance of stars among Batswana

Among the Batswana, knowledge, philosophy about the stars is held by elders. Using their own natural astronomical instrument (eye) they developed names, songs, poems, stories, riddles about the stars which were significant to them. Glegg (1986) posits that in Setswana, the stars are commonly known as *dinaledi* and they are regarded as the spirits of the dead; their brightness being related to the importance of the person in his earthly existence, or inversely to the length of time he or she had been dead.

Leeuw (2007) indicates that for the sky and stars, there is a Setswana riddle that says *mosese wa mmankgathi, maranthata* which means the dress of the painter is a myriad patterns. This demonstrates that Setswana astronomical nomenclature is woven deeply in Batswana culture and language. Batswana like many other cultures, developed systems of names or terms about different types of stars, such as *selemela*, *naka*, *kopadilalelo*, *kgogamasigo*, etc whose meanings will be discussed below. Naming “things” is a part of general human communication using words and language.

There are different version among the Batswana with regard to the importance and meaning of stars. People use stars for time reckoning / computation, temporal planning during a specific night, month, season or year, as a medium (Fabian, 2001). Snedegar (1995) stars and asterisms helped South African people define temporal locations within a seasonal framework.

Stars are large balls of burning gas mainly consisting of hydrogen and helium and which are self-luminous (Alcock, 2014). The above is supported by Mark (1987) that stars are other Suns, a giant balls of incandescent gas. There are about millions stars in the sky, however, about 2500 stars are visible to the naked eye on a clear and dark night sky (Alcock, 2014).

Mark (1987), stars vary in size, colour, temperature and physical behavior. The true understanding of the nature of stars only began with the advent of stellar spectroscopy (Mark, 1987). When discussing major stars, brighter stars are more important in specific cultural lenses. Fabian (1992) points that stars are perceived due to their brightness, color and movement in ordered regularity, as something beautiful, both aesthetically and as a pattern for appropriate relationships and responsibilities.

Many of stars in Southern Africa, not unexpectedly, are bright and relatively easy to find in the heavens with the unaided eye. Few experiences can be more inspiring than that of a starry night out in the African bush, where Nature's primeval splendour embraces the imagination as well as the senses. Here the night comes alive.

Constellation are essentially a northern hemisphere concept and where not a feature of South Africa of yesterday (Alcock, 2014). However, certain associations of stars were known to indigenous inhabitants in Southern Africa (Alcock, 2014). Scholars such as Fabian (2001) and Snedegar (2007) provided some critical examples of the identified stars, constellations which are significant among the Batswana and the major ones will be discussed in this section. The well-known author and political activist, Solomon Plaatjie (1876 - 1932) wrote about astronomic matters in two Setswana / English language newspaper which he edited known as *tsala ya Batswana* (friend of Batswana people) and *tsala ya batho* (friend of people).

Fabian (2001) posits that for many people throughout the world, careful and interesting star gazing was of vital importance. The study argues that Batswana did not have access to modern scientific equipments such as the telescope, despite this, they had knowledge of different stars which played a significant role in their sustainable livelihood. Among the Batswana, stars were also important in agricultural cycles and navigation (Glegg, 1986). The above is supported by Fabian (2001) who argues that people use stars for time reckoning, temporal planning during a specific night, month, season or year, as a medium.

In modern astronomy, the naked eye may be used to observe astronomic events and objects visible without equipment, such as passing comets and meteor showers, etc (Davidson, 1993; Kahmen, 1999 & Gerstbach, 2000). However, this study argues that the Batswana were not just meagre or ordinary stargazers, they had a particular worldview, philosophy, relational ontology with the cosmos and the stars played a significant role in their daily livelihood.

In addition, Snedegar (1995) states that together, stars and species informed man of the order and unity of an African cosmos, a worldview that must have been as satisfying as it was beautiful. In modern Western astronomical terms, a star is type of astronomical object consisting of a luminous spheroid of plasma held together by its own gravity (Iben, Icko Jr. 1991). Modern Western astronomy has organised the entire starry sky into 88 formal constellations so that every star can be accurately identified and located (Fabian, 2001).

Many other stars are visible to the naked eye from Earth during the night, appearing as a multitude of fixed luminous points in the sky due to their immense distance from Earth (von Spaeth & Ove, 2000). Stars are also present in day time, the sun much brighter luminance renders them invisible to the naked eye (Fabian, 2001). The above is supported by Mack (1987) that stars are other Suns, a giant balls of incandescent gas. There are about millions stars in the sky, however, about 2500 stars are visible to the naked eye on a clear and dark night sky (Alcock, 2014).

Mack (1987) points that stars vary in size, colour, temperature and physical behavior. The true understanding of the nature of stars only began with the advent of stellar spectroscopy (Mack, 1987). Many of stars in Southern Africa, not unexpectedly, are bright and relatively easy to find in the heavens with the unaided eye. The sky is divided into 88 areas or constellations (Astronomical Society of Southern Africa, 2017).

A constellation is a group of stars that are considered to form imaginary outlines or meaningful patterns on the celestial sphere, typically representing animals, mythological people or gods, mythological creatures, or manufactured devices (Kovalevsky, Seidelmann & Kenneth, 2004; Britton, 2010 & Rogers, 1998).

Naming of constellations dates back to ancient civilization. The above is supported by Mack (1987) that ancient astronomers split stars up into random groups called constellations. Names and boundaries of constellations were officially agreed on in a 1930 resolution of the International

Astronomy Union (Britton, 2010 & Ridpath, 1988). Most of constellation names are *Latin*, although several are derived from Greek.

The following are the examples of commonly known constellations, *Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricornus, Aquarius, and Pisces*. Constellations are different from some familiar star groups called asterisms. Asterisms are a small group of stars that forms visible pattern but it is not a constellation (Allen, 1969; Burnham, 1978; Michanowsky, 1979 & Pasachoff, 2000). The most famous examples are the Pleiades, Big Dipper (Ursa Major) and Little Dipper (Ursa Minor).

However, certain associations of stars were known to indigenous inhabitants in Southern Africa (Alcock, 2014). The study argues that stargazing was not only limited to the Greeks and Romans, infact various cultures had knowledge about stars and groups of stars and this reflected their views and ways of life. Historically, the most prominent stars were grouped into constellations and asterisms, the brightest of which gained proper names (North, 1995 & Murdin, 2000). According to Mack (1987) supported by the Astronomical Society of Southern Africa (2017) points that *Mons Mensae* is the only constellation named after a geographical feature (Table Mountain) and this is the creation of a French astronomer La Caille who visited the Cape Peninsula in the early 1750s.

Like other people elsewhere in the world, Southern Africans had extensive lists of constellations and star lore associated with them (Medupe, 2015). Some of them, such as the Southern Cross (Giraffe stars), were quite useful for navigational purpose. As early as 1888, Tooke (despite his repulsive racist tone and language) noticed the remarkable star knowledge of the Khoisan and their pictorial talent (as he puts it).

Warner (1996), in San mythology the stars are animals or people of earlier times; the names given to them usually represent animals that are abundantly available at the seasons that the stars are prominent". Beyer (1919) first presented a small chart of the Basotho and Batswana stars and constellations. Snedegar (1997) expanded on this to include isiZulu and isiXhosa star names and gave good justification for linking some Southern African constellations with European ones.

Batswana have knowledge about major, brighter, groups of stars and their significance in their lives. When discussing major stars, brighter stars are more important in specific cultural lenses. Stars are perceived due to their brightness, color and movement in ordered regularity, as something beautiful,

both aesthetically and as a pattern for appropriate relationships and responsibilities (Fabian, 1992). Sirius is the brightest star followed by Canopus in the night sky (Alcock, 2014). Brosch (2008) and Holberg (2007) Sirius is also known colloquially as the "Dog Star", reflecting its prominence in its constellation, Canis Major (Greater Dog).

Many cultures have historically attached special significance to Sirius, particularly in relation to dogs. The Egyptian civil calendar was apparently initiated to have its New Year "Mesori" coincide with the appearance of Sirius (Holberg, 2007). The above is supported by Rappenglück (1999); Hart (2005) and Muller (2004) that the ancient Egyptians based their calendar on the heliacal rising of Sirius and devised a method of telling time during the night, method based on the heliacal risings of 36 stars, a star for each 10-degree segment of the 360-degree zodiac circle.

The Dogon people are a cultural group in Mali, West Africa, reported by some researchers to have traditional astronomical knowledge about Sirius that would normally be considered impossible without the use of telescopes. However, the Dogon and their knowledge of Sirius is a subject of controversy in modern astronomy. This analysis demonstrates that knowledge of the stars, the Milky Way, constellations among the Batswana held cultural, spiritual and cosmological significance. It is important to move beyond the Eurocentric and narrow view of Batswana knowledge of the stars commonly portrayed in previous re-search. There is a need to lay ground work foundations for future researchers to use the lens, and language of the local communities in conducting their research. The following section provides the discussion of *Selemela*.

2.4 Selemela

The most famous asterism or star cluster among the Batswana is known as *Selemela* or the Pleiades. Fabian (2001) posits that among the Batswana they are an important group of stars and they signify the time to cultivate. The Pleiades, play an important role in southern African indigenous astronomical beliefs and they were used for regulating the cultivation season. Sparavigna (2008) posits that for many ancient populations, the Pleiades were relevant stars and their rising was marked as a special time of the year.

Medupe (2015) points that pre-colonial Southern Africans were largely agriculturists who depended on changes in the night sky and on earth to predict seasons. Although Tempelhoff (2008) suggests that there were sites of irrigation-based agriculture during pre-colonial Southern Africa, most of

agriculture in this region dependent heavily on rainfall. Therefore, it was critical each year, for tribes to commence cultivation at roughly the time of the first rains in September.

The Africans have a particularly strong tradition of observing the Pleiades. Some people viewed the cluster as a group of six or seven stars, one Shona name for them being *Chimutanhatu*, simply 'the six,' another *Chinyamunomwe*, 'the seven.' A tshiVenda riddle asks: "I counted which stars and had to give up?" The correct reply is "the Pleiades." Stayt (1931) reports that the Venda discerned only six stars. A Shona term, *chirema*, meaning 'lame' or 'abnormal,' is also applied to the cluster, suggesting that the Pleiades were seen as an unnatural conglomeration. The Zimbabwean journalist J. Gandari described the cluster as small stars held by an unknown attraction awaiting a time when they could fall away to an independent life as do children when they leave the home (McCosh, 1979).

Ambrose (2000) refers to this star cluster as the cultivator, because the Pleiades appear in spring rising to the North Eastern horizon, a little while after dark. It then the time for cultivation to commence. The Pleiades often played an important role in the agricultural lives of black African communities. Obenga (1982) points out that among the Lobi of West Africa planting of crops is done as soon as the Pleiades appears. Hard (2004) points that they are called the Seven Sisters in Greek Mythology.

Sparavigna (2008) Pleiades are an open cluster in the constellation of Taurus. They are most obvious to the naked eye and they gained special place among the Batswana and many other ancient cultures. In Kiswahili the Pleiades are known as *Kilimia*, 'the Digging Stars.' Referring to the *vuli* and *masiku* rainy periods of East Africa, and by implication the cultivating seasons associated with them, a Swahili proverb runs: "If the Digging Stars set in sunny weather they rise in rain, if they set in rain they rise in sunny weather."

Widely dispersed by the migration of Bantu people, the observation of the Pleiades' rising and setting became commonplace throughout Eastern, Central and Southern Africa. Interpretation of these events varied in accordance with local weather patterns, but the general tradition was so strong that many African people knew the stars by the same title.

For the Nyasa of Malawi the Pleiades are *Lemila*; the Venda call them *Tshilimela*; the Karanga, *Chirimera*; the Tsonga, *Xirimelo*; Basotho-Tswana, *Selemela*; and Zulu, *isiLimela*. Stayt (1931)

derives the Venda *Tshilimela* from the verb *u lima*, 'to plough.' Von Sicard (1966) finds the Shona root *-rima*, meaning 'to till, cultivate or hoe.' IsiZulu dictionaries render *isiLimela* as 'the Digging Stars,' also implying hoeing (the hoe had been the principal cultivating implement in Southern Africa before the introduction of the plough by Europeans).

Bororo men, especially on a clear and dry night of reclining on palm mats in the village plaza to view the myriad brightly colored stars in their firmament or sky (Fabian, 2001). The single most important stellar phenomenon to the Bororo are the Pleiades, coincidentally pluralized in Bororo as *Akiri-doge* (while *akiri* is white down, the name actually refers to numerous small, white or down like flowers of the *akiri-i* (Bororo) or *angico* (Portuguese) plant, a tropical legume). This asterism is used to gauge the passage of time during the night, but also serve for seasonal timing of significant cultural activities.

The Pleiades are known and important in various religious cosmologies and mythologies. Harness (1999) in Indian astrology the Pleiades were known as the nakshatra *Kṛttikā* which in Sanskrit is translated as "the cutters". The above is supported by Von Del (1982) that among the Indians, the Pleiades are called the *star of fire*, and their ruling deity is the fire god Agni. The Pleiades heliacal rising was widely recognised in Austral regions, as the beginning of the new-year and then of agricultural season (Sparinga, 2008).

To the Maori of New Zealand, their heliacal rising signifies the beginning of a new-year. For the Bronze Age people of Europe, the Pleiades started to be associated with mourning and funerals Sparinga (2008). What is remarkable about the Pleiades is how significant they seem to be in so many systems of indigenous astronomy, especially as primary seasonal indicators, predict rainy seasons (Fabian, 2001).

Urton (1981) posits that among the Runa of central Peruvian Andes, the Pleiades are called storehouses and are related to the cycle of maize cultivation. They are called the winter stars in the Northern Hemisphere and summer stars in the southern hemisphere and were known since ancient times. They are well known among the Batswana, Maori and Australian Aborigines, Chinese, Maya and Aztec and Native peoples of North America.

In a nutshell, the Africans, including the Batswana have a strong tradition of observing the Pleiades (Snedegar, 1995). Africans developed riddles, songs, stories, poems and artefacts about this group

of stars. They were well known not only among the Batswana, but even among the amaVenda, Shona, among the Tsonga, amaZulu and as far as Malawi. The following section is about the meaning of *mphatlalatsane* and *kopadilalelo* among the Batswana.

2.4.1 Mphatlalatsane le Kopadilalelo

The Batswana, like the amaXhosa, amaZulu and other ancient cultures regarded Venus as two distinct celestial bodies called the morning star or *mphatlalatsane* and the evening star *kopadilalelo* (Alcock, 2014). Glegg (1986), the Batswana people of South Africa called the evening appearance of Venus *kopadilalelo* and its morning appearance *mphatlalatsane*. This is one of the well-known and major and brighter star among the Batswana visible to the naked eye. According to Cain (2008), Venus which is a planet not a star have got nicknames and is referred to as the morning and evening star. The above is supported by Kumar (2014) that the brightest object in the sky after sun and moon is not a star but a planet which is Venus.

Kumar (2014), in the ancient time, people believed that the evening and morning stars are different objects. The ancient Greeks and Egyptians thought that Venus was actually two separate objects, a morning star and an evening star. The Greeks called the morning star Phosphoros, “the bringer of light”; and they called the evening star Hesperos, “the star of the evening (Cain, 2008). A tradition is reported that if *kopadilelo* is not visible at ploughing time, there will be drought, and if it does appear, then there will be a good harvest (Glegg, 1986). Venus is clearly visible in the evening at ploughing time roughly four or five times a decade (though not necessarily every other year), a pattern which does not correspond to the known rainfall pattern (Glegg, 1986).

The orbit of Venus is inside the orbit of Earth. Unlike the outer planets, Venus is always relatively close to the Sun in the sky. When Venus is at its brightest, it becomes visible just minutes after the Sun goes down. This is when Venus is seen as the evening star. When Venus is on the other side of the Sun, it leads the Sun as it travels across the sky. Venus will rise in the morning a few hours before the Sun. Then as the Sun rises, the sky brightens and Venus fades away in the daytime sky. This is Venus the Morning Star (Cain, 2008). The star known as *kgogamasigo* is discussed in the following section.

2.4.2 Kgogamasigo

Fabian (2001), the Batswana had knowledge of the star called “*kgogamasigo*”. It is said to be visible throughout the night in summer and it pulls the night across (Glegg, 1986). The name is

derived from the name of the part of the plough to which the drought animal is attached. Fabian (2001) points that it rises at around 4:00 am in November, the time to feed and water the oxen in the ploughing season so that maximum use can be made of daylight hours.

Glegg (1986) indicates that *kgogamasigo* it is most probably Arcturus (Bootes), possibly Sirius or one of the stars in the constellation of Orion. Ambrose (2001) citing Matumo (1993) support (Fabian, 2001) and Glegg (1986) including Brown (1968) that *kgogamasigo* is said to be Arcturus. Some scholars such as Breutz (1955) reports that Mars was the star known as *Kgogamasigo*. Other scholars rejects the idea of Arcturus and argue that the star under discussion is known as Spica. Hence, the study argues that there has been controversy around the star *kgogamasigo* especially by Western researchers with regard to the naming and the nature of this particular astronomical phenomena. The star called *dithutlwa* is discussed below.

2.4.3 Dithutlwa

Glegg (1986) and Fabian (2001) state that the Setswana name for Southern Cross is *dithutlwa* which literally means giraffes. Reference here is made to the giraffe, with the two brightest stars of the cross (alpha and Beta Crucis). Being male giraffe, and the two others stars (gamma and delta Crucis (as female giraffe). The false cross is known as the *thutlwa e namagadi* or female giraffe (Ambrose, 2000 citing Matumo, 1993).

The Southern Cross has found its way into the heraldic consciousness of a number of southern nations (Astronomical Society of Southern Africa, 2017). It appears in the national flags, state flags and also appears on the coins of many countries. Fairall (2006) states that the Cross itself is an easily recognisable pattern, almost as symmetrical as a manmade cross. The following section provides a discussion on the star known as *naka* and its meaning among the Batswana.

2.4.4 Naka

Some of the significant star well known among the Batswana include Canopus commonly known as *Naka*. The Basotho, Batswana and Venda people traditionally knew Canopus, the second brightest star in the night sky, as *Naka* or *Nanga* in Venda, “the Horn Star.” For the Zulu and Swazi it was *inKhwenkwezi*, *Khwekheti* to the Tsonga, simply meaning “brilliant star. The Basotho-Tswana initiation schools commenced upon morning sighting of the *Naka* star (Canopus), this happened during the month of May, at the beginning of winter (Snedegar, 1997).

The calendrical significance of Canopus is more clearly discerned among the Basotho-Tswana people than with the Nguni (Snedegar, 1995). *Naka* was said to break up the year and to burn up anything green in nature as it heralded the winter season and the browning of the veld. *Naka* or *Canopus* should be visible in the pre-dawn sky by the third week of May (Snedegar, 1995).

Among the Venda the first person to see *Nanga* at that time of year would sound the *phalaphala* horn from atop a hill. He would receive a cow as a prize. The Lobedu considered the first person to view *Naka* as having good luck. Upon learning that *Naka* had been spotted the people would chant, “*Naka* has come out, the boy has come out” (Krige, 1931). The star’s dawn rising was a signal for rainmaking ceremonies to proceed; it also had some connection with the Wolika boys’ initiation ceremony.

Beyer (1919) maintained that every year the Basotho carefully watched for *Naka* toward the end of May. Like their Venda counterparts, Basotho kings awarded a cow for the earliest sighting of *Naka*. On the day of the sighting the kings would call their medicine men together. Throwing their bone dice, the doctors would judge whether the new season would be favourable or not. One of the most easily recognizable constellation is Orion, which was separated into parts by various groups in Southern Africa (Medupe, 2015).

The stars comprising Orion’s Belt and Sword formed asterisms in the minds of South Africans. According to Norton (1906), other Southern Africans imagined the Orion’s belt stars were pigs (*Dikolobe* in Setswana and *Nguruve* among the Karanga of Zimbabwe). Those of Orion’s sword are called dogs (*Dintsa*), chasing pigs by the Batswana.

The *Dikolobe* stars have their acronychal rising one could say that they are being born about the third week of November (Snedegar, 1995). To have associated the reappearance of the stars with the appearance of new pigs must have been only natural. Intriguingly, bush pig and warthog litters often consist of three piglets (Smithers, 1971). If the Africans recognized this fact it would have given them another reason to identify the three Belt stars with pigs. The Orion’s Belt and Sword is known as *imphambo* among Zulu, for Basotho they are known as *makolobe*, called *mbwa* in Shona language (Snedegar, 1995). That the motif of these stars chasing or hunting each other was current among diverse African people may offer evidence of the transmission and transformation of folk information in Africa.

Snedegar (1995), the Basotho and Tswana recognized a group of stars called *Dithutlwa*, the giraffes. *Thuda* is the Venda equivalent. Normally there are four giraffes, two male and two female. Sometimes the Venda add a little giraffe, *thudana*. In Setswana parlance the males are the brighter stars, B Centauri, while B Crucis are the females. Snedegar (1995) the Basotho-Tswana term *Thutlwa* is itself suggestive of the horizon-skimming stars. It means above the trees. *Molalatladi* is discussed in the following section.

2.4.5 Molalatladi

The Basotho and Batswana knew the Milky Way as *molalatladi*, the place where the lightning bird rests, they also used the term *molalakoko* and occasionally *molawagodimo*, '(Snedegar, 1995). The vague Basotho-Tswana term *serogabolo* also pertains to the Milky Way in its seasonal aspect. Its verbal roots are *roga* (to swear, curse or insult) and *balogu* or *balosa* (to blurt out or cause to blurt out). According to Clegg (1986) rain is due when *serogabolo* reaches the zenith.

Several other Batswana and Basotho participants said that the Milky Way indicates the constant movement of time and that it turns the Sun to the east (Breutz, 1969). Evidently, the Milky Way served as a special indicator of the rainy season (Snedegar, 1995). The Milky Way best matches this description on September evenings when the Scorpius-Sagittarius region, the very centre of the Galaxy, appears overhead. Yet while the spring rains may begin in September they are quite often delayed by weeks and even months. In drought years it would only be appropriate for the Tswana to blurt out a curse after hopes of rain taken from this celestial sign had gone unfulfilled (Snedegar, 1995).

The Xam had their own understanding and knowledge of the Milky Way. The Songye call it 'the dividing line of wet and dry places.' A Khwe Bushman knew it simply as 'the Line. The Venda normally call it *Mululu-vhungu* (Snedegar, 1995). In modern astronomy, the galaxy of which the sun and the solar system are a part and which contains the myriads of stars that create the light of the Milky Way. The following section discusses *kgora le tlala*.

2.4.6 Kgora le tlala

The Large Magellanic Clouds (LMC) and Small Magellanic Clouds (SMC) are visible to the naked eye, plays a significant role among various cultures and regarded as remarkable objects (Astronomical Society of Southern Africa, 2017). According to Alcock (2014) and Fabian (2001), among the Batswana, Small Magellanic Cloud was called *Tlala* and Large Magellanic Cloud was

known as *Kgora*. Medupe (2015), they were used to predict drought or rainfall, because the Large Magellanic Cloud (LMC) is brighter than the Small Magellanic Cloud (SMC). During drought, the dust in the air obscures the SMC. Both Magellanic Clouds are clearly visible when there is less dust in the air after the rains.

They were also associated with Famine and Plenty among the Karanga (von Sicard 1966). Selin (2000) points that Magellanic clouds feature in cosmologies and mythologies of various cultures such as the Batswana, Khoisan, and Australian Aboriginals regard them as the home of two sisters. Pukui et al (1986) supported the above statement that to the ancient Hawaiians, for example they were regarded as the white and black butterfly. A number of stories are documented among various cultures about this interesting celestial objects.

The Magellanic Clouds or *Nubeculae Magellani* are two irregular dwarf galaxies visible in the Southern Celestial Hemisphere, they are members of the Local Group and are orbiting the Milky Way Galaxy (Allen, 1963). The two galaxies are referred to as the Large Magellanic and Small Magellanic Clouds. Ruggles (2005) points that the Magellanic clouds are actually great clumps of stars or dwarf galaxies, satellite appendages to our own large galaxy (Milky Way) to be seen best in summer. Apart from Milky Way itself and this clouds can be seen from the Southern Hemisphere and the tropics (Ruggles, 2005).

The above is supported by Fairall (2006) that they are the two small irregular galaxies, satellites to our galaxies, like patches broken from the Milky Way. This clouds were originally known to European navigators as the “Cape Clouds”, they were renamed to honour Ferdinand Magellan (Fairall, 2006). According to Batswana tradition if SMC or *tlala* is clearer or on top, there will be drought, a time of agricultural plenty (good rains) was imminent if the reverse situation was applicable (Alcock, 2014). A contrary belief was mentioned by Glegg (1986) that drought is indicated when *tlala* looks faint or is more difficult to see in the sky. The inference is that dust in the atmosphere is more pronounced during drought and obscures the skies.

A similar view was expressed by Medupe (2005) who stated that the two bodies signify *kgora* (plenty, i.e. food) or *tlala* (drought or famine) respectively to Batswana in the past. The reasoning is that SMC is less visible than LMC in dusty conditions and was consequently associated with drought (Medupe, 2005). Fairall (2006) points that it is a fact that LMC is lower in the sky than LMC during the months of September - January, i.e. encompassing most of rainy season.

Mathewson and Visvanathan (1986) proposed that the SMC may in fact be split in two, with a smaller section of this galaxy behind the main part of the SMC (as seen from Earth's perspective), and separated by about 30,000 light years. Where the Milky Way sweeps past the south celestial pole, they are seen on the opposite side of the pole, the small or lesser Megallinic clouds more or less directly across the Southern Cross, and the larger or greater Megallinic clouds off to one side (Ruggles, 2005).

In a nutshell, the Megallinic Clouds are well known among the Khoisan in Southern Africa, the Aborigines in Australia, among the Maori of New Zealand they are called collectively *Nga Patari-Kaihau* or *as Te Reporepo* and were thought to predictors of wind, known as important navigation markers among the Polynesians, well known in Western Asia and Arabic culture. In Sri Lanka from ancient times, these clouds have been referred to as *Maha Mera Paruwathaya* meaning the great mountain as they look like the peak of a distant mountain range (Allen, 1963). The following figure provides a table which summarises the names of stars in Setswana ontology, including English name and significance.

Table 2. 1: The Significance of Batswana Stars (Fabian, 2001)

Setswana Name	English Name	Significance
<i>Dithutlwa</i>	Southern Cross	Giraffes. The bright two are males, the other two are females.
<i>Selemela</i>	Pleades	An important group of stars. They signify the time to cultivate.
<i>Naka</i>	Canopus (Argo)	Seen late at night in winter. It indicates that the wind will soon start to blow and the tress will lose their leaves. Time to put the sheep to the ram.
<i>Dintsa le dikolobe</i>	Orion	The three dogs (Orion belt) are chasing the three pigs (Orion sword).
<i>Serogabolo</i>	Betelgeuse (Orion)	When vertically above in the evening, rain is due.
<i>Magakgala</i>	Antares (Scorpio), Spica (Virgo)	When visible in the evening, the corn must be harvested.
<i>Kgogamasigo</i>	Most probably Arcturus (Bootes), possibly Sirius or stars in Orion	Visible throughout the night in summer. Pulls the night across. The name is derived from the name of the part of the plough to which the drought animal is attached. Rises at around 4 am in November, the time to feed and water the oxen in the ploughing season so that maximum use can be made of daylight hours.

<i>Tlala</i>	Small Megallic Clouds	Indicative of the amount of rainfall in the season to come.
<i>Kgoro</i>	Large Megallic Clouds	Season to come.
<i>Mphatlalatsane</i>	Venus- morning star	Time to rise.
<i>Kopadilalelo</i>	Venus - evening star	Supper / dinner time.
<i>Senakane</i>	Antares (Scorpio)	May evenings.
<i>Ntshune</i>	Fomalhaut (Pisces)	Winter morning (kiss me). Said to indicate the time for lovers to part before parents discover them.
<i>Makgoro</i>	Unknown star	-
<i>Makgala</i>	Regulus (Leo)	July evening.
<i>Manake</i>	Alpha – Centaurus	-
<i>Kgalapane</i>	Unkown star	-
<i>Sefapano</i>	Unidentified	Bright star in the evening southern sky in spring, used as direction finder with <i>Selemela</i> (Pleiades). Keep sefapano on the left and <i>Selemela</i> on the right to travel west.
<i>Tshobego</i>	Unidentified	A southern star visible in winter. Plants will die when it appears.

Fabian (2001) identified more than 20 stars among the Batswana and their significance. He also managed to group them in English names. The above table is one of the testimony that proves that the Batswana developed names of the stars and attached meaning to every single one of them. The study argues that Fabian is one of the scholars who managed to conduct a comprehensive and detailed analysis of the significance and names of stars among the Batswana.

However, some of the stars were unidentified and did not have any English names. Like many people across the globe, Africans have for many generations been awed by the night sky and they used their natural astronomical instruments, the eye in order to observe (Leeuw, 2007). The following section provides a brief discussion about the concept of the Sun and its significance among the Batswana.

2.4.7 Letsatsi

The English proper name “Sun” developed from Old English “*sunne*” and may be related to *south*. Cognates to English *sun* appear in other Germanic languages, including Old Frisian *sunne*, *sonne*, Old Saxon *sunna*, Middle Dutch *sonne*, modern Dutch *zon*, Old High German *sunna*, modern German *Sonne*, Old Norse *sunna*, and Gothic *sunnō*.

The Sun is the star at the centre of the Solar System. It is a nearly perfect sphere of hot plasma, Basu and Antia (2008) with internal convective motion that generates a magnetic field via a dynamo process (Charbonneau, 2014). It is by far the most important source of energy for life on Earth. The Batswana had a belief that there is only one Sun (*letsatsi*). Some say that after setting it moves back under the earth; some say, over the top of the sky (in which there are small holes which let in the light as stars). Yet others report that, after setting, the sun is eaten by a large crocodile which excretes it in the east the following morning.

This legend bears a remarkable similarity to the Egyptian one of the Sun-God Ra, being swallowed at the end of each day by a snake, passing right through it overnight, to emerge, none the worse for his experience, to rise the following morning (Glegg, 1986). As well as being the source of heat and light, the sun is the eye (or the lantern) of God, who, realising that his people cannot be expected to work all the time, chooses not to watch them all the time.

Due to the fact that God is not watching during the night, it is at this time that evil or corrupt deeds are done. There is a legend (whether it dates from pre missionary days in some form is not known) that at dawn on Christmas day, the sun dances. To watch this event, however, it is court celestial disapproval, with possible serious consequences (Glegg, 1986).

The Batswana also had the knowledge about the solstices and equinoxes. They regarded the solstices as the sun's summer house and winter house, because he (the sun) seems to rest there for a few days (Casalis, 1861). Bass (1994) a solstice is an event occurring when the sun appears to reach its most northerly or southerly excursion relative to the celestial equator on the celestial sphere. Two solstices occur annually, on about 21 June and 21 December.

The seasons of the year are directly connected to both the solstices and the equinoxes (Bass, 1994). The day of the solstice in either hemisphere has either the most sunlight of the year (summer solstice) or the least sunlight of the year (winter solstice) for any place other than the Equator. The concept of *ngwedi* is discussed below.

2.4.8 Ngwedi

The Basotho and Batswana shared similar notions and understanding about a number of celestial or terrestrial bodies, such as the moon. Stevenson (1987) the moon is the fifth-largest natural satellite

in the Solar System, and the largest among planetary satellites relative to the size of the planet that it orbits (its primary).

Batswana had a belief that the new moon was (or is) a symbol of prosperity, happiness, joy and that seed will germinate successfully when sown after the new moon. Watson (1983) points that the Northern Basotho name for the moon is "*Kgwedi*" and among the Batswana is called "*Ngwedi*", which means "something which is bright". Some of the traditional initiation ceremonies among the Basotho, Batswana, Balobedu and Bapedi took place during the new moon.

Among the Batswana the appropriate new moon signalled the time of the Feast of the First Fruit or New Year festival (Alcock, 2014). Krige and Krige (1980) relate that among the Lobedu the sign of certain stars heralded the approach of winter and the time for circumcision. Du Plooy (2006) further confirms the appearance of certain stars among the Basotho and Batswana was a clear indication that winter is coming.

The moon is an astronomical body that orbits planet Earth, and one of the largest natural satellite in the Solar System (Bussey & Spudis, 2004; Cain, 2008; Moore, 2001 & Spudis, 1996). The stars, Sun and Moon revolve around the Earth, which is flat (Clegg, 1986). Alcock (2014) states that the moon, like the stars, was an indicator of various events or practises amongst Africans in olden times. Leeuw (2007) posits that among the Batswana, kids used to play indigenous games at full moon during the night. The above statement is supported by Beyer (1919) and Watson (1983) that the people, especially the children, cheered when the thin, New Moon was first seen.

Among African indigenous communities, the moon has value and has different meanings and understanding. For instance, it is called *iNyanga* to the amaXhosa and amaZulu, *Nwedzi* to the Shona and Venda, and *Ngwedi / Kgwedi* to the Basotho and Batswana. It is probably the most obvious feature in the night sky, because of its size, brightness, and changing appearance (phases). As the moon orbits the Earth it goes through a sequence of phases, from new moon (invisible) to crescent, half-moon, full moon, half-moon, and back to new moon (Alcock, 2010).

Leeuw (2007) states that the moon is used to represent a symbol of a woman in wall murals of the Batswana. This version of a moon as a symbol of woman is also common among the Swazi people (Alcock, 2010). A mural is any piece of artwork painted or applied directly on a wall, ceiling or other permanent surface (Willsdon, 2000).

Marshall (1986)) points that South Africa has a long history of mural art, beginning with the ancient San painted rock shelter, continuing through various African traditions of decorating the homestead, the wall painting practices of European settlers, and the Afrikaner Nationalist murals commissioned by the state as a form of public art.

The above statement is supported by Changuion (1989) and Gerdes (2001; 1998) that the tradition of mural art in Southern Africa is not of recent origins. Basotho archaeological sites have revealed archaeological remains in hut floors that have survived the elements for as much as 1500 years (Grant, 1995). Some of the evidence suggests that mural painting dates back at least five centuries (Grant 1995 & Van Wyk 1998). Until the 19th century the geometric patterns were found on the inside rather than the outside of dwellings (Gerdes, 2001; 1998; Zulumathabo, 2016 & Mothibe, 1976).

The Batswana had references and deep fascination with the moon such as it is displayed in their wall paintings and language (Leeuw, 2007). Ethno astronomically, what is significant here is that the Batswana's common and deep reference (of a woman in house walls murals) and a comparison or celebration of only light but also the lower heat or radiation from the moon, differentiating it from that of the sun (Leeuw, 2007).

Farrer (2002) ethnoastronomy generally involves learning about the astronomical systems of non-Western people. Hence, this study argues that the Setswana astronomical nomenclature may be debatable, however, there is evidence to proof that Batswana had interest in the moon and other constellations and they also developed poetic and artistic understanding which goes beyond probably what is termed "star lores".

There is a Setswana riddle that says *mosese wa Mmakgathi maranthatha* which means "the dress of the painter is a myriad patterns". Leeuw (2007) states that this demonstrates that the Setswana astronomical nomenclature is woven deeply in the language and culture of the Batswana, riddled with poetry, indirect or evasive speech.

The Batswana were well aware that the Moon travels more slowly through the sky than the Sun, with both bodies rising together once every 28 days (Clegg, 1986). The Batswana had their own observations and understanding about the different phases of the moon. The phases of the Moon are

the different ways the Moon looks from Earth over about a month (Sinnott, Olson & Fienberg, 1999).

There are 8 major phases that the moon goes through such as new moon, waxing crescent moon, first quarter moon (or a half moon), waxing gibbous moon, full moon, waning gibbous moon, last quarter moon (or a half moon) and waning crescent moon. The waxing Moon carries diseases in its hollow, while an inverted waning Moon spills these diseases out on the Tswana to their detriment (Clegg, 1986).

A New Moon with a vertical crescent indicated rain. The Batswana resident in the Ventersdorp area, in the present-day North-West Province, once believed that the New Moon exerted a dangerous influence for this very reason (Breutz, 1954). A New Moon with a vertical crescent indicated rain (Alcock, 2010).

Among the Batswana, the different phases of the moon was also used to determine the reproductive health or menstrual cycle of woman. The above statement is supported by Breutz (1969) that the subsequent dead Moon and female menstruation were linked. Woman were taught to determine their fertility, when to abstain from sexual intercourse with man using phases of the moon. There was a symbolic association here between the menstrual cycle of woman and lunar phases (Breutz, 1969).

A custom once observed by Africans throughout South Africa was that of showing a new-born baby to the Moon. The Tembe-Thonga in Maputaland (North Eastern KwaZulu-Natal) apparently still adhere to the custom, after which the baby is taken down to the beach where a wave is allowed to wash over it (Koch, Cooper & Coetzee, 1990). The custom is known as *ukukhombisa inyanga*.

Alcock (2010) points that the amaSwazi, amaZulu, other VaTsonga, Northern and Southern Basotho, Batswana and amaVenda babies, likewise, were ceremonially shown to the Moon (new, waxing, full or unspecified as per the given source). This action was believed to be essential for the mental growth, development and health of the child, and heralded a new phase of life (Hammond-Tooke, 1993 & Mönnig, 1983).

Breutz (1969), in discussing the Basotho -Tswana in general, noted that the presentation of a very young baby to the New Moon was an expression of the fertility symbolism of the Moon, since this

celestial body was thought to have a positive influence on fertility. There were different versions of the stories of the moon among the Batswana. There are stories of the man on the moon carrying an axe (Clegg, 1986). Another perspective is that a lunar halo signified that there was an assembly of spirits (*kgwedi e epile pitso*) (Breutz, 1969). The hare was associated with the Moon and Batswana children were forbidden to eat this animal (Breutz, 1969).

There are also some of the initiation ceremonies of the Batswana such as ceremony for boys was known as *bogwèra* and that for the girls as *bojale*. The ceremony for *boys* which nearly always began with the New Moon in the lunar month of *Tlhakole* (February). The traditional leader among the Batswana was responsible and a custodian of initiation ceremonies. The newcomers remained in the camp during the *Mophitlho* and *Moranañ* moons (March and April), returning home when the *Motsheganoñ* Moon appeared in May (Alcock, 2010).

Breutz observed in 1969 that the Hurutshe and other Batswana continued to begin and end their circumcision schools with the New Moon. The same procedure applied to the Kgatla, where the youths remained in the initiation camp for about three months, until the second day after the New Moon of the fourth month (Schapera, 1978). The Batswana had an annual sacrifice of a black bull to honour the king's ancestors, the timing of which was according to a specific New Moon (Breutz, 1969).

The above is supported by Du Plooy (2006) that the same was also practiced in other cultures such as Basotho, whereby the initiation of Basotho girls in the old days began at New Moon, while the initiation of boys started with the Full Moon. The two ceremonies were linked with one following the other, although female initiation took place first. The Full Moon symbolizes female initiation, sexuality and fertility (Du Plooy, 2006). The following figure, presents a brief summary of the phases of the moon among Batswana.

Table 2. 2: Linguistic terms describing phases of the moon (Matumo, 1993).

English	Setswana	Description
Moon	Kgwedi / ngwedi	The Moon is referred to as ngwedi or kgwedi
New Moon	kgwedi e e rogwang ke badimo or kgwedi e e rogwang	It is new Moon'
Full Moon	kgwedi e kgotsheng	Full Moon
Waning Moon	kgwedi e a sêlwa	to wane, of the Moon'
Absent Moon or the end of the Moon	kgwedi e ile ditshweneng / kgwêdi ya ditshwêne	The Moon between old and new', the moonless night between the old and new moons, literally: 'Moon of the baboons'
Halo round the Moon	kgwedi ya pitsô	halo round the Moon

The above table illustrates that the Batswana had their own knowledge about the moon and they understood and interpreted its phases differently and in a unique approach. Knowledge of the moon was not only common among the Batswana. Divination bowls found amongst the Venda / Lemba (Stayt, 1968) are known to have been filled with water and have a central cowry shell that is placed on a raised zone with mastic glue, this effectively 'calibrates' as it were, the orientation of the bowl in order to view new moon reflections through a year, with the submersed underlying carved figures providing the required durational comparison.

The study argues that the Batswana like all other cultures developed their own calendar system. The above provides evidence that knowledge of different phases of the moon was not just unique to the Batswana, but is knowledge that is found across the African indigenous communities and even outside the African continent. For instance the Lembas have the names of the different phases of the moon. Each phase of the moon lasted for about 10 days.

BaLemba had customs used to be performed every month in connection with the new moon, this is also practiced among the Basotho were a young baby is taken outside during full moon to perform rituals. The following section provides the discussion of calendar making among the Batswana.

2.4.9 Botswana and calendar making

The study argues that the Batswana like all other cultures developed their own calendar system. Indeed all organised societies whether they are villages, towns, cities or empires, have developed calendar systems. People performed important rituals and ceremonies during special days that were determined by the calendar (Medupe, 2010). For example, the Batswana of Botswana needed to know the beginning of the rainy season in order to prepare rituals to cleanse the land, and in Swaziland, the first fruit ceremony (*incwala*) was performed annually on the 21 of December, during the summer solstice (Medupe, 2010).

Solstice is derived from the Latin words *sol* (sun) and *sistere* (to stand still). The above is supported by scholars such as Ruggles (2015) who argues that all human cultures developed their own calendar system, for instance to synchronize or coordinate events, to arrange events chronologically, to provide a temporal framework for referencing and enacting events, and to determine durations (time intervals) between events.

Medupe (2010), calendars are used as a way to manage activities in societies throughout the year. They are typically, although not exclusively, linked to one or more astronomical cycles such as the phase cycle of the moon, the seasonal cycle of appearances and disappearances of stars and asterisms, and the seasonal movement of the position of sunrise or sunset to and fro along the horizon (Ruggles, 2015).

Different authors have written about the sun and moon calendars, however, many of them agree that the origins of the calendar is a controversial study in itself (Sparlinger, 1995). The way in which we divide the day into hours and minutes, as well as the structure and length of the yearly calendar, owes much to pioneering developments in ancient Egypt (Alistair, 2017).

Richards (1998); Curry (1990) and Alistair (2001) point that the study of the Egyptian indicates that there were three different calendars, firstly the lunar calendar based on 12 lunar months, secondly, the civil calendar used for administrative purposes. A third calendar, which dates back at least to the fourth century BCE was used to match the lunar cycle to the civil year. It was based on a period of 25 civil years which was approximately equal 309 lunar months (Richards, 1998; Curry, 1990 & Alistair, 2001).

Fleminger (2008) states that there is scientific evidence to prove that Africa was the 'Cradle of Humanity'. Therefore, the study argues that Africa is also the home of astronomy. Medupe (2010) states that African indigenous communities used various calendar systems. Some used the lunar calendar, whilst others combined the observation of the sun, moon and stars (Medupe, 2010). In African thought a calendar was not an arbitrary organisation of the days of the year but a record of the spiritual and physical order and administration of the affairs of the universe

The term calendar is taken from *calendae*, the term for the first day of the month in the Roman calendar, related to the verb *calare* "to call out", referring to the "calling" of the new moon when it was first seen (American Heritage Dictionary, 2017; Dershowitz & Reingold, 1997). Doggett (1992); Richards (1998) and Lynn (1999) indicate that *Latin calendarium* meant "account book, register" (as accounts were settled and debts were collected on the calends of each month).

The Latin term was adopted in Old French as *calendier* and from there in Middle English as *calendar* by the 13th century (the spelling *calendar* is early modern). The first recorded calendars date to the Bronze Age, dependent on the development of writing in the Ancient Near East, the Egyptian and Sumerian calendars. Some calendars date back to the Iron Age (American Heritage Dictionary, 2017; Birashk, 1993; Dershowitz & Reingold, 1997). A calendar is a system of organizing days for social, religious, commercial or administrative purposes. This is done by giving names to periods of time, typically days, weeks, months and years (Spier, 1986 & Zerubavel, 1985).

In summary, there various types of calendars such as the Julian, Gregorian, Islamic, traditional and lunar calendars. In Cairo, Nabta Playa, stones were erected and aligned with the rising sun during the summer solstice. These rocks were used as a calendar that helped them to know when the summer solstices occurs. Among the Batswana, the coming of the rains, after the dry winter season, marked the renewal of the year. It was decided that this time was suitable to start a new year.

Therefore, the New Year started around September. The traditional calendar of Batswana like many other African indigenous communities such as the Dogon of Mali is based on observing the different phases of the moon. Some African communities used the lunar calendar, other used the observation of the sun. There are more than one version of the Batswana months. The following table is a summary of one version of the months according to the Batswana. The study takes into consideration that there are several versions by various scholars on Batswana months. The summary of 12 Batswana months, according to R. Pretorius, D.T Cole and P.M Sebate, are listed below.

Table 2. 3: The description of Batswana months

Setswana	Eng	Discription
<i>Phatwè</i>	Augt	<p>This month in the past was ‘the one that starts the year’ (the beginning of the Tswana year).</p> <p>The year knocks and says: ‘<i>Twaa! Twaa!</i> It is clean’ signifying a new beginning, a new life.</p> <p>It is the time to start ploughing when the first rains (<i>kgogolammoko</i>) can be expected.</p> <p>The Tswana once regarded August as the first month of spring. August, nevertheless, is also the time of strong winds and clouds of dust.</p>
<i>Lwetse</i>	Sept	<p>The month of illness or <i>bolwetse</i> when new life begins in spring, and there is much illness amongst the people and the animals.</p>
<i>Phalane</i>	Oct	<p>Also a month of spring.</p> <p>Rain falls, the veld grass begins to grow, trees come out in flower, and the happy sounds of animals and birds can be heard.</p> <p>This is the time when some animals give birth to their young and the birds are breeding or hatching their eggs.</p> <p>These sounds resemble the sounds of whistles or <i>diphala</i>, giving rise to the name of the month.</p> <p>According to D.T. Cole, it is in this month that the impala drop their young: hence <i>diphalana</i> or ‘the young impala antelope [plural]’.</p>
<i>Ngwanatsele</i>	Nov	<p>The start of summer when temperatures increase.</p> <p>The month when the young of many wild animals and cattle are born (<i>ngwana</i> = ‘child’ and <i>tsala</i> = ‘to give birth’ = <i>Ngwanatsêlê</i>).</p> <p>Another interpretation is that the name of the month refers to the plentiful supply of fruit in the fields.</p> <p>Children can pick the fruit that they desire: ‘<i>Ngwana itsêêlê</i>’ where <i>itsêêlê</i> means ‘to take for yourself’.</p> <p>D.T. Cole states that the name of the month is derived from <i>Ngwana-itsêêlê</i> meaning ‘Child take for yourself, help yourself’.</p>
<i>Sedimonthole</i>	Dec	<p>Summer is now in full swing.</p> <p>Vegetables, fruit and other crops are plentiful in the fields.</p> <p>The woman need help when returning home from the fields, since their baskets are so full of produce.</p> <p>The baskets are balanced on the heads of the woman.</p> <p>The name of the month reflects this procedure where <i>go ithola</i> means ‘to take something off your head’, hence <i>se di mo ntholê</i> or ‘help me to take it off my head’.</p> <p>D.T. Cole maintains that the name of the month is derived from <i>sedimo</i> meaning ‘ghost, unearthly creature’ (a reference to the <i>badimo</i> or ancestors) and <i>ntholê</i> or to ‘remove or take off [from my head] all the produce from the fields’.</p>

		The harvest, certainly for the woman of southern Africa, was not altogether a joyous occasion. Lloyd, Parr, Davies and Cooke (2010) have suggested that the repeated carrying of a heavy load on a person's head is linked to chronic neck pain.
<i>Fêrikgong</i>	Jan	<p>It is very hot in this month.</p> <p>The Sun is fierce and even affects grazing as well as the grain crops in the fields.</p> <p>The intense heat of the Sun, it is said, causes the branches (wood) of the <i>mofiri</i> or perhaps the <i>mperifiri</i> shrub or small tree to become dry or brittle. The species could be the Bell Spike-thorn or Klokkiesspondoring (<i>Gymnosporia tenuispina</i> = <i>Maytenus tenuispina</i>) which is a shrub.</p> <p>A further possibility is the Small Honeysuckle Tree or Kleinkamperfoelieboom (<i>Turraea obtusifolia</i>) which is a spindly shrub or small tree.</p> <p>The wood (<i>legong</i>; <i>kgong</i>) of the shrub or tree can be broken off without too much effort, and is highly sought after for making fires.</p> <p>The name of the month is indicative of this 'easy to harvest' feature of the species.</p> <p>The heat, it is stated, also induces snakes to escape from their holes in the ground.</p> <p>D.T. Cole indicates that the name of the month is derived from <i>fêra</i> or 'to bend fingers in counting' and the word for firewood (<i>di</i>) <i>kgong</i>.</p>
<i>Tlhakolé</i>	Feb	<p>February is the month which 'cleans away' (<i>e tlhakola</i>) the heat or <i>mogote</i> of January.</p> <p>The grass recovers from the baking heat of the previous month.</p> <p>One result is that the wild animals again graze in the veld (<i>di tlaa fula</i> = 'they will graze').</p> <p>This month is the beginning of autumn (<i>letlhafula</i>).</p> <p>According to D.T. Cole, the name of the month comes from <i>motlhakola</i> or the Common Guarri / Small-leaved Guarri or Gewone Ghwarrie / Fynblaarghwarrie (<i>Euclea undulata</i> = <i>E. undulata</i> var. <i>myrtina</i>; <i>E. myrtina</i>).</p> <p>The leaves of this shrub or small tree were once used as toilet paper to 'wipe off'.</p> <p>The expression is derived from <i>tlhakola</i> or 'to clean the anus', especially of a child, with the said leaves.</p>
<i>Mopitlwê</i>	March	<p>It is now autumn.</p> <p>Crops such as green maize and sweet-sorghum are maturing in the fields. Each child is able to eat until his stomach is very full (<i>mpa go pipitlelwa</i>). The beans are bursting with growth, and are said to be <i>pitlaganeditswe</i> ('full in their skins'). The grass begins to lose its green colour.</p>
<i>Moranang</i>	April	The growth (<i>marang</i>) of the crops slows down in this last month of autumn. The agricultural season is almost at an end and there is time for

		<p>a degree of leisure.</p> <p>The summer rains are virtually over.</p> <p>A chill in the air, noticeably at night, is now evident.</p>
<i>Motshêganông</i>	May	<p>This is the first month of winter when the rain ceases and a strong southerly wind blows.</p> <p>The grass turns yellow, the trees shed their leaves, and small pans dry up. The larger pans hold only a little water.</p> <p>The name of the month refers to the fact that the grain crops are now mature. The crops are said to be laughing at all the birds (<i>dijala di tshêga nông</i>), since the birds or <i>nông</i> are unable to eat the mature ears of the grain crops.</p>
<i>Seêtêbosigo</i>	June	<p>Low temperatures are now very apparent.</p> <p>Bitter cold results from the southerly winds (i.e. cold fronts).</p> <p>It is so cold that it is not really possible to travel at night (<i>go eta bosigo</i>), given that there will not be enough blankets available at other homesteads to share with visitors.</p> <p>A relevant Tswana proverb is: ‘<i>Moeng wa mariga o mo adima mpa, eseng dikobô</i>’ meaning that one can lend a traveller a stomach (give him food) in winter, but not blankets. Frost and veld fires are characteristic of this month.</p>
<i>Phukwi</i>	July	<p>This is the last month of winter and also the year when harvesting is nearly finished.</p> <p>The intense cold of winter begins to ease, particularly since there is a change in wind direction from southerly to northerly.</p> <p>Some rain might fall in this month.</p> <p>The people often expressed a desire for the year to come to an end so that a new beginning (year), when life starts afresh, can be enjoyed.</p> <p>The name of the month, as per D.T. Cole, is derived from <i>Phukwi maphukutsa-ditlhare</i> or ‘July, the shaker off of leaves from the trees’.</p> <p>The name is linked to the wind and the dried out leaves.</p>

The above table provides a brief version of different names of months according to the Batswana. As indicated earlier, the Batswana from time immemorial they had their own calendar system which was based on the lunar system. However, due to the influence of slavery, colonialism and apartheid, often led by missionaries influenced the African calendar systems and also distorted them.

According to literature, there are various versions of the months according to the Batswana. For instance, *Lwetse* is derived from (lwala) which is used metaphorically. Maru a lwala pula means (maru a dusa pula) jaaka kgomo e dusa namane). This is the month when it starts raining. Another version of Sedimonthole is that: *Motho wa ntlha yo o tshwanetseng (go loma) letlhabula ke kgosi. Fa basadi ba ile masimo ba fitlhela phare, legapu kgotsa leraka le setse le bodule, ba tsenya mo*

serotwaneng (basket), mme fa godimo ba beye morula kgotsa maungo mangwe a naga gore fa go na le mongwe yo o ka ba bonang, ba bone maungo a naga, gore ba seke ba iswa kwa kgosing ka gonne ba tshetse molao. Fa ba fitlha kwa gae, ba re sedimo nthole morwalo ke o, (talking to an imaginary figure). Fa gae ba tla mo rola morwalo, ba tlhologanya gore o tshotse eng mo serotwaneng.

There is another version of *Ferikgong* that the name of the month derives from a dove called *mhiri*. These doves are fond of the wild and are not commonly seen around villages. *Mhiri*'s colour is greyish-brown and has a black stripe around the neck which looks like a bangle *mhiri* which is worn by women as an ornament. *Mhiri*'s name was derived from this parallel and has since been catalogued as such. *Ferikgong* is the month when *mhiri* collects little sticks to build a nest before laying eggs.

Another version of *Motsheganong* is that When the seeds are hard *Thaga* is no longer able to crack them. It is for this reason that a fore-bearer has named the month of May, *Motsheganong*. The name is made up of the prefix *mo-* + stem *tshaga*(laugh) + noun *nong* (bird) which means (one who laughs at the bird) the seeds are laughing at the birds. The metaphor is better understood against the background of two objects, namely, *mabele* and *nong* given human characteristics of laughing and being laughed at.

Only human beings can laugh and experience the agony of being laughed at. *Nong* is perpetrating the anguish felt by *mabele*. Now that the torture is over *mabele* are laughing at *nong* who is disappointed and sad about the sudden change of fortune. Allegorically it is Batswana who are laughing at the bird and celebrating its misery. The following section is about *nako le lefaufau* among the Batswana.

2.4.10 Nako le lefaufau

Among the Batswana *nako* is called time in English and *lefaufau* means that which exists outside the earth `s atmosphere. Marava (2015) posits that in general, the concept of time in Africa has been researched on in a number of perspectives. The concept of time in Africa is not about punctuality, but about relationships (Kabiza Wilderness Safari, 2015). Time is an observed phenomenon, by means of which human beings sense and record changes in the environment and the universe (Nnaji-for, 2016). Time is associated with social activity, and how other peoples organised their daily lives fascinated and horrified Western observers (Smith, 1999).

In Africa, the Americas and the Pacific, Western observers were struck by the contrast in the way time was used or organised by indigenous peoples (Smith, 1999). The concept of time plays a pivotal role in the way a society derives its values, beliefs and conceptions (Marava, 2015). The study argues that the Batswana like other African communities, developed their own conception of time and space which was centred on their language, worldview, philosophy, astronomy and cosmology.

Smith (1999) time and space are particularly important for some indigenous languages because language makes no clear or absolute distinctions between the two, for example, the Maori word for time and space is the same. Other indigenous languages have no related word for either space or time, having instead a series of very precise terms for parts of these ideas or for relationship between the idea and something else in the environment.

Matjila (2017) to the Batswana, time was determined by past and current events, the everyday chores and activities of men, woman and children, the behaviour of wild and domestic animals, the colour or shape of the landscape and other objects, the sound and music of the birds, the appearance, disappearance and reappearance of celestial objects like the sun, the moon and the stars. Matjila (2017) points that time in Setswana ontology is outlined and distinguished by different images, namely celestial objects, members of the animal world, and religious or mythological figures.

Brown (1993); Cole, Moncho and Warren (2012) indicates that Batswana used their knowledge of celestial images to measure time. For instance *mahube* ('reddish sky', i.e. early dawn), *moso* ('sunrise'), *phirimane* ('sunset, darkness setting in soon'), *lotlatlana* ('dusk, eventide or early evening twilight - the gloaming' (Brown, 1993), and *maabanyane* 'the evening after sunset, towards night' (Brown, 1993). Time was also measured using animal images which include domestic and wild animals such as cattle, goats, sheep, pigs, birds, field mice, eland, etc. for instance, *mahube a naka tsa kgomo* which illustrate or means early in the morning.

Matjila (2017) posits that the religious practices of the Batswana, communion with the spirits, is important in determining their concept of time, and the images *Bile* and *Lowe* are used to demonstrate ancient times. Batswana's interpretation of time illustrates their relationship with the environment and how time governs their social, economic and cultural activities. These images are

the innermost essence rooted in and nourished within the context of Setswana culture, history and experience, and this is more metaphysical and spiritual (Matjila, 2017).

While modern societies tend to depict space and time as types of independent entities, real things, or universal and objective categories (Shanks and Tilley, 1988), for most pre modern and non-Western societies time and space remained embedded in their activities and events. From an anthropological viewpoint, concepts of space and time should be viewed as cultural products (artefacts), products of thought, situated within Karl Popper's (1972) third world but remaining embedded and embodied in physical objects, events, and processes taking place in his first world.

Western ideas about time and space are encoded in language, philosophy and science (Smith, 1999). Lefebvre (1991) argues that the notion of space has been appropriated by mathematics which has claimed an ideological position of dominance over what space means. Lefebvre (1991) Mathematics has constructed a language which attempts to define with absolute exactness the parameters, dimensions, qualities and possibilities of space. This language of space influences the way the West thinks about the world and how they view society.

The scholarship on the concept of time in Africa cannot be discussed without reference to Mbiti's (1969) 'African Concept of Time'. In Mbiti's doctoral dissertation, he uses the concept of time as a paradigm case study of African philosophy. In other words, the concept of time is his unique way of discussing African philosophy (Nnajiolor, 2016). Babalola and Alokun (2013) argue that Mbiti, has discussed African concept of time in the context of the religious thought system of Africans.

In this perspective, he wrote that African concept of time is the key to our understanding of the basic religious and philosophical concepts of the people. This study argues that African thought system on time conception have existed long before slavery and colonialism. Babalola and Alokun (2013) argue that Africans, even from pre scientific time, have their conceived ideas about time, but that their time conception is highly philosophical and thought provoking. It stretches beyond the physical world of reality even to the time eternity.

Babalola and Alokun (2013) point that Mbiti wrote that the concept of time may help to explain beliefs, attitudes, practices, and general way of life of African people, not only in the traditional set up, but also in the modern situation (whether political, economical, educational or church life). He

opined that the world of scholarship should bear with the fact that in this area of research, there is no enough literature to depend upon. (Mbiti, 1969).

Time to Mbiti, in African Concept of Time, is of little or no academic concern, especially in their traditional life. Babalola and Alokun (2013) state that it is obvious that Mbiti's work also captured African life in the pre- colonial era. In his words, to Africans, time is simply a composition of events which have occurred, those which are taking place now and those which are immediately to occur (Babalola & Alokun, 2013).

From the writings of African scholars such as (Achebe, 1958), a lot of references to time concept on African thought. Chinua Achebe, wrote about the concept of time in Nigeria, wrote from the perspective of his Igbo people. Achebe portrayed the people's consciousness of time with references to the moon, harvest, planting seasons and so on. Another example is of the Zimbabweans perception of time and how such conceptualizations affect their views on death and afterlife.

Marava (2015) states the Zimbabweans reflects that death is another life time zone whereby a dead person can continue to live. Babalola and Alokun (2013) indicates that Chinua Achebe expressed the idea of time tied to events and they continue to give examples such as the Yoruba of South West Nigeria where time is tied to events. Mbiti has portrayed the concept of time among the Ankore of Uganda and the Lutaka of Sudan. He argues that time is reckoned in reference to events pertaining to cattle or how events govern the approximate reckoning months.

Matjila (2017) states that time as a basic concept influences the life and worldview of African people as religious and economic life is deeply rooted in time. Africans reckon time in connection with events. A day, month, year in one's lifetime or human history are all viewed according to the specific events that make them meaningful (Mbiti, 1969). Mbiti (1969) describes African time and human behaviour as an experience. The Batswana's thought process and its underlying influence are rooted in their culture and tradition. They revered nature and had the utmost respect for what it offered. It is for this reason that they were influenced by cosmic elements such as animals, plants, the moon, the sun and the stars in their formulation of time (Matjila, 2017).

The following figure provides Setswana time images which were obtained from all DPS Monyaise's five novels, namely, *Marara* (1961), *Bogosi Kupe* (1967), *Go ša baori* (1974), *Ngaka Mosadi Mooka* (1976) and *Omphile Umphi Modise* (1983). This Setswana time images were summarised by Matjila (2015) in his article *Images of traditional Setswana time concepts in DPS Monyaise's novels*. The images are divided into three categories, namely celestial, animal and religious.

Table 2. 4: Celestial images

Celestial Images	Translation
<i>Mahube</i>	Mahube is derived from hubedu, meaning red in Setswana, that is, reddish skies or the dawning of the day, redness of the sky in the morning or blush of dawn; the streaks of colour and light at dawn or red tinges in the sky at dawn. The word is formed by the prefix <i>ma-</i> + adjective stem <i>-hubedu</i>
<i>Mahube a 'naka tsa kgomo</i>	This is at first dim light or when the skies are reddish and one can see the horns of the cattle etched against the morning sky. Only the horns of cattle are visible in the dark, as they are white.
<i>Mahube a banna</i>	This is, at first light, very early in the morning before mahube a basadi.
<i>Mahube a basadi</i>	This is very early in the morning, when it is light enough for the woman to go out and fetch water or collect firewood.
<i>Mahube a magakgala</i>	This refers to the very first rays of daylight which look like caterpillars with glittering button-like shapes. Magakgala are the stars of the dawning clouds
<i>Moso</i>	The word moso means sunrise. It is derived from the stem <i>-sa</i> meaning clearing of the darkness of the night, to disperse darkness.
<i>Motshegare</i>	The word is derived from motsi- meaning time and space, and gare in the middle. The word means the middle of morning and afternoon.
<i>Sethoboloko</i>	Sethoboloko means noon or midday. It is approximately twelve noon.
<i>Maitseboa</i>	Maitseboa is early afternoon to shortly before sunset. The word is derived from motsi- time and space, and the verb stem <i>-boa</i> , as in <i>di boa di tla gae</i> , they are coming back home. This refers to people coming home or animals coming back to the kraal before sunset
<i>Phirimane</i>	The word phirimane is derived from phirima meaning 'set'. Bophirima is the direction of the setting sun. Phirimelela is when the sun sets before a task has been done or completed or accomplished, or to force one to stay overnight owing to darkness setting in soon. Phirimane is when the sun sets, with darkness setting in soon.

<i>Lotlatlana</i>	Lotlatlana is dusk, eventide, early evening twilight - the gloaming.
<i>Maabanyane</i>	Maabanyane is the evening after sunset, towards night.
<i>Maitiso</i>	Maitiso is late evening and time for conversations before retiring to bed, time for story-telling.
<i>Bosigo</i>	Bosigo is night or time to go to bed and rest.

Table 2. 5: Animal images

Animal Images	Translation
<i>Makuku</i>	Makuku is derived from kuku/koko or cock. This indicates time very early in the morning. It is when the cock crows, to announce day break. Kuku is an onomatopoeic sound of the cock's crow: prefix ma- + root -kuku
<i>Maneelo</i>	This is the suckling time for giving young animals to their dams or the time for giving she-goats their kids so that they may suckle. The Maneelo stage covers the period 12:00 up to around 15:00:
<i>Mampa</i>	Mpa, as in meriti e le mampa, refers to the shadows lengthening towards the east; the evening is drawing on. This is approximately at 5 o'clock in the afternoon.
<i>Mampa a podi</i>	Mampa a podi is when shadows lengthen towards the east; the image of the shadows looks like the goat's belly that is close to the surface of the ground
<i>Mampa a kolobe</i>	Mampa a kolobe is when shadows lengthen towards the east; the image of the shadows looks like the pig's belly that is closer to the surface of the ground (about six o'clock in the afternoon).
<i>Di a bolola</i>	Bolola means going from one place to another. Di a bolola means go off as livestock from the kraal to the grazing fields (about five o'clock in the morning).
<i>Di tlwaela mafulo</i>	It is the time when livestock are getting accustomed to the grazing fields at about 10 o'clock in the morning

Table 2. 6: Religious images

Religious Images	Translation
<i>Bile</i>	Bile is regarded as the Setswana first born of the human family. Bile is a mythological ancestor of the Batswana. Mareme refers to bile as Motsalwapele wa Motswana or the first Motswana
<i>Lowe</i>	According to oral tradition, Lowe is the cave or place the first man came from (Brown, 1993). Snyman et al. (1990) refer to Lowe as a mythological ancestor of the Batswana

African concept of time is unique and different from European concepts and understanding. The narrative that African communities do not value time is inaccurate and misleading. Among the

Africans, time is not about punctuality but about the mutual relationship which human beings have with the environment, cosmos and the universe at large

Language is also important when it comes to analysing and understanding the concept of time and space among the African indigenous communities. Celestial bodies, animals, religious or mythological figures play a crucial role in understanding the concept of time in Setswana ontology. The following section discusses and provides evidence that Batswana and other African indigenous communities had knowledge and understanding of comets and meteor showers.

2.4.11 Comets and meteors showers

Davidson (2008) indicates that the word comet derives from the Latin word “cometes” that means an icy Small Solar System Body (SSSB) and, when close enough to the sun, displays a visible coma (a thin, fuzzy, temporary atmosphere) and sometimes also a tail. In a universe that seems ordered and predictable, transient events such as comets and meteors were often seen with fear and apprehension (Norris & Hamacher, 2009).

As a result, in most African indigenous communities and all over the world, events such as comets and meteor showers were often associated with bad luck, evil or death. However, one cannot generalise that the knowledge and understanding of comets and meteor showers among African indigenous communities is a straitjacket and is the same everywhere.

The concept and understanding of meteors and comets is unique among African indigenous communities and there are different interpretations of what this means in their life. For instance, the Tiwi of Bathurst and Melville Islands (Mountford, 1959) and the Kninjku of Arnhem Land (Taylor, 1996) saw meteors as the fiery eyes of evil spirit beings who raced across the sky, hunting for the souls of the sick and dying. Furthermore, the arrival of the great comet of 1843 caused fear among the Ngarrindjeri and was seen as a harbinger of calamity (Eyre, 1845).

Norris and Hamacher (2009) argue that these views about comets and meteors are unique to Africans, but are shared by peoples all over the world. There are many stories among different cultures in the world that describe events such as comets and meteors. Most of African indigenous communities have developed stories, mythologies, proverbs, songs and poetry about stars, comets, meteors, eclipses and planets most of which remain unknown to Western science.

This necessitates further research and systematic documentation in this area of oral art that depicts indigenous astronomy and its relevance to modern times, like the many artefacts describing the star system of the Dogon (Akwadapa, 2008).

A prime example of a comet in South African literature is that of *Mhudi*, a novel written by Solomon Tshekisho Plaatje, and only belatedly published in 1930 (Alcock, 2010). *Mhudi* is probably the first novel written in English by a black South African (Couzens, 1987). Plaatje writes how the comet signified to the Barolong that the Matebele would be defeated and the understanding and meaning of the terrestrial bodies around them.

Gardner (1983) however, the novel written by the Zulu author R.R.R. Dhlomo: *An African Tragedy*, and published in 1928, appears to be one of the earliest works on the comet in South Africa. There is also evidence of recordings of a number of astronomical events, such as the one below of the meteor shower of August 1583, recorded by the Songhay historian, Mahmud Al Kati (Hunwick, 2001).

In the year 1583 in God's month of Rajab the Goodly (August, 1583) after half the night have passed, stars flew around the sky as if fire had been kindled in the whole sky east, west, north and south. It became a mighty flame lighting up the earth, and people were extremely disturbed about that. It continued until after dawn. Recorded by the humble servant of his lord, Alfafi Kati Mahmud. In addition to the above quotation, there are many different views, stories, proverbs and mythologies about comets and meteors amongst the dreaming stories of various aboriginal groups in Australia. This research is, therefore, also an attempt to convince the reader that sciences, like astronomy, are rooted in Africa.

The youth and public at large need to, therefore, be made aware and educated on how the diverse cultures in Africa as a whole have been involved in the science of astronomy, by looking up and observing the night sky and also being quite aware of events such as meteor showers and comets. In general terms a meteor is often called a "shooting star" or "falling star". Jenniskens (2006) defines a meteor shower as a celestial event in which a number of meteors are observed to radiate from one point in the night sky. Jenniskens (2006) further states that intense or unusual meteor showers are known as meteor outbursts and meteor storms, which could produce greater than 1 000 meteors an hour. The following section discusses Batswana indigenous astronomy and natural disaster management.

2.4.12 Indigenous astronomy and natural disaster management

This section aims to describe how Batswana used their indigenous astronomical knowledge in Natural Disaster Management (NDM). Traditionally, they used the behaviours of plants, domestic and wild animals, birds, insects, atmospheric, astronomic and wind as indicators of various forms of natural disaster in their arid and semi-arid environment (Kaya & Koitsiwe, 2016). Indigenous peoples use Early Warning Signals (EWS) to mitigate, develop preventive measures using natural resource and knowledge. Environmental conservation and natural disaster management are important in the livelihoods of African local communities (Kamara, 2008). The effects of natural disasters such as floods, droughts and earthquakes to cyclones, landslides and tsunamis affect both developing and developed countries (Kaya & Koitsiwe, 2016).

The study further argues that most of the Batswana indigenous astronomical knowledge on natural disaster management lies with the elders who are mostly not literate and was passed down orally from generations. This knowledge faces extinction due to the fact that it is not appropriately researched, well documented and it is often marginalised in global and national initiatives for natural disaster management strategies.

Kaya & Koitsiwe (2016) however, much of this knowledge is not documented and hence vulnerable to loss when the older knowledge holders die. Kamara (2008) indicates that a large number of people in Africa, in both rural and urban communities live in hazard-prone areas and have over the years developed various indigenous or community - based knowledge systems (IK) of adapting and mitigating against these natural disasters. These knowledge systems developed over years and traditionally transmitted orally across and within generations, include skills, technologies, practices and beliefs on the natural environment (World Bank, 2004).

Further still McMillan (2000) contends that most of these communities have prominent phonological markers that signal the change of the seasons. These can be seen in the different movements and shapes of constellation. There are also atmospheric indicators used by community elders to determine weather conditions. For example, hot weather, especially at night, during the months of September to November, signals the advent of good rains and a long growing season (McMillan, 2000).

According to the community knowledge experts, the Batswana had over the year's devised mechanisms of natural disaster preparedness against heavy rains / floods, hail, cyclones and thunderstorms (Kaya & Koitsiwe, 2016). Batswana predict droughts as well as weather related diseases by watching the movements of the moon, sun, stars and other constellations. Such early warning systems were effective, appropriate and community based.

Hence a blend of approaches and methods from science and technology and from traditional knowledge opens avenues towards better disaster prevention, preparedness, response and mitigation (Kamara, 2011). Kamara (2011) states that in Africa, local communities of Batswana had well-developed traditional indigenous knowledge systems for environmental management and coping strategies, making them more resilient to environmental change. This knowledge had, and still relevant, and needs to be well documented and preserved.

These proves that the Batswana had a symbiotic relationship with the natural environment and they devised local mitigation and adaptation strategies to cope with the effects of changing climatic conditions. Nyong et al. (2007) indicate that communities affected by climate variability have developed and implemented extensive mitigation and adaptation strategies that have enabled them to reduce their vulnerability to past climate variability and change. However, this knowledge is rarely considered when designing early warning system.

The United Nations International Strategy for Disaster Reduction (2009) indicates that an early warning system is the set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organisations threatened by a hazard to prepare and act appropriately and in sufficient time to reduce the possibility of harm or loss. Early warning systems exist at different levels such as the global, national and local levels. The levels are determined by the magnitude of the problems and the capacities of the various levels to address them.

Macherera and Chimbari (2016) indicate that successful early warning systems have been developed for the agricultural sector and include the USAID's Famine Early Warning System (FEWS), SADC Food Security Programme (REWU) and FAO Global Information. All these systems are developed at global level and communicated down to the regions and countries concerned until the warnings reach the affected populations (Macherera & Chimbari, 2016).

The study argues that developing early warning systems of natural hazards such as heavy rainfall, droughts, diseases are based on local community knowledge is vital. These early warning systems are cost effective, based on local language, belief systems, culture and traditions. Early warning systems are an essential component of the Community-Based Disaster Risk Management (Centre for International Studies & Cooperation 2011).

Macherera and Chimbari (2016) very successful community-based early warning systems have been developed in the Asian countries, probably because natural disasters frequently affect these nations. Most of the community-based flood early warning systems developed in Asia are based on the four elements of people-centred early warning systems recommended by the United Nations International Strategy for Disaster Reduction (UNISDR) Platform for the Promotion of Early Warning (Macherera & Chimbari, 2016). Acharya (2011) argues that, in the traditional African worldview, environmental resources for example, celestial bodies such as stars, moon and the sun also land, water, animals and plants are not just production factors with economic significance but also have their place within the sanctity of nature.

Winnie et al. (2002) add that pastoral communities have used indigenous forecasting methods for a long time to predict seasonal climatic events. Some pastoral communities observe clouds, wind and lightning that likely have their origins in traditional understandings of what contemporary researchers recognise as atmospheric science (Winnie et al., 2002). Various signs were used by the community in Kenya to predict the onset of rains (Kagunyu et al., 2016). For example, about half (53%) of the respondents stated that they observed the pattern of seven stars. According to them, these stars formed a particular pattern which showed whether it would rain or not (Kagunyu et al., 2016).

The location of the stars was also an indicator of the amount of rain and how soon it would rain (Kagunyu et al, 2016). Kamara (2005), studies in Kenya on the application and use of traditional knowledge in environmental conservation and natural disaster management have cited examples of areas where such knowledge is still prevalent and is harnessed.

Mulenga (2010), in a study in Kamaroja, Uganda, reported the use of Indigenous Knowledge in Disaster Risk Reduction as follows: Cluster of six stars: cluster-relationships with the moon can be used for the prediction of bad years. Urama (2008) states that, in the Andean cosmology, celestial bodies played a very important role because it was a star cluster whose careful observation was

useful in predicting the quantity of pluvial precipitation and the climate change which were to be seen during seasons.

That role is still being played today in some high-plateau Andean communities. Huy (2009), in a study in Hai An, Vietnam, found that a local traditional method for predicting cyclones, floods, and other hazards had been set up. Indigenous knowledge is used to interpret observed natural signals. The movement of sea waves, the appearance of clouds and wind directions are observed, and their interpretation disseminated to assist in preparing for disasters.

The above examples is testimony that not only the Batswana, but local communities in different parts of the world have over the course of history relied heavily on indigenous astronomical knowledge systems to deal with disasters. Among different indigenous communities, celestial bodies were not only used for early warning systems but are also used for practical purposes such as to observe the sun and moon for timekeeping and creating an accurate calendar.

Batswana relied on an intimate knowledge of seasonal patterns to secure an ongoing supply of food, medicines and other resources. They interpreted the stars, weather, and other physical and biological indicators to predict biological events and signal when to pursue cultural activities. They further believe that the sign of thunder and storms are clouds which resemble mountains in the sky. When this happens, they know that they have to prepare to control and stop the severity of the pending storm. Cajete (2000) states that when a cyclone rises "*setsokotsane*" and is in the shape of a cow's tail, the community predicts danger and destruction of houses and the environment.

The moon controlled the tides and certain agricultural activities, and patterns of stars in the sky, especially the zodiac which regulated the annual round of production. Knowing the colour of clouds that may carry hailstorms enabled people to run for cover. Similarly, knowing that prolonged drought was followed by storm, thunder and lightning during the first few rains enabled people to prepare or expect a disaster (Baki, 2006).

Brokensha and Riley (1991) African traditional communities and wide knowledge of early warning systems. Batswana like other African indigenous communities had rich knowledge of natural disaster management. The following section is about the Bakgatla -Baa- Kgafela and their knowledge of rainmaking "*go fetlha pula*".

2.4.13 Bakgatla -Baa- Kgafela le go fetlha pula

Rainmaking or “*go fetlha pula*” among the Bakgatla -Baa- Kgafela of Southern Botswana are documented in detail on the monographs by Schapera (1971). He (Schapera) also wrote about the beliefs and practices associated with rainmaking rites among the Bafurutshe, Bakwena, Bangwaketse and Bangwato. Rainmaking ceremonies, beliefs and practices of the Batswana was mostly documented by European fieldworkers, ethnographers and other writers who were mostly missionaries who often relied on interpreters in their field work. Rainmaking beliefs and practices by Schapera was mostly documented a long period ago which is the 1900, which means that there is a gap of recent and credible literature on subject matter.

Hence, the study argues that most of the literature on rainmaking among the Batswana is based outdated and written mostly by non-Batswana like the missionaries who did not have an insider view and did not understand the language, culture and worldview of the researched. The study further argues that there is lack of credible, accessible, recent research and literature that has done comparative study of rainmaking among the Batswana indigenous communities.

There is research or literature on rainmaking by authors such as Reverend Dornan, who wrote the book called the Rainmaking in South Africa, published by Bantu Studies in 1928. In addition, Willoughby (1905) notes that sacrifices of cattle was very prevalent among the Batswana for rainmaking rites. Some of the information on rainmaking was written by Willoughby, in his book Notes on Totemism of the Becwana, this book was also published in 1905. Furthermore, the study argues that the introduction of Christianity also had impact with regard to marginalization and demonization of the role of the king and the rainmaker with the idea that it is only God who can make rain.

Dornan (1928) points that rainfall is an important subject in South Africa. Rain was very and is still important among the Bakgatla for their sustainable livelihood and economy. The Bakgatla are an agrarian society who relied on cattle herding and cultivation of land as the main economic activity (Makgala, 2009). Thompson (2010) an agrarian society (or agricultural society) is any society whose economy is based on producing and maintaining crops and farmland.

In an agrarian society cultivating the land and ownership of livestock such as cattle is the primary source of wealth (Thompson, 2010). Farming was carried out on subsistence basis. Subsistence farming or smallholder agriculture is when one family grows only enough to feed themselves. There

is not usually much harvest to sell or trade, and what surplus there is tends to be stored to last the family until the next harvest.

Makgala (2009) points that cattle herding was very fundamental among the Bakgatla and they had an economic system called *Mafisa*, where the rich loaned out some of the cattle to the poorer people to look after them on their behalf. In this system there was reward for the recipient with a heifer to build his own herd (Makgala, 2009). It is also important to note that the Bakgatla also hunted wild animals to supplement their diet.

Narayan-Parker and Motshelo (1980) the Bakgatla families had their own *masimo* (agricultural fields) where they cultivated using mixed cropping system to cultivate *mabele* (sorghum) *mmopo* (maize), *magapu* (melons), *mpye* (sweet reed), *dinawa* (beans), *lebelebele* (millet), *letlhodi* (small green), etc. The above sentence indicates that the Bakgatla relied on natural rainfall for their harvesting of crops and it was regarded as a source of life.

Rain in the culture of Batswana symbolizes peace, happiness and abundance of life. For instance, Bakgatla have an exclamation, “*Agone pula*” let it rain. This exclamation is usually made by the traditional leader during traditional ceremonies or at the “*kgotla*” (council place) and the tribe will respond in full throated chorus “*pula*” which means rain (Schapera, 1971).

Makgala (2009) the skill and ritual of rainmaking (*go fetlha pula*) was very important to the bogosi. A Kgosi who was successful in bringing rain and the subsequent economic prosperity to his *morafe* became very popular with his people. A Kgosi or Regent who did not possess the skill of rainmaking engaged rainmakers who performed the necessary ritual under his instruction and supervision (Makgala, 2009). There were numerous elaborate rainmaking ceremonies but here only two are mentioned.

Schoeman (2006) indicates that before the introduction of Christianity, the Batswana king were responsible for rainmaking rituals and ceremonies. It was their duty to intercede with the ancestors and ask them to intercede with God. There was a mutual and spiritual relationship between the king and the deities. In the olden days, the king was a rainmaker of the tribe, or sometimes he worked with *moroka wa pula* (rainmaker).

A number of Batswana kings were rain controllers and no one was allowed to make rain without their permission. Private rainmakers were banished for trying to usurp the kingship (Schapera, 1971). The rain prayer (*thapelo ya pula*) was instituted by the traditional leaders of the Bakgatla - Baa- Kgafela in Mochudi (Schapera, 1971). The people of Botswana even greet each other by saying “*Pula!*” (Literally meaning “Rain!”). The answer to that greeting would be “*A e ne!*” meaning, “let it rain!” <http://www.pitlanemagazine.com/cultures/the-meaning-of-rain-in-botswana-culture.html>.

Rain is so revered in Botswana that before the beginning of the rain season, a public celebration is held in many villages to welcome the rain. At such celebrations, the rain is praised in poem and song. Batswana to indicate the importance of rain in their lives and culture, they name their children with names that symbolizes the value and significance of rain. There are names such as son named “*Pula*” (rain), “*Rra-Pula*” which means “father of the Rain”. Girls are called *Mma-Pula*” which means “Mother of the rain”. To show just how important rain is to the country, the money for the country is called the “*Pula*” (<http://www.exchange-rates.org/history/BWP/USD/G>).

Rain is viewed as a sacred and phenomenal gift from the deities, the most explicit expression of their goodness, providence and love. This important herald of creation serves as a first sign (droughts and flood) of the anger of the creator. Rainmakers represent the people’s contact with the blessings of time and eternity, a link between humans and the Divine. The rainmakers do not rely exclusively on their spiritual powers; they are well versed in weather and environmental matters and may spend long periods of apprenticeship acquiring their knowledge (Iwu, 2014).

There were three rainmaking ceremonies recorded among the Bakgatla (Schoeman, 2006). It is recorded that *thapelo ya pula* (prayer for rain) was instituted by Kgosi Lentswe who was a convert of Christianity in the 1892. It was a modification and replacement of the old traditional ceremony known as *pulanyana* (little rain) and the purifying of the land ceremony (*go tlapisa lefatshe*). The *pulanyana* was one of the annual rainmaking and agricultural rituals which was performed at the *kgotla* at the beginning of each agricultural year. The king performed the ceremony with the help of the rainmaker.

The *pulanyana* ceremony was convened by the king and both young boys and girls performed their set of duties. The young girls collected or fetched water for the rain pots kept in the sacred rain enclosure. Kgosi Lentswe’s rain enclosure was located on the Phuthadikobo hill at Mochudi,

Botswana and it was still used by his successors (Schapera, 1971). These ceremonies represent two sets of beliefs and worldviews about the concept of rain.

In the first the king was responsible for rain, working with the rainmaker, through interceding with the ancestors and God. The second is the Christian doctrine and belief system in which Christian God is the only source of rain (Schapera, 1971). Botswana had different Setswana ontology with regard to rain, the following provides some of the names of rain: *pula e namagadi*, *pula ya tladi*, *pula ya medupe*, *pula ya sefako*. The following section is about the significance of rainmaking ceremonies.

2.4.14 The significance of rainmaking ceremonies

Rainmaking ceremonies are known worldwide in many diverse communities (Frazer, 1926). A rainmaking ceremony may contain one or more of the following elements: water pouring, imitation of rainfall and thunder prayers, use of musical instruments/special songs, sacrifices and the use of special objects for these ceremonies (Dafni, 2007). The ceremony is carried out by special members of the community such as the traditional leader and the rainmaker. It is often carried out as a secret and sometimes is a public ceremony, which takes place in special places frequently sacred ones such as at *kgotla*, mountains, hills, trees, etc.

The above statement is supported by Garden and Mtshali (1990) who explain the connection between sacred trees and rain making ceremonies "The trees are important for the formation of clouds that move up to the peak of the mountain". According to local belief, when clouds ascend it is a sign that rains will start. If the trees are cut, no clouds would come up to the mountain top and there would be no rains" (Garden & Mtshali, 1990).

Ruppert (2007) "the sources of rain were conceived in various ways, most commonly as one form or another of deity, especially associated with the heavens or with creation in general". The tree is the abode of the sky, cloud, rain, thunder divinity who is "in charge" of rain (Chidhakwa, 2007). Chidhakwa (2007) stated: "some sacred trees are places where rain ceremonies are conducted and are regarded as the protectors of the village and the seat of the ancestors" (Laird, 1999).

Iwu (2014) points that the process of rainmaking is complicated and differs enormously from place to place. Rain is viewed as a sacred and phenomenal gift from God, the most explicit expression of God's goodness, providence and love (McIntosh, 2017). The rainmakers do not rely exclusively on

their spiritual powers, they are well versed in weather and environmental matters and may spend long periods of apprenticeship acquiring their knowledge (McIntosh, 2017).

Rainmaking can be generally defined as a weather modification ritual that attempts to invoke rain. Rain is a central concern of African societies which depend on it for their sustenance and that of their animals. The power to make rain is a usual attribute of African kings. In a number of African societies kings who failed to produce the expected rain ran the risk of being blamed as a scapegoat and killed by their people (Simonse, 1992). Tribal rain dances are done to ensure rain comes. Notable people known to have done rain dances are tribes on the Sahara Desert and Ethiopia (Simonse, 1992).

Many cultural groups across the globe still treat the natural phenomena as the will of the God or gods or ancestral spirits (Reddy, 2017). Many ethnographic studies show how different societies give meanings to the natural phenomena (Reddy, 2017). There are many ethnographic studies and general reports about rainmaking rituals (Parkman, 1993; Haland, 2001; Jarus, 2013; Ryukyu, 2014; Haruna & Native net, 2017). The rain-making rituals have been in practice since, long back.

Haland (2001) drew similarities in rainmaking rituals between the ancient and modern times in Greece. Native net (2017) reported that rain dance is most common among the Native Americans in South west of America during long drought in summer. WATTS (1983) observed that “rain rituals, rites and prayers, were common among Muslims (Hausa). Among Islamic communities (Hausa) a preferred rite was a “water chase” *farautaruwa*, exclusively effected by married woman and seen as an act of ritual purification in which drought was clearly endowed with a moral etymology”.

Jarus (2013) reported the significance of rain making ceremony to the agricultural communities of South Africa inhabiting in areas near Botswana and Zimbabwe. Wu Shamans in ancient China performed sacrificial rain dance ceremonies in times of drought (Schafer, 1951 & Unschuld, 1985). Evidences of practicing rainmaking rituals, ceremonies, dances and prayers are found in almost all parts of the world including North America, Africa, China and Thailand, etc.

Akong'a (1985) points that information collected in the Kitui district lies in a semi-arid region of Kenya in 1982 and in 1985, shows that there used to be several rainmaking rituals in different parts of the district. McIntosh (2017) adds that Australian Indigenous people perform rain ceremonies as part of caring for country. Among the best known examples of weather modification rituals are

North American rain dances, which were performed by many Native American tribes, particularly in the South West area of the country (McIntosh, 2017). The rainmaking ceremony at the village of Kaukab Abu el Heija, in the Western Galilee, was so famous that people from other villages in the region used to take part and each delegation brought its special flags which were assigned for this specific purpose (Dafni, 2007).

Ryukyu (2014) reported that rain making ritual was held on 18th Novemeber, 2014 on Kohoma island in which thunder stone worshipped by *Kantsukas* (woman priests) in the form of singing to invoke rain. Reddy (2017) it is reported that *Gandoura* stones are used in rain-making ritual since early times on the island. The sound made by these stones resembles the thunder and it brings rain (Reddy, 2017). The following section discusses in detail the knowledge of the celestial bodies that was transmitted though oral traditions.

2.4.15 Oral traditions and indigenous astronomy.

This section briefly discusses the role that oral traditions has played in the promotion of indigenous astronomy among the Batswana. Wa Thiongo (1986) argues that oral art of Africa are rich and varied, developing with the beginnings of Africa indigenous cultures and they remain living traditions that continue to evolve and flourish today. The classic definition of myth from folklore studies finds clearest delineation in William Bascom's article "The Forms of Folklore: Prose Narratives" where myths are defined as tales believed as true, usually sacred, set in the distant past or other worlds or parts of the world, and with extra-human, inhuman, or heroic characters.

Such myths, often described as "cosmogonic," or "origin" myths, function to provide order or cosmology, based on "cosmic" from the Greek *kosmos* meaning order (Leeming 1990, 3, 13; Bascom, 1965). Magoulick (2004) cosmology's concern with the order of the universe finds narrative, symbolic expression in myths, which thus often help establish important values or aspects of a culture's worldview. For many people, myths remain value-laden discourse that explain much about human nature.

The study argues that the knowledge of the sky with regard to the moon, sun, stars, rainmaking ceremonies and cosmology was often not documented among African indigenous communities, hence it was transmitted from one generation to the other through oral traditions. Knowledge of the stars is found in many aspects of culture including storytelling, symbolism and religious traditions (Canadian Heritage Information Network, 2003).

In ancient times, indigenous astronomers used this knowledge to help guide the day-to-day affairs of their communities. The study argues that it is fundamental for indigenous researchers to work with indigenous knowledge experts who are mostly elders in the communities to better understand the intricate and complex ways in which indigenous astronomical knowledge is developed and encoded in oral traditions and material culture.

Oral traditions as a vehicle to transmit astronomy is not unique among the Batswana. Hamacher (2012) argue that indigenous Australians have been developing complex knowledge systems for tens of thousands of years. These knowledge systems which seek to understand, explain, and predict nature are passed to successive generations through oral tradition. Hamacher (2012) explains a story recounted by Aunty Mavis Malbunka, a custodian of the Western Arrernte people of the Central Desert, tells how long ago in the Dreaming, a group of woman took the form of stars and danced a corroboree (ceremony) in the Milky Way.

African indigenous oral art play an important role in the socio - economic and cultural development of local indigenous communities. The broader understanding of oral art is that its standard is transmitted orally, by imitation or other means. Oral art has been an important means of transmitting information ever since the dawn of humanity.

African indigenous oral art are a product of long reflections about the relations among humans and between humankind and the environment plays a very significant role among indigenous communities. It is believed that oral art is also a basis for moral, ethical principles and enhances self-esteem and cultural identity. It is a vehicle for effective education and personal development of youth.

The importance and uses of oral art differ from one community to another and revolves around to serve community needs, hence indigenous songs, proverbs, have a great significance to the Batswana and their indigenous astronomical knowledge. Hamacher and Goldsmith (1987) indicate that Aboriginal cultures did not develop written languages, relying instead on strong oral traditions where *Journal of Astronomical History and Heritage*, knowledge was passed through successive generations in the form of story, song, dance, art, and material culture.

Aboriginal knowledge is typically transmitted through the “Dreaming”, which is the embodiment of the oral traditions, laws, customs, and culture of the community (Rose, 1992). Hamacher and Goldsmith (1987) in Aboriginal cultures, the dreaming is sometimes thought of as a time in the distant past where spiritual ancestors and beings formed the land and sky. The study argues even though Batswana indigenous astronomy is a thin area in terms of research, there is a wealth of oral traditions among the Batswana related to rainmaking ceremonies, knowledge of the stars, sun, moon and other constellations.

Hence, it fundamental to research and document in indigenous languages the relationship between Batswana oral traditions, their knowledge of astronomy and cosmology. There are certain oral traditions among the Batswana with deep connection to the sun, moon, stars and other constellations. Furthermore, there are also star lore among various indigenous communities in the world. Star lore is the creating and cherishing of mythical stories about the stars and star patterns (constellations and asterisms); that is, folklore based upon the stars and star patterns. One example of star lore is the inventing of the story of Orion the Hunter and the Scorpius the Scorpion by the ancient Greeks.

There are other examples such as the star lore behind the constellation Andromeda, also known as "the chained woman". Andromeda was the daughter of the king and queen of Ethiopia, King Cepheus and Cassiopeia. There is also Draco which is another example of star lore in ancient Greek. The word *pula* (rain) often occurred in the praise songs of kings and kingly duties were highlighted in the following three (03) Batswana rain songs with the English translation provided on the right hand side:

Pula

*Pula! Pula! Pula! Morena
Re shoele re le batho ba hao.*

Rain

Rain! Rain! Rain! King
We are dead who are your people.

There were rain songs like the one above which were used to praise the Batswana kings and their role in rainmaking. However, there were others songs which were sung when the king was unable to bring rain and there was drought in the village. The link between king and rain was so strong that the inability to make rain could even cost them their kingship. Below is a song performed in the old annual rainmaking ceremony about the king who could not bring rain during drought. This songs were recorded by Schapera (1971):

Pula

*Isang walona oa loa
 Le Kwapeng walona oa loa
 Le Rakgari wa loan oa loa
 barelomeletsa pula
 gabake barethotheletsa pula
 kogodimo kwa.*

Pula

*Morena refe pula,
 Isang refe pula
 Molefi refe pula
 Moroka refe pula
 Marena refeng pula.*

Rain

Your Isang bewitches
 and your Kwapeng bewitches
 and your Rakgari bewitches
 they deprive us of rain.

Rain

King give us rain,
 Isang give us rain,
 Molefi give us rain,
 Rainmaker give us rain,
 Kings give us rain.

However, it was noted that Christian missionaries such as Mr Reyneke preached at church and encouraged kings to abandon such traditional beliefs and practices about rain. The study argues that that rainmaking beliefs and practices was affected negatively by the advent of Christianity among Batswana kings. The Christian missionaries believed that such traditional practices caused drought and discouraged offerings of sacrifices, use of traditional medicines and only encouraged the kings to do rain prayers because rain comes only from God.

As indicated earlier, the Batswana developed proverbs which were related to the sun, moon and other constellations. For example, there is a Tswana proverb is: '*The Moon laughs at the Sun saying "You are white" ' (Campbell, 1972). The explanation here is that one should look at one's self before attacking others. Other African indigenous communities such as the Northern Basotho, developed riddles and other expressions related to the moon.*

For instance, another Northern Basotho riddle is: '*I walk together with my friend, and when I enter my dwelling he stays outside*'. **Answer:** 'The moon' (Makopo, 1989). Two further riddles with the same answer are: '*My lamp burns at night, but not during the day*' and '*My lamp emits light without using paraffin*' (Makopo, 1989). Also relevant is: '*The whole area is white*'. **Answer:** 'The moon' (Makopo, 1989). Likewise of interest is: '*Something white on its stomach*'. **Answer:** 'A child of the moon' (Endemann & Hoffmann, 1927).

The Batswana also developed poems regarding different months. Some of the poems are published in the book written by Chweneemang B.E called Tswana poetry. He wrote fascinating using Setswana language and metaphores about Batswana months such as *ferikgong* (January), *tlhakole* (February), *seetebosigo* (June) and *sedimonthole* (December). Magoleng BD and Motlhake SF (1969) also wrote and published poems about Batswana and their knowledge of the sky. He wrote poems about *dinaledi* (stars), moon (*ngwedi*) and *letsatsi* (sun) among the Batswana. These are the poems about different types of stars, the morning sun and the moon.

Dinaledi

*Ga itsiwe ke modimo go kwala,
pampiri-tshelete a e tladika,
Le legodimo la phirwa dika,
Le kgatshwa ke bomme ba le dikwala;
lelapa la lopana le thitelo,
modiri a dira go se dithitho.
Tshwatlhana re bona maphatsiphatsi;
Mosetsanyana o rwele dibaga;
'tlalo ngaka e apere lwa noga.
Modisanyana o jarile kgetsi;
Magodimo a tshumile dipone;
Badimo ba re reketse diipone.
Kgwedi eno e begela bolwetse;
E sa feng bolwetse e bega pula,
Motlhaope re tla tshotlha letlhabula.
Ga di kitla di pharama ditsetse;
Le batssetse ba ka se je ka seatla,
Mme mabele a tla tlala difala.
Kopadilalelo o maalomabe;
A le nosi o ipala gararo,
O busa legodimo la boraro.
Kopadilallo ke mphatlalatsane;
Mphatlalatsane ke kgogamasigo,
O begelwa ke dikoko bosigo.
Mme magodimo a sukasuketswe;
Kolobe e fenekolola direpe;
Dithutlwa di gatana ka direthe,
Tsotlhe logageng di a phelemetswa.
Tona e mpampetsa tshadi ka kgara,
Dikgaka di belebethlwa ke kgora.
Tswetswee, kgwedi o ntlele ka botshelo!
Motsheganong keole o a roga!
Beke eno pula ga e goroge;*

Stars

The unknown is the written god
He coloured paper money
And the heavens patched with debris
Laid by expert woman
The ground married with smoothening stone
The worker toiling without sweat
Tshwatlhana we see the glitterings
The girl is wearing beads
The doctor wears the snake`s skin
The young shepherd is carrying a bag
The skies have put on the lights
The gods brought us lights
This month reports illness
If not singing illness, it precipitates rain
Maybe we may enjoy autumn`s harvest
The calved cattle will not perish
Even the new mother will not be handicapped
And corn will fill up granaries
The even star is nocturnals
He counts himself three times
He govern the third heaven
The evening star is the morning star
The morning stars is the night dragger
He is carried by the chicken at night
And the heaven have been jostled
The pig is digging up vegetable species
Giraffes tread each other with heels
All of them disappear into a cave
The premier is covering the woman`s mistakes
The guinea fowls feed beyond saturation
Please, you month bring us good life
The May month is coming out
The rain is not promising this week

*Maru a ga a na bona botshelo;
A re tshwaretse ona maithamako,
Dilo tsa banyanyana ba tshameka.
Naka e tlhaba re a tshabatshaba;
Phefo e re tsena gare ga mmoko,
Le banyanyana ba alaswa mmoko,
Bojang gab o na go tlhola bo tlhaba;
Bo omoletse le tsona dinono,
Bo kgaoga metlang le yona menoto.*

These clouds bear no life
They only encompass hypocrisy
Childish thing of play
Naka star appears with shyness
The wind penetrate our marrow
And the children are cured for smallpox
The grass will no longer grow
It is dry even the stems
Their roots are cut off even their nodes.

The poem above is evidence in of how Batswana transmitted their knowledge of the sky to the younger generation. The poems talks about Batswana sky knowledge, different stars such as *kopadilalelo*, *mphatlalatsane*, *naka* and their significance. The following five (05) poems is about molalatladi, ditlha tsa ngwaga, phirimo ya letsatsi and the English translation is provided on the right hand side.

Molalatladi

*Bontle o bo abetswe noga ya godimo!
Ya gago mebala ga e na palo
Go o motala, mohibidu le serolwana
Le e re sa itseng
Ya gago kgalalelo e itumedisa matlho
Go go yo a itseng tshimologo le bokhutlo
Ba gago boleele ke ba tsela ya kgalagadi
Ke wena o re bontshang go sag a pula
Kgalalelo yona o e abetswe
Ke kgogedi ya matlho banyaneng
Mma nkapese kobo ke ye ntle!
Ke ye go dumedisa kgosi ya loapi
Ga o laolwe ke boesengmang
O laolwa ke mmopi fela
Mma ntlogele ke boke
Ke boke mokgabisa loapi.*

Milky way

Beauty has been bestowed up you, snake of the sky
Your colours are abundant in number
There is blue one, red and yellow
And those we don't know Your brilliance is admired through eyes
No one knows the beginning and the end
Your longevity equals that of Kgalagadi road
You are the one showing us the stoppage of rain
The brilliance is bestowed upon you
Its an attraction of children's eyes
Mama wrap up a blanket around me
I want to go outside
To go and greet the king of the sky
You are not governed by novices
You are governed by the creator only
Mama leave me to praise
Praise the decorator of the sky.

Ditlha tsa ngwaga

*Ditlha ke tse nne ngwageng
 Di laolwa ke Mmopi fela
 Tatelano ya tsone ga e fetoge
 Dikgakologo, Selemo, Letlhafula le Mariga
 Ditlha ga di Tshwane ngwageng
 Dingwe di ratwa mo go maswe
 Dingwe ga di ratwe ke batho
 Ditlha, motheo wa ngwaga
 Dikgakologo tshimolog ya bontle
 Ditlhare di thunye, di talafale
 Bojang bo talafatse naga
 Go gakologa sa mariga serame
 Selemo maungo ntle-ntletse
 Moretologa, motlhatswa, moumo
 Ditshwene di je, di lebelele ka matlho
 Dinonyane di letse melodi
 Legodimo le apere kobo e ntsho
 Metswedi ya legodimo e pumpunyege
 Lefatshe le nwe metsi-botshelo
 Fatshe le sale le re talaa!
 Mariga go fetoge gotlhelele
 Bojang bo sale bore setlhee!
 Tshoswane e tshabele tlase ga lefatshe
 Batho ba itshube matlong.*

Legadima

*Go tshikinya tumelo bobo
 Fa tintibane a befile
 A golola legadima
 Go kgakola magodimo mpa
 Lo otlolola menwana
 Go tlamparela ka tshakgalo
 Kago eno ya segosi.*

Letsatsi morago ga pula

*Letsatsi moswamotona
 O letse a apere maru dikobo
 A tloga a ditlatsa bokgola
 Fatse la nelwa ke pula.
 Banyana ba tswile ba opela
 Ba re ke moroto - wa - letsatsi
 Gompiano o gana go tsoga*

Seasons of the year

There are four seasons in the year.
 They are controlled by the creator only
 Their sequence never changes
 Spring, summer, autumn, winter
 Seasons are not similar in the year
 Some are bued abundantly
 Others are disliked by the people
 Seasons, the foundation of the year
 Spring is the beginning of beauty
 Trees blossom and get green
 Grass turn the veld into green
 The winter frost melt
 In summer fruits are in abundance
 Baboons feast and despair
 Sour plum, emetic fruit, rock - fig
 Baboons eat all and despair
 Birds whistle in song
 The sky is apparelled with black blanket
 The spring of the sky trickle with water
 The earth then drinks the fountain of life water
 The earth then remain green
 Water then changes completely
 The grass then remains pale
 The ants flee for cover under the earth
 People hibernate in house.

Lighting

Shaking belief grossly
 When the worse has come
 Unleashing the lightning
 To test the heaven`s belly
 It stretches its fingers
 To grasp with anger
 The erection of kingship.

The day after rainfall

The sun mortal giant
 Yesterday you were cloth
 with clouds as blankets
 They may (clouds) dampen them
 A cause subsequent rain on earth
 The girls come out singing
 Saying it`s the sun`s urine

*O ntsha tlhogo ka ditlhong
E bile o anegile dikobo
Di ffiditse le loapi
O di gotseditse molelo
O mogote o a tuka
O tlhapetse le badiri
Ba bile ba nnetse maaka.*

Phirimo ya letsatsi

*Mongebo oo wa gago, ngwayana
Wa mmala wa metsi a bophelo
Ke o utlwile o ntlhomela diphuka
Ka bona fela ke fofafofa
Legodimong la baratani
Letsatsi le lona ke la me tota;
Ka lona ruri o mpeile pelo
Wa e faposa mmitlwa ya bodutu.
Modimo o thusitse wa letlhabisa,
Fela ke utlwa botlhoko jang
Ka e le beetse phirimo
Kamoso ke tla be ke phela
Ka dikgakologelo fela.
Phirimo ya letsatsi
Ke tla eletsa motlha mongwe
E seng gompiano le ka gope
Ke e bone e mphufagela
E hibitsa bodikela
E bona ke Abelwa dikatlo
Ditoro tsa bosigo ga ke di tshepe,
Tseo didibana di pele
Di ka go tlela ka diletseng
Tsa matlhomola le ditlhong
Tsa tla tsa go sulafaletsa
Tsa go gemisetsa moso.*

Today you don't want to wake up
You protrude your head with shame
You have even hung your blankets
They have darkened the sky
You have kindled fire for them
You are hot you are burning
You washed over the workers
And they are braising with lies.

Sunset

That smile of yours, you young girl
With a colour of life water
I felt you pick my feathers
I see myself flying all over
The lovers heaven
Even the sun is mine truly
Thereby you have certainly appeased me
And steered it away from thorns of loneliness
God help by allowing the sun to shine
But I am aggrieved
Because it's preserved for setting
Tomorrow I will be alive
In autumn only
The sunset
I will wish for some other day
Not today at all
I saw it showing jealousy
Showing red in the west
Seeing what I am awarded prices
I don't trust night dreams
Those are empty promises
They may come with the unexpected
Of sorrow and shame
Which will because you regret
And freeze you tomorrow.

The above Setswana poems highlights that oral traditions such as poems were used to promote knowledge of celestial bodies from the old to the young generation. This is evidence that most of the knowledge about celestial bodies among the Batswana can be found in narratives, songs, poems, riddles, etc. This is one of the strategy that was used by the Batswana to promote and ensure that knowledge of celestial bodies does not fade away.

The above poems is about *molalatladi* (Milky Way), *ditlha tsa ngwaga* (seasons of the year), *phirimo ya letsatsi* (sunset), *legadima* (lightning) and *letsatsi morago ga pula* (the sun after rainfall). The following provides the gaps that emanated from the reviewed literature on African indigenous astronomy: It is on the basis of the above that this thesis identified a number of deficiencies on *bolepa-dinaledi*, as discussed in detail below:

The large corpus of writing describing various aspects of African indigenous astronomy, i.e. the Great Zimbabwe ruins, Dogons of Mali, Nabta stone alignments were often carried out by foreign researchers using Western research methodologies, theories, paradigms and languages. These sources which include reports, documents, field notes, published articles and book chapters are mostly written in Arabic, French, German and English and hardly accessible to the majority of original Africans due to language barriers.

Although African indigenous astronomy rose to its prominence and was popularised by foreign researchers, the vast diversity of African indigenous astronomy has been overlooked and misinterpreted as a result of language and cultural barriers. Since early European colonisation, ancestral indigenous knowledge, languages and other indigenous forms of meaning construction have not been validated or legitimised by Western academics or by its formal schooling systems (Battiste, 2000).

There is lack of collaboration, partnerships and networking among researchers, scholars, indigenous knowledge experts and other stakeholders working in the field of African indigenous astronomy and indigenous knowledge systems. There are pockets of researchers and scholars working in isolation in this field. This results in fragmented and uncoordinated efforts to advance and integrate African indigenous astronomy into the education system. Considering the rich heritage of astronomy in Africa, researchers, scholars and indigenous knowledge holders and practitioners need to collaborate and conduct joint research projects that is underpinned by indigenous philosophies and theories, specifically related to promoting indigenous astronomy research.

The study further argues that the Bakgatla -Baa- Kgafela, like any other tribal group in South Africa, Botswana and Africa in general, have sustained their knowledge of the stars, moon, sun and other terrestrial bodies for millennia. The gaps identified in previous studies motivated the researcher to investigate the indigenous astronomy of Bakgatla -Baa- Kgafela. This brings the researcher to the conclusion that the successful research of African indigenous astronomy will not

only depend on the knowledge and perceptions of communities, local institutions and other stakeholders, but will also require special emphasis on developing creative approaches or new methodologies in research.

There is a need to include modern day Western astronomy and emphasise a holistic approach that recognises the understanding of knowledge of the stars and other terrestrial bodies from an African indigenous perspectives and analysis in the research of astronomy.

2.4.16 Conclusion

Literature reviews adopted in this chapter assisted in expanding the phenomena under study, by bringing more clarity and understanding of views as articulated by other scholars. This is the building block in reflection of the study investigated. Another crucial aspect was the definition and elaboration of key concepts such as astronomy, cosmology and indigenous knowledge systems that are most crucial in the study. The gaps from previous literature are highlighted in this chapter. One of the important discoveries about the literature is that although there is current publications in this subject like Medupe (2005) and Alcock (2010), most of the publications are outdated and were conducted by non-indigenous scholars.

CHAPTER THREE: PHILOSOPHICAL FRAMEWORK OF THE STUDY

3.1 Introduction

Philosophical framework is about what philosophies underpin the study, the type of research questions asked by researcher, literature reviewed, data collection methods, analysis and interpretation (Chilisa, 2012). Most philosophies and approaches in research do very little to provide an overall understanding of ontological framework of *bolepa-dinaledi* and indigenous knowledge systems in general. Chilisa (2012) support the above statement that western philosophers such as Aristotle (383 - 348 BC), Francis Bacon (1561-1626) and John Locke (1632-1704) contributed to what we know today as positivism which is an approach that holds that the scientific way is the only way to truth and reality.

In research that there are several philosophical frameworks depending on the researcher's goal and purposes. Therefore, in analysing *bolepa-dinaledi*, the study followed or applied more than one philosophical frameworks. This is supported by Ornek (2008) who argues that philosophical frameworks in research is selected based on the researcher's goals and purpose. Philosophy plays a very important role in the study of *bolepa-dinaledi* and indigenous knowledge systems in general. It is therefore necessary to determine the place of philosophy and also ascertain its implication in indigenous knowledge systems (Mwinzi, 2012).

A wide reflection about reality, thoughts and ideas denotes a philosophy (Mwinzi, 2015). For instance, Batswana may see a dark clouds outside and concludes or theorise that it is going to rain because of the dark clouds. Furthermore, they may see a rainbow (*motshe wa godimo*) outside and they may theorize that this is a sign that the rain is going to stop. The primary purpose of theorizing is to achieve a better understanding of human enterprise in terms of its empirical and definite aspects.

Kombo and Tromp (2006) holds that a philosophy is a reasoned statement or groups of statements supported by evidence to explain a phenomenon. The term philosophy refers to the general and abstract principles of facts (Mwinzi, 2012). This is why the concept of philosophy is fundamental in the study of *bolepa-dinaledi*. Therefore, this chapter provides a critical debate on the origin of philosophy, the Afrocentric, phenomegraphy and appreciative enquiry philosophy. The following section provides critical debates on the foundation of philosophy.

3.2 Debates on the foundation of philosophy

A critical discussion about the origin of philosophy in this study is fundamental. The term philosophy does not have its etymology in Greek, but in Africa which is the cradle of human kind. The term philosophy, *philosophia*, *filosofia* is not originally Greek word and it simply means those who love science, wisdom, hence *philosophia* (Obenga, 1992). Most Western scholars have in the past spread the misconception that Africa does not have a philosophy of its own. However, there is growing evidence that Africa is the cradle of humanity, therefore disciplines such as astronomy, mathematics, science, philosophy including physics has its origin in the ancient Egypt.

Asante (1990) points that language, myths, truth, memory, dance-music-art, and science provide the source of knowledge, the canons of truth and the stimulus structure of truth. The above statements is supported by Christian (2000) “for people of colour they have always theorised, but in forms quite different from western forms of abstract logic. And I am inclined to say that our theorizing is often narrative forms, in the stories we create, in riddles and proverbs, in the play with language, since dynamic rather than fixed ideas seem more to our liking”

Diop (1981) says that African philosophy cannot develop except on the original terrain of the history of African thought. Karp and Masolo (2000) see African philosophy defending the value of philosophy in the newly independent nations of Africa, arguing that philosophical training and tools provide rigor and method that are badly needed for the task of national development. Odora Hoppers (2002) comes clear about the deep wisdom in African philosophy. She notes that traditional thought and philosophy embodies insights into human nature and the nature of knowledge that underpins IKS practices and values.

It is evident from Hutchison (2003) Robbins et al (2005) that philosophical perspectives are interrelated sets of assumptions, concepts and propositions that constitute a view of the world. Different people in the world have different views, philosophies and perspectives with regard to their knowledge about the night sky. These diverse philosophies, views, perspectives and different ways of constructing and developing knowledge need to be acknowledged.

The researcher also argues that the global knowledge economy has always been dominated by Western philosophical frameworks and science, which tend to dismiss the existence of other theories or epistemologies. This is supported by Ntsoane (2002) who indicates that academic research and its theoretical foundation are based on Western orientations. Odora Hoppers (2002)

posits that critical approaches to both methodology and theory should be seen as a corrective measure in “integrating knowledge” and moving towards a philosophy of articulation.

The consideration and recognition of other philosophical options is vital, especially when carrying out research in indigenous astronomy and indigenous knowledge systems, which is local or community based. Based on this, part of the solution to the problem is to first radically decolonise Western research methodologies, paradigms and philosophies, and to move towards the use of indigenous language, including post-colonial indigenous paradigms and epistemology as well as ensure active participation of indigenous knowledge holders and practitioners in all phases of research.

Battiste and Henderson (2000) argue that if researchers are to take these lessons to heart, they must seek methodologies that build a synthesis without relying on negative exclusions or a strategy of differences. Philosophical framework gives definitions of relationships among all variables for the reader to understand the theorised relations amongst the variables better.

This means that philosophy should always form the basis for investigation, i.e. the researchers investigate facts that exist to obtain information about their realities and how these can be tested for use to improve human life. Philosophy and research is very important in the study of African indigenous knowledge systems and African cultural astronomy.

Various concepts and theories based on the literature, which were previously conducted by various scholars or theorists, was critical in the research study. Choosing a philosophy is very fundamental step in understanding the nature, characteristics and new epistemologies in indigenous astronomy and African indigenous knowledge systems that tends to challenge the legacy of colonial history and the way of conducting research among indigenous communities.

This research study successfully clarifies the philosophical frameworks that have been developed to understand *bolepa-dinaledi* and to provide the motivation and insight for the need to shift research methodologies and paradigms, when conducting research in indigenous astronomy and indigenous knowledge. Battiste (2000) argues that the task for indigenous academics has been to affirm and activate the holistic paradigm of indigenous knowledge, to reveal the wealth and richness of indigenous languages, worldviews, teachings and experiences, all of which have been

systematically excluded from contemporary educational institutions and from Eurocentric knowledge systems.

The researcher further points out that the shortcomings of previous studies could then be identified and rectified appropriately, to pave the way for new studies within the discipline in the future. Finally, the philosophy studied can be tested in a reliable manner. On the basis of the results or findings from existing literature, future researchers can be informed about existing work on the topics they intend to investigate. Through this act of intellectual self-determination, indigenous academics are developing new analyses and methodologies to decolonise themselves, their communities, and their institutions (Hill, 2000 & Cajete, 2000).

This study argues that the global knowledge economy has always been dominated by Western philosophies and science, which tend to dismiss the existence of other philosophies or epistemologies. Therefore, the consideration and recognition of other theoretical options is vital, especially for research into *bolepa-dinaledi* and indigenous knowledge systems which is local or community based.

The study argues that social scientists have often failed to acknowledge, understand and recognise the value of indigenous astronomy and indigenous knowledge systems for four main reasons. Firstly, many of them have not examined the philosophical foundations of their own cultures, traditions and knowledge systems. This has made it difficult for them to understand African ways of life, knowledge systems, African thought patterns, cosmologies and epistemologies.

Secondly, even those who have examined the philosophical foundations underpinning Western oriented thought have failed to recognise its African equivalence, simply because they were blinded by different idioms or expressions and language. There has been a tendency to dismiss any language different from theirs as no language of the “other” all. This has resulted in the domination of African indigenous languages by foreign languages, as medium of instruction in education systems across the African continent.

Thirdly, to understand a different knowledge system and to evaluate its cogency or logic, it is necessary to know the questions and puzzles such study systems propose to answer. Understanding these questions and puzzles in turn necessitates reconstructing the social, historical and conceptual context that forms the horizon of enquiry and this has been absent in the scholarship.

Identifying the organising questions, the puzzles Africans have posed about the environment, life and nature is important. This is due to the fact that they have not understood such questions and the context of such questions, Western scholarship has been shallow and biased towards recognising and acknowledging the significance of indigenous knowledge systems.

Fourthly, understanding always involves understanding from within a framework that makes sense for us. The only way to understand the next culture or other people inevitably requires a framework that makes sense to you. In this sense, learning the questions of other people involves posing questions to those other people in light of one's own conceptual preoccupations.

Philosophy in the context of indigenous astronomy and IKS in general begins with African cultural and intellectual experience, with African mentalities, and traditions. Odora Hoppers (2001) supports the assertion of Senghor in that unlike the traditional philosophy of Europe for instance which is dualistic and dichotomous, founded upon separation and opposition, and which separates body from mind, soul, matter and spirit, Africa philosophy that underpins indigenous astronomy conceives the world beyond the diversity of its forms and seeks synthesis.

Philosophy is well known for examining its presuppositions before it actually begins to argue for something. It is the argument of this study that the fallacy that philosophy originated in Greek should be challenged, and the mono - way of doing things by using our perspectives from Africa. The following section provides the discussion of phenomenography as one of the philosophies underpinning this study.

3.3 The philosophy of phenomenography

As indicated earlier, one or more philosophical frameworks or orientations are used in research. Ornek (2008) points that phenomenography is one of the philosophical framework and approach used in qualitative research. Hence, in this chapter, phenomenography as a qualitative research metaphysical framework, is presented, discussed including its appropriateness and application in the study. Phenomenography as a qualitative research philosophical framework is not very well known, in contrast to other philosophies familiar to most qualitative researchers of today (Larson & Holmstorm, 2007; Ornek, 2008). Published articles on phenomenography and its tenets have been observed and critically reviewed as part of the philosophical framework.

Most of the literature on phenomenography reviewed tend to come to the same conclusion, firstly, that it emanated from thematic analysis of other types of qualitative analysis, secondly, from the empirical educational framework of researchers in Sweden in the 1970`s, thirdly, it subsequently evolved as philosophy of learning and awareness. (Winterling, Wasteson, Glimelius, Sjoden & Nordin, 2004; Larson & Holmstorm, 2007).

In addition, the development of phenomenography represented a reaction against and alternative to, the then dominant tradition of positivistic, behaviouristic and quantitative research (Svensson, 1997). Ornek (2008) indicates that phenomenography is an empirical research tradition that was designed to answer questions about thinking and learning, especially for educational research. Therefore, this chapter describe and discuss phenomenography and it illustrates how this philosophy is applicable and can be pragmatic in this study.

Furthermore, the study illuminates how phenomenography can be a useful device in the study on *bolepa-dinaledi*. Phenomenography is deemed to be appropriate due to the fact that it assist the researcher to depict, the different but interconnected thinking, philosophy, knowledge, understanding, experience, imagination, epistemology, cosmology, of Bakgatla -Baa- Kgafela in Botswana and South Africa with regard to *bolepa-dinaledi*.

Phenomenography as a philosophy often depicts how people understand, distinguish, recognise, imagine, conceive and experience the different aspects (characteristics) of the world around them: "conception" (Carbone, 2007). Therefore, it is dealing with people`s perceived understanding or experience of a particular phenomenon (Khan, 2014). Marton (1986, 1988b) described phenomenography as an empirical based approach that aims to identify the qualitatively different ways in which different people experience, conceptualize, perceive and understand various kinds of phenomena.

Khan (2014) states that the main aim of phenomenography is to discern the qualitatively different means of experience, and to conceptualize, interpret of grasp a range of phenomena and aspects of the world. Bowden (2000) and Marton (1994) points that the researcher in this paradigm believes that people are experiencing or conceiving a particular phenomenon in a limited number of qualitatively different ways.

Hence, phenomenography is a search for qualitatively different, logically interconnected conceptions or understandings that a group of people endure for a particular context (Marton, 1994). The following section is about the foundation and beginning of phenomenography.

3.4 The foundation and beginning of phenomenography

Khan (2014) points that the term phenomenography has its Greek etymological root, which has derived from the two words "*phainmenon*" (appearance) and "*graphein*" (description). Therefore, phenomenography is the description of appearance (Hasselgren & Beach, 1997). The term phenomenography originated in the mid 70`s from the original work of Ference Marton and his colleagues at the University of Goteborg in Sweden, but the term was used by Ference Marton himself in the 80`s (Richardson, 1999).

Richardson (1999) argues that for the past 25 years, there has been an increasing interest of researchers in higher education with regard to the application of phenomenography as a philosophical framework and approach. Khan (2014) support the above statement that phenomenography is a qualitative research framework which has recently being used by researchers in developing countries whereas developed countries has already taken up since the last two decades. Richardson (1999) adds that researchers in countries such as Australia, Netherlands and United Kingdom have already taken up this framework.

Marton (1986), "phenomenography is a theoretical research tradition that was designed to answer questions about thinking and learning, especially for educational research." Khan (2014) phenomenography is the theoretical study of the different ways in which people think of the world. In phenomenography, the researcher chooses to study how people experience a given phenomenon, not to study a given phenomenon. Marton (1986) and Booth (1997) described phenomenography as: "Phenomenography is focused on the ways of experiencing different phenomena, ways of seeing them, knowing about them and having skills related to them.

Marton and Booth (1997) points that phenomenography seeks to explore these different conceptions or structures of awareness which people constitute from their world of experience. Entwistle (1997) argues that an understanding of the contribution of phenomenography has made to research in higher education depends on recognising its origins and its subsequent development as a philosophy and approach in research.

Entwistle (1997) quotes the summary by Saljo in the following terms: “What eventually became codified as phenomenography started out as an attempt to scrutinize and understand human learning by focusing on what people are in fact doing in situated practices and when studying. In particular, the approach and philosophy was driven by an attempt to replace the abstract and empirically unverified conceptual framework, such as those which implied that people “process” or “store” information in various processing devices of dubious ontological status.

The aim was of reinstating a truly empirical approach and philosophy to learning as a human and institutional phenomenon, with an interest in classifying functional relationship between what people do when they engage in learning activities and the nature of understanding they end up with. The spirit was one of adding sensitivity to understanding by showing that content and context were essential and that any attempt to do away with these would lead to abstractions.

Phenomenography is about diverse ways of understanding (Larson & Holmstorm, 2007). It is the result of a person thinking intentionally, interacting with the phenomena and striving to create a meaning. A phenomena can theoretically be perceived in an infinite number of ways, but in the process of creating meaning, only a limited number of ways of understanding will remain (Uljens, 1996 & Ekeblad, 1996). The different ways of understanding have both the “what” and “how” aspects. The “what” aspects tells us what is in the subject focus, the “how” aspect describes how meaning is created (Larson & Holmstorm, 2007).

In this chapter, a range of articles considering the philosophy of phenomenography and its application have been reviewed. There are articles that celebrates the fundamental validity and those that critique phenomenography (Entwistle, 1997). However, all contribute to the discourse and debate on phenomenography. Most of this debates started in the article *Nordisk Pedagogic* between 1993 and 1995. There are also other scholars such as Webb (1997) who continued this debates further. Scholars such as Booth (1997) have also contributed to the debate on phenomenography and its contribution to teaching and learning.

Svensson, Saljo, Hasslegren, Beach wrote articles and presented useful arguments in this subject matter (Entwistle, 1997). Hazel Conrad and Martin argue that phenomegraphy has failed to give sufficient attention to gender. The argumerit here is that phenomenography does not address appropriately issues that relate to the voices of poor and marginalised woman, instead it promote traditional patriarchal disciplinary frameworks (Entwistle, 1997).

Scholars such as Mugler and Landbeck contributed to the philosophical debate on cultural variations in conceptions of learning and assessments. Entwistle (1997) concludes that some of the articles may seem to undermine the value and validity of phenomenography and question its credibility. However, many of the criticism can be viewed, not as a dismissal but as a caution or warning to researchers about the pitfalls, challenges, complexities and paradoxes of conducting research. The following section deals with the epistemological and ontological assumptions of phenomenography.

3.5 The epistemological and ontological assumptions of phenomenography

It is pertinent to enquire into the epistemological and ontological foundation of phenomenography as a philosophy and approach (Richardson, 1999). Phenomenography as a research approach developed from strong empirical roots (Hasselgren & Beach, 1997). As it became more widely used as an approach, a greater emphasis was placed on making explicit its philosophical underpinnings. The development of phenomenography is a response to the dominant tradition of positivistic, behavioural and quantitative research (Svensson, 1997).

Marton, in his seminal paper on phenomenography (Marton, 1981) laid much of the early foundations for the ontological and epistemological underpinnings of phenomenography. Epistemology basically means what relationship the researcher have with the research. It is concerned with how do we get knowledge or how do we discover things? How do we construct reality in such as way that the “I” (researcher) does not overshadow the other and the community or “We” does not shadow the “I”? Jensen (2007) has argued that workers in education, development, policy makers and researchers have at times adopted the individualistic approach to the construction of knowledge and its application.

This study argues that in research, there are mainly two basic beliefs about how we should gather knowledge. Some belief that research should be done in an objective way, so that the researcher does not influence the data that is gathered. Which means that knowledge should be gathered through objective measures. They think that in order for the researcher to find out knowledge, they need to stay as far away from the research as they can so that they can get objective measurements. The argument is that truth can be found and measured. This approach is also known as the “*Etic Approach*” to research. It means that a researcher has to take an outsider’s view of someone’s else situation. It is a quantitative and has to do more with statistical mathematics and positivist approach.

In contrast, this study embraces the “*Emic (inside) Approach*” that believes in subjectivity approach to reality. Interacting with people to find out what truth means to them is fundamental. So the researcher in this approach would like to get inside the community, interact and listen to the community. Interaction is crucial to discover meanings and to get an in-depth understanding of what is going on. This approach is qualitative and has to do more with interviews and focus group discussions. Phenomenography is designed to explore lived experiences of communities.

Hence, in-depth interviews was conducted with the participants to understand the context of their experiences. The use of interviews done to explore the context of the situation means that the “emic epistemology” is being used. In phenomenography complex decisions are made about how data should be collected and analysed. Talking to participants to gather information about the situation is fundamental.

Marton and Pang (2008), the epistemological stance of phenomenography is based on the principle of intentionality. This principle embodies a non-dualistic view of human consciousness whereby experience is depicted as an internal relationship between human beings and the worlds (Pang, 2003). Hence, according to phenomenography, knowledge is constituted through internal relations between people and the world, it is conceptualised as human-world relationship (Bowden & Marton, 1998; Marton & Pang, 2008).

Therefore, in phenomenography, knowledge is understood in terms of various meanings associated with phenomena of interest, the similarities and differences in those meanings (Svensson, 1997). Marton and Booth (1997) argue that this variations in experience is said to represent “collective consciousness” about the phenomena. Hence, this study, therefore it is not based on a realistic ontological assumption that leads to an etic epistemology based on positivists thinking. It is not based on realism, measurements of truth, objectivity and does not entertain the idea of a researcher measuring without disturbing the reality that you are studying.

Knowers are seen as beings with connections to other beings, the spirits of the ancestors, the world around them that inform what they know and how they know it (Chilisa, 2012). African perspectives view relational epistemology as knowledge that has a connection with the knowers. It is the well-established general beliefs, concepts and philosophies of any particular people, which are stored in their language, practices, rituals, proverbs, folktales, myths, and stories.

Explaining knowing informed by the multiple connections of knowers with other beings and the environment, Deloria (1995) observes for instance, that indigenous communities gain knowledge and understanding of the world by participating in events and observing nature such as birds, animals, rivers, and mountains. In this study, the so called indigenous knowledge experts (*baitseanape ba kitso ya tlhago*) have a wealth of indigenous astronomy (*bolepa-dinaledi*) which encompass the philosophy, thinking, knowledge, philosophy, cosmology and application of knowledge of the sky.

Indigenous knowledge experts are the sources or custodians of this knowledge and transmitted it from generations through their own language, songs, stories, proverbs, riddles, etc. They have a symbiotic relation with the cosmos, sky, environment, and the ancestors. Wilson (2008) and Getty (2010) add that knowledge comes from the people's histories, stories, observation of the environment, visions, and spiritual insights. A common thread in postcolonial indigenous relational epistemologies is that knowledge arises out of the people's relationships and interaction with their environments.

Chilisa (2012) argue that this view underscores the right of the formerly colonised and indigenous peoples to construct knowledge in accordance with the self-determined definitions of what they want to know and how they want to know it. Ontological assumptions relate to the nature of being, that is questions regarding the nature of reality and the nature of human beings in the world (Denzin & Lincoln, 2003). In philosophical terms it refers to the study about our existence and the fundamental nature of reality of being.

Chilisa (2012), ontology is term that is used to define the philosophical assumptions about reality. It is a term that is for beliefs about reality. Relational ontology addresses the nature of being and how worldviews on being are implemented in the social construction of realities (Chilisa, 2012). She (Chilisa) further argues that the "Ubuntu" world sums up this conception of reality. The Ubuntu worldview expresses an ontology that addresses relations among people, relations with the living and the non-living and spiritual existence that promotes love and harmony among peoples and communities.

Senghor (1966) in the principle of "I am because we are" the group has priority over the individual without crushing the individual, but allowing the individual to blossom as a person. Goduka (2000) supports the above statement and argue that the concept of self that is individually defined and is in

tune with monolistic and one dimensional construction of humanity. Different kinds of research are founded on different beliefs of what we think truth is. Hence, this study argues perceptions of truth or reality influences what we think we can know. What we think reality is will shape what we know about reality. There are different philosophies about reality known as positivism and realism.

However, there are more other ontologies than the two mentioned above such as critical and historical realism. Realists believe that only one truth exists and does not change. They also believe that truth can be measured and can be generalised to other situations. Hence, this study is not carried out using the ontology based on realism. In fact, this study is based on relativism which believes in multiple versions of reality.

It argues that there is existence of multiple realities and what is real depends on the meaning we attach to truth and shaped by content. Realists believe that truth does not exist without meaning and they argue that since reality is context bound it cannot be generalised, it can only be transferred to another similar context. Positivism for example is a paradigm that searches for the truth or facts about reality that can be measured objectively.

The study argues that the ontology within the positivistic paradigm is based on objectivity and dualist in nature. The researcher takes an outsider's view and is distant from research, normally uses statistical mathematics with large samples and the methodology is experimental. It is based on relativist ontological perspective within the qualitative or constructionist paradigm of research.

Phenomenography believes in multiple construction of reality which is influenced by social interactions and experiences. In general truth is subjective, dynamic, complex, and co-contextual. Which means that individuals or groups construct reality based on interactions with the environment. Marton (1986) adds that phenomenography is a qualitative research methodology, within the interpretivist paradigm, that investigate the qualitatively different ways in which people experience something or think about something.

Marton (2000) explains phenomenography non-dualist ontology perspective stating: There are not two worlds: a real, objective world, on the one hand, and a subjective world of mental representations, on the other. There is only one world, a really existing world, which is experienced and understood in different ways by human beings. It is simultaneously objective and subjective.

A non-dualistic stance therefore assumes there is an inseparable relationship between people and the aspect of their world and exploring this relationship is the focal point of phenomenography (Yates, Partridge & Bruce, 2012). This perspective has led to phenomenography being referred to as a relational approach to research. Svensson (1997) because the research object in phenomenography has the character of knowledge, its ontological assumptions become epistemological in a broad sense.

An example of Ornek's (2008) is that work where the existence of relation between the object and subject is more clear. When children are asked to create the number six (06), one may come up with $4 + 2$, another might say $5 + 1$, and another can reply with $3 + 3$. Their decision may come from their experiences related to number 6, it could be the reflections or many other possibilities. In all the scenarios, though 6 is created with a pair of numbers: 4 and 2, 5 and 1, 3 and 3. As a result researchers simply cannot deal with an object without understanding, or having experienced it in some way. In the above case, the subject (children) and the object (counting numbers) are not independent, rather they are intertwined with each other.

Entwistle (1997) and Biggs (1993) points that phenomenography see learning as relational, it takes place through as an interaction between the student, content of learning material and the overall learning environment. The ontological assumptions of phenomenography are subjectivist, which means that the world exist and different people construct it in different ways and from a non-dualistic view point (Marton & Booth, 1997).

Based on the above scenario, a number of researchers such as (Entwistle, 1997; Richardson, 1999 & Svensson, 1997) argued and criticised Marton's original work, one of the argument was that it lacked philosophical basis and is irrational. This led to the development of the tenets of phenomenography as a way to explain the rationale for this approach and philosophy and to distinguish it from other qualitative approaches in social sciences such as ethnography and phenomenology (Richardson, 1999 & Marton, 1981).

Rigorous data collection methods and analysis are hallmarks of phenomenography (Entwistle, 1997). Many researchers argue that various data collection methods can be used in phenomenography such as interviews, focus groups discussion, and written reflective statement. However, interview is the primary method of data collection in phenomenography, however, as indicated above, other methods can be applied. The aim of interview is to encourage the participants

to reflect and fully explain their own views of the phenomenon under study, according to their own way of delimiting the phenomenon (Entwistle, 1997; Lindberg, 2008 & Svensson, 1997). The following section discusses the Afrocentric philosophy.

3.6 The Afrocentric philosophy

Afrocentric philosophy is concerned with establishing a worldview and paradigm shift about research, writing and speaking of the oppressed, marginalized, dominated people, their knowledge systems and ways of life. Asante (1980; 1987) posits that Afro centricity is an intervention paradigm which aims at facilitating the transformation of the Africans from the state of dependence to a state of independence and self-reliance.

Afrocentricity has been chosen as one of the appropriate philosophy due to the fact that this study seeks to change a worldview about indigenous astronomy which has been ostracized and negated by researchers. Most of the studies in indigenous astronomy has been done from the outsider perspective using irrelevant philosophies. Current philosophy such as Hermeneutics, Phenomenology and Structuralism for example, cannot be applied in this study due to the fact that they are rooted in Eurocentric metatheories and positivistic tradition.

Afro centricity is a philosophical framework whose origin is attributed to Molefi Kete Asante's works, *Afrocentricity* (1988b), the *Afrocentric idea* (1988a) and *Kemet, Afrocentricity, and Knowledge* (1990). It literally means, placing African ideals at the centre of analysis that involve African culture and behaviour (Asante, 1980). Asante (1985) states that the basic assumption of Afro centricity is that all Africans share elements of a common culture.

This is the same with Bakgatla -Baa- Kgafela in Mochudi and Moruleng, in the sense, that they share common history, struggle, culture, traditions, totems and they also speak the same language which is Setswana. Therefore, this suggest that all African challenges, social, political and otherwise, should be addressed from an African perspective. The above is supported by Chilisa (2012) that this perspective places the African ways of perceiving reality, ways of knowing and value systems on the equal footing with other scholarly examinations of human experience. It is an Afro cantered worldview which establishes a conceptual framework of how the world is professed, comprehended and understood.

Diop (1978) posits that it is culturally specific and draws on African philosophical and theoretical assumptions and serves Africans, just as classical Greek civilization serves as a point of reference for Europe. Afrocentric philosophy provides an indigenous pathway towards unearthing local community perspective, knowledge, challenges and prospects of Setswana indigenous astronomy and its role in the education system.

Afrocentric philosophy, also referred to in the literature as Afro-centricity, “literally means placing African ideas at the centre of any analysis that involves African culture and behaviour”. (Asante, 1998) and Asante (1988) assert that: “Afro- centricity is the belief in the centrality of Africans in the post-modern era: It is our history, our mythology, our creative motif, and our ethos exemplifying our collective will”.

Asante (1980; 1987) posits that Afrocentricity is an intervention paradigm which aims at facilitating the transformation of the Africans from the state of dependence to a state of independence and self-reliance. It is a worldview based on values of classical African civilization. Advocates of Afro-centricity, argues that high rates of social problems among Africans are a direct results of the imposition of Eurocentric view on Africans (Asante, 1980) and Karenga (1988) concur with this view when he argues that Eurocentric socialization has had an adverse impact on Africans including loss of historical memory of their African cultural heritage.

It is striking that there are some conservative, Eurocentric sceptics who are still jumbled about its implications and long term goals. The study argues that Afro-centric philosophy have been misinterpreted, misused and there has been intentional distortions which resulted in wide spread confusion and misunderstanding about it. This line of argument to distort Afro-centricity was sustained through a number of publications and books.

However, Asante (1988) clarifies this confusion that Afro - centricity does not seek to replace “white “knowledge” with “black knowledge”. Asante was not alone in this enterprise, his line of thinking was inspired by intellectual ancestors such as David Walker, W. E. B. Du Bois, Ida B. Wells, Cheik Anta Diop and George James. The Afro-centric worldview is not anti-white, rather its primary objective is to facilitate a critical reconstruction that dares to restore missing and hidden parts of the African self-formation and pose the African experience as a significant paradigm for human liberation and higher level of human life (Karenga, 1988).

There is nothing strange about Afrocentric philosophy and all distorted or otherwise negative understanding of it are rooted in the way that Eurocentric scholars view Africa. Rejection towards Afrocentricity is based on the hegemony of white supremacy and its philosophy of racial discrimination. It is an inclusive philosophy because it seeks to reorient our worldview in ways that challenges Social Darwinism, Capitalism, and all forms of Marxism all of which are grounded in their own peculiarity (Asante, 1988).

On the same vein, the researcher used Afrocentricity as a philosophical framework through which people should interpret *bolepa-dinaledi* and how on practical basis Bakgatla -Baa- Kgafela use this knowledge on daily basis. It is about fundamentally affirming tradition, customs, values and validating or promoting people's cultural worldviews, epistemologies and knowledge systems in their environment.

In this research, the main objective of Afrocentricity as an intellectual expedition is to demystify and redress historical misconceptions about indigenous astronomy and their cultural values, traditions, practices and customs and to re-construct a historiography that precisely embodies and acknowledges African cultural contributions to development of astronomy. This view is supported by Mkabela (2005) who argues that Afrocentricity focuses on Africa as a cultural centre for the study of African experiences and interprets data from an African point of view.

Asante (2007) contend that Afrocentric philosophy enables researchers to view African identity from the perspective of African people. Asante (1988) posits that the aim of Afrocentricity is to seek ways to unite Africans at home and abroad based on mutual respect for the cultural agency of all peoples.

The history, knowledge systems and values of Africans cannot be interpreted simply from the standpoint of white supremacy and hegemony. Afrocentricity, projects the metaphor of a melting pot, pluralism and respect for cultural diversity. Its fundamental function is to demonstrate the illogic in empiricist epistemologies while at the same time questioning the conceptual cosmologies that give rise to the concept of the foundation of civilization in a Greek miracle (Asante, 1988).

Asante (1998) Afrocentricity is not just a philosophy but a moral and an intellectual location that posits Africans as arbiters of their own destinies. It projects the perfectly valid and scientific basis for the explanation of African historical experiences and it will always reject every form of

hegemony. Afrocentricity analyses re-establishes the centrality of the ancient Kemetic (Egypt) civilization and Nile valley cultural complex as points of reference for an African perspective in which the much the same way that Greece and Rome serve as reference points for European worlds (Asante, 1988).

Furthermore, Afrocentricity is a lens to appreciate the complexity, historicity of Africa culture and to develop a systematic approach of articulating the African world voice. Hence, the researcher was fascinated by Afrocentricity as not just relevant but appropriate philosophy to underpin the study on indigenous astronomy of Bakgatla -Baa- Kgafela in Botswana and South Africa. This study shares the same view of scholars such as Asante, Diop and others who argue that objectivity in research is based on empiricist epistemologies. The study agrees with Asante (1988) that there other ways in which to experience phenomena rather than viewing them from a Eurocentric vantage point and lens. The philosophy of appreciative enquiry is briefly discussed in the following section.

3.7 Appreciative inquiry philosophy

The Appreciative Inquiry (AI) was coined by David Cooperrider as one of the first post-Lewinian Organizational Development Methods and probably catalysed the subsequent proliferation of Dialogic OD methods (Bushe & Marshak, 2009) that operated outside the Lewinian paradigm. Cooperridge, 1986; Cooperridge & Sekerka, 2006), Appreciative Inquiry (AI) did not begin life as an organizational change technique, but it began as a research method for making grounded theory building more generative.

Acknowledging that all social research is inherently biased by the positioning of the researcher, Cooperridge argued that this was not a reason to throw hands and give up the pursuit of knowledge. What researchers choose to study and how they study it creates as much as it discovers the world and therefore, a wide field of creative, positive, possibility beckons us (Barret 1995; Cooperridge & Srivastva, 1987).

Most of the research approaches are Eurocentric, problem focused, aiming at discovering communities from the outsider's objective view of reality, aiming at discovering communities constraints and unmet needs (Chilisa, 2012). Mertens (2009) points that problem focused modes of inquiry work with deficit questions and they serve only to contain conversations, silence marginal voices, fragment relationships, erode community, create social hierachy and contribute to cultural

enfeeblement, thereby allowing scientific vocabularies of deficit to establish the very same condition they seek to eliminate (Mertens, 2009).

Ludema (2002) recommend combining participatory action research with appreciative enquiry to change the mindset of the researcher and the researched, inform the questions researchers ask and how they ask the, and ultimately create a research process that leads to social change and transformation. However, in this study, appreciative enquiry is combined with Afrocentricity and phenomenography philosophy to provide affirmative assumptions about the Bakgatla -Baa- Kgafela and their thinking, knowledge, understanding, cosmology and epistemology about *bolepa-dinaledi*.

Ludema et al (2001) points that one of the challenges researchers are facing is moving away from the deficit-focused modes of enquiry using deficit-based questions to philosophical frameworks of positive psychology with emphasis on strengths and positive images of the researched. Appreciative inquiry is a change focused research approach that is guided by affirmative assumptions about the researched people or communities (Chilisa, 2012).

Appreciative Inquiry (AI) is the cooperative search for the best in people, their cultures, organizations and the world around them. The traditional approach to change is to look for a problem, do a diagnosis, and find a solution (Sue, 1998). In conventional approaches to research, the primary focus is on what is wrong, or broken, since we look for problems, we find them. By paying accounts to problems, we emphasize (stress) and amplify (intensity) them. In contrary, Appreciative Inquiry (AI) suggests that we look for what works in an organization, culture or community. White (1996) posits that Appreciative Inquiry (AI) focuses us on the positive aspects of our lives and leverages them to correct the negative, it is opposite of problem solving.

Appreciative Inquiry (AI) is a philosophy and practice for approaching change from a holistic framework. It is both a worldview and a practical process (Watkins & Mohr, 2001). In philosophy Appreciative Inquiry (AI) is a perspective, a set of principles and beliefs about how human systems function, a departure from the past metaphor of human systems as machines (Watkins & Mohr, 2001). It can be used to create the transformative processes and practices appropriate to the culture of a particular organization or community. Appreciative Inquiry (AI) is grounded in the philosophy of “social constructionism”. It recognizes that human systems are constructions of the imaginations, and are therefore, capable to change at the speed of imagination (Watkins & Mohr, 2001).

AI is heavily influenced by theorists and narrative especially as applied to organizational change (Barret et al, 1995; Boje, 1991; Marshak & Grant, 2008; Oswick, Grant, Michaelson & Wailes, 2005). The initial storytelling that the participants engage in, when they describe their ‘best of stories’ is a key to innovation of the AI method and widely regarded as essential for setting the tone of an AI intervention (Ludema, 2002).

Cooperrider and Srivastva (1987) argued three main points in support of AI. Firstly, they criticized the problem solving approach that, at that time, dominated action research, arguing that problem solving, as a tool of social innovation, did not do a very good job, and might in fact be counterproductive. Secondly, they argued that organization were best viewed as socially constructed realities, and that forms of organization were constrained only by human imagination and shared beliefs of members of the organization.

As socially constructed realities, forms of enquiry were potent in constructing the systems they inquired into, and that problem solving approaches were just as likely to create more of the vey problems they were intended to solve. Thirdly, they argued that the most important force for change were the new ideas. They decried the lack of new ideas generated by conventional action research, and proposed AI as a method that was more likely to create new ideas, theories, images that would lead to social innovations.

Appreciative Inquiry (AI) is about the co-evolutionary search for the best in people, their cultures, organizations, institutions and relevant world around them (Cooperrider, 2001). It involves in a central way, the art and practice of asking questions that strengthens the system’s capacity to apprehend, anticipate and heighten positive potential. Its task of intervention gives way to speed of imagination and innovation, instead of negation, criticism, instead there is discovery, dream and design. Appreciative Inquiry fundamentally seeks to build a constructive union between a whole people and the massive entirety of what people talk about as past and present capacities, achievements, assets, unexplored potentials, innovations, strengths, stories, expression of wisdom, opportunities, traditions, and strategic visions of valued and possible futures (Cooperrider, 2001).

Cooperrider (2001) argues that AI deliberately seeks to discover people’s exceptionality, their unique gifts, strengths, and qualities. It is based on the principle of equality of voices, everyone is asked to speak out their vision of the true, the good, and the possible. It builds momentum, success because it believes in people and it is an invitation to a positive revolution (Cooperrider, 2001).

The outcome of AI is long term positive change in the organization or culture. It is important because it works to bring the whole organization or community together to build upon its positive core. It encourages people to work together to promote a better understanding of the human systems, the heartbeat of the organization (Cooperrider et al, 2003).

As people are brought together to listen carefully to the innovations and moments of organizational life, sometimes in storytelling modes, interpretative or analytical modes, a convergence zone is created where the future begins to be discerned in the form of visible patterns interwoven into the texture of the actual images of the future emerge out of the past (Cooperrider et al., 2003). Appreciative Inquiry (AI) is a form of action research that attempts to create new theories or ideas or images that aide in development change of a system (Cooperrider & Srivastva, 1987).

The key data collection innovation of appreciative inquiry is the collection of people's stories of something that is best. These stories are collectively discussed in order to create new, generative ideas or images that aid in the development change (Bushe, 1998). The story is the genesis of all that is human, societies are stories, as our companies, families, communities, and cities (Bushe, 1998).

Bushe (1998) describes five different ways of thinking about how an appreciative inquiry can create a change in social systems. They are the social construction of reality, heliotropic hypothesis, organizational inner dialogue, paradoxical dilemmas and appreciative theories of change. Each directs us to different ways of how to implement AI when our purpose is developmental change. The key data collection innovation of AI is the collection of stories of people's best experiences in a community, culture or organization (Bushe, 1998). Different ways of implementing AI approach needs to be embraced.

In the Social Construction of Reality, all social organization are a result of social construction. Our ability to create new and better organization, cultures and communities is limited by our imagination and collective will. Furthermore, language and words are the basic building blocks of a social reality. Language is not seen as a passive purveyor or gossip monger of meaning between people but as an active agent in the creation of meaning. As we talk to each other, we are constructing the world we see and think about and as we change how we talk, we are changing the world.

The heliotropic effect is the hypothesis that societies, cultures, organizations, groups and individuals work towards the most positive images they hold of themselves (Spacey, 2017). The term heliotropic describes the ability of plants to move or grow towards the sun. The heliotropic effect explains why organizations that have a compelling mission and vision for their future may outperform (Spacey, 2017). When individuals believe in an exciting mission they tend to be fully awake. This likely has significant value.

Cooperrider (1990) argued that the “heliotropic hypothesis” is that social systems evolve towards the most positive images they hold of themselves. These images are not necessarily conscious in that they may not be discussable by the members of the social system, but nevertheless, such images exist and the more they affirm the group the more firmly they hold the group to a pattern of being prescribed by the theory, ideas and images the group has of itself as its very best.

Appreciative Process theorizes that you can create change by paying attention to what you want more rather paying attention to problems. Cooperrider (1991) review of the sports psychology, the Pygmalion effect and brain functioning supported the ancient wisdom that you get more of whatever you pay attention to. As a change technique, appreciative process focus or involves tracking and fanning. As part of shifting the study about indigenous communities from problem focused modes of inquiry to change focused research, Chilisa (2012) suggests that there are four phases such as:

Discovery: during this phase, participants talk discover and learn the best of the moments in the history of an organisation or community. Participants tell stories of exceptional accomplishments and discuss the aspects of their history that they most value and want to enhance.

Dreaming: during this phase, participants envision and imagine other possibilities of their organisations or communities. They may, for instance, use the positive stories to create a portrait of an organisation or community`s potential. Positive images grounded on extraordinary moments of a community or organization `s history are used to envision possibilities and suggest plans for the future.

Design: in the design phase, participants dialogue on strategies to implement their dream.

Destiny: this final stage involves the delivery of new images of the future. During this stage, everyone realigns their activities with the positive images or ideal in a community or organisation, and co-create the future.

An appreciative enquiry propels researchers to address the questions: how are research questions asked, research objectives phrased, and interview guide questions frame? Chilisa (2012) this provides an opportunity for participants to tell their own stories, offer dynamic and unrehearsed information, speak more openly using their own language with less fear or intimidation.

3.8 Conclusion

This chapter has argued that research cannot be conducted in a theoretical vacuum, regardless of whether it is social, scientific or indigenous research. Hence, different philosophical frameworks such as appreciative inquiry, Afrocentricity and phenomenography were used as tools to underpin this study on *bolepa-dinaledi*. In a nutshell, the philosophy underpinning the study on indigenous astronomy and indigenous knowledge systems in general, need to be relevant, appropriate, address the thinking, ontology, epistemology and cosmology of the indigenous communities. The following chapter discusses the methodology of the study.

CHAPTER FOUR: RESEARCH METHODOLOGY

4.1 Introduction

This chapter firstly discusses, justifies the relevance and appropriateness of the methodology and methods applied or chosen in this study. Methodology is a term used to describe the way we discover knowledge in a systematic way. Lincoln and Guba (as cited in Mertens, 2005) describe methodology as the process of gathering knowledge by stating that “the methodological question asks, “How can the knower go about obtaining the desired knowledge and understandings? It is more specific, practice based than epistemology.

The study argues that the appropriate methodology is driven by relational ontological and epistemological beliefs. The methodology of the study is briefly discussed to supply the reader with the roadmap and methods deemed appropriate for the study. However, the term methodology should not be confused with research methods. In research there are different methodologies, however, only those chosen will be discussed. The research methodology was guided by the research objectives, research problem and how data will be collected in the study communities. The research involved indigenous knowledge experts or key participants who have information or knowledge on *bolepa-dinaledi*. The researcher used qualitative approach in data analysis.

4.2 Methodology

Indigenous peoples’ interests, knowledge and experiences must be at the centre of research methodologies and construction of knowledge about indigenous peoples (Rigney, 1999). In recent years, there is a tendency to use methodology and methods interchangeably as if they are the same. Methodology is just a design process and not a procedure or instrument (Berg, 2009; Creswell, 1998; Franklin, 2012; Guba & Lincoln, 1989 & Herrman, 2009). Chilisa (2012) challenges all researchers to debate whether the social science methodologies that originated in the West and are indigenous to the West are necessarily universal for the rest of the world.

Simply defined, methodology is about how research does or should proceed (Porsanger, 2004). Thus, methodology is a body of approaches and methods, rules and postulates employed by research (Porsanger, 2004). Indigenous methodology is a body of indigenous and theoretical approaches and methods, rules and postulates employed by indigenous research in the study of indigenous peoples.

The main aim of indigenous methodologies is to ensure that research on indigenous issues can be carried out in a more respectful, ethical, correct, sympathetic, useful and beneficial fashion, seen from the point of view of indigenous peoples. Methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. Typically, it encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques (Irny & Rose, 2005).

The methodology is the general research strategy that outlines the way in which research is to be undertaken and, among other things, identifies the methods to be used in it. These methods, described in the methodology, define the means or modes of data collection or, sometimes, how a specific result is to be calculated (Savin-Baden & Major, 2013). Methodology does not define specific methods, even though much attention is given to the nature and kinds of processes to be followed in a particular procedure or to attain an objective.

This study support the argument made by Wilson (2001) that indigenous methodologies are a paradigmatic approach based upon an indigenous philosophical positioning or epistemology. Thus, it is not the method, per se, that is the determining characteristic of Indigenous methodologies, but rather the interplay (the relationship) between the method and paradigm and the extent to which the method itself is congruent with an Indigenous worldview (Kovach, 2010). Therefore, worldview or paradigm is at the centre of indigenous methodologies.

Taking into consideration the complexity of African indigenous astronomy of Batswana in Botswana and South Africa, the research study followed a case study approach. Case studies research is directed at understanding the uniqueness and peculiarity of a particular case / cases in all its intricacy. The resulting body of 'case study research' has long had a prominent place in many disciplines and professions, ranging from psychology, anthropology, sociology, and political science to education, clinical science, social work, and administrative science (Yin, 2014 & Milfs et al, 2010).

Usually, its objective is to investigate the dynamics of some single bounded system, typically of a social nature, such as a family, group, and community, participants in a project, institution or practice. Hence, the study argues that, the Bakgatla -Baa- Kgafela in Botswana and South Africa are bounded by tradition, philosophy, customs, language, totems, and thinking with regard to the knowledge of indigenous astronomy.

In addition, the Bakgatla -Baa- Kgafela are a single unit in the sense that they share common struggle, history, language and have a common objective of promoting the culture, values and traditions to posterity. Secondly, there is a geographical implication in the sense that both communities used to live together many decades ago, however, due to historical and political reasons they are now separated by colonial artificial borders which is Botswana and South Africa.

Welch et al (2011) distinguishes four common case study approaches. First, there is the “no theory first” type of case study design, which is closely connected to Eisenhardt’s methodological work. The second type of research design is about “gaps and holes”, following Yin’s guidelines and making positivist assumptions.

A third design deals with a “social construction of reality”, which is represented by Stake (1995). Finally, the reason for case study research can also be to identify “anomalies”. Each of these four approaches has its areas of application, but it is important to understand their unique ontological and epistemological assumptions. There are substantial methodological differences between these approaches. Besides these research methods are very different in nature. Case study can also refer to a teaching method.

A case may be chosen because of the inherent interest of the case or the circumstances surrounding it. Alternatively, it may be chosen because of researchers' in-depth local knowledge; where researchers have this local knowledge they are in a position to "soak and poke" as Fenno (2014) puts it, and thereby to offer reasoned lines of explanation based on this rich knowledge of setting and circumstances. Three types of cases may thus be distinguished for selection, namely; key cases, outlier cases and local knowledge cases.

Since the study has a strong community focus there was a pertinent need for a wide consultation with the traditional leaders, indigenous knowledge experts in all phases of the research process. In research, case studies may use both qualitative and quantitative methods. However, this study predominantly used qualitative research methods. The following section discusses the qualitative approach.

4.3 Qualitative approach

Qualitative research embodies emancipatory, empowering values of critical pedagogy. This involves a re-visioning of critical pedagogy, a re-grounding of Paulo Freire’s (2000) “Pedagogy of

the Oppressed” in local, indigenous context (Denzin, Lincoln & Smith, 2008). Qualitative research is primarily exploratory research. In addition, qualitative research encompasses varying philosophical positions, methodological approaches and analytical procedures.

Qualitative research is a type of scientific research. Denzin and Lincoln (1994) define qualitative research as multi-method in focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative researchers study things in their natural settings, attempting to make sense of or interpret phenomena in terms of the meanings people bring to them. Qualitative research involves the studied use and collection of a variety of empirical materials case study, personal experience, introspective, life story interview, observational, historical, interactional, and visual texts-that describe routine and problematic moments and meaning in individuals' lives.

Creswell (1998) defines qualitative research as an inquiry process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem. The researcher builds a complex, holistic picture, analyzes words, reports detailed views of informants, and conducts the study in a natural setting.

Nunan (1992) draw distinction between qualitative and quantitative studies. He suggests that a quantitative research is obtrusive and controlled, objective, generalizable, outcome oriented, and assumes the existence of 'facts' which are somehow external to and independent of the observer or researcher. Qualitative research, on the other hand, assumes that all knowledge is relative, that there is a subjective element to all knowledge and research, and that holistic, ungeneralisable studies are justifiable.

The qualitative research approach was used, since it is best suited to help the researcher to understand human behaviour and functions (Thorne, 2000). It is used to gain an understanding of the underlying reasons, opinions, and motivations. It provides insight into the problem or helps to develop ideas or hypothesis for potential quantitative research (Bless et al, 2013). Qualitative research also is used to uncover trends in thought and opinions, dives deeper into the problem.

Qualitative data methods vary in using unstructured or semi structured techniques. Some common methods include focus groups discussions, individual interviews and participant observations. In this study the sample size was typically small due to the fact that there are few people who are experts in indigenous astronomy in both study communities. Another reason is that *bolepa-dinaledi*

just like traditional healing system is categorised as specialised knowledge, hence there are few elders in the community who are regarded as credible indigenous astronomy experts.

In this study, qualitative research is any type of research that produces findings not arrived at by statistical procedures or any means of quantification (Strauss & Corbin, 1998). Qualitative research is interpretative, the stories of both the researcher and research participants are crucial. Qualitative research diverges most clearly from traditional positivist quantitative research approach of using questionnaires and statistics.

Qualitative research methods mimic a familiar everyday activity, the human conversation. This however, facilitates an easy talk between the researcher and the respondents or people interviewed. People are allowed to use their own words to share their first-hand information about the matter being investigated with the researcher (Lillejord & Soreide, 2003). Denzin and Lincoln (2003) add to this understanding of qualitative research by stating “qualitative researchers stress the socially constructed nature of reality, the intimate relationship between the researcher and what is studied and the situational constraints that shape the enquiry.

It is an approach that offers space for indigenous ways of researching. The qualitative approach advocated in the study research as Neuman (2011) argues views information as one contribution to the creation of knowledge that can support sustainable practices. Bearing in mind the fact that raw information are the fields of power and values that give shape and form to knowledge, and qualify its uses.

Qualitative research it is quite common for social science and indigenous researchers to develop their own tools of analysis on the basis of theoretical approach. Lillejord and Soreide (2003) indicate that a qualitative research method produces knowledge with certain characteristics that must be taken into consideration when interpreting the data and presenting the findings of the research. It is thus obvious that qualitative research has its strength and limitations.

Buckland (1991) argues that methods of research need to be appropriate to the research problem at hand. Moahi (2002) suggest that we need to be more creative and consider methods other than the famed survey using questionnaires which inevitably forces us to quantify the unquantifiable. The researcher was motivated to use a qualitative research design to be chosen for this study due to the fact that such a design allows for multiple realities to exist that are determined by the perceptions

and experiences of the individuals or groups and therefore are context specific (Struwig & Steed, 2001).

Therefore, this approach was deemed appropriate, relevant for the study, due to the fact that this study focused on the Batswana communities, especially Bakgatla -Baa- Kgafela in Mochudi (Botswana) and Moruleng (South Africa). The following section is based on the significance of reflexivity in qualitative research.

4.4 Reflexivity in qualitative research

Reflexivity has gained paramount status in qualitative enquiry. It is central to debates on subjectivity, objectivity, and ultimately the scientific foundation of social science and research (Burawoy, 1998; Denzin & Lincoln, 2005). It is one of the fundamental concepts that differentiate qualitative and quantitative research. To build upon the interactive nature of qualitative research, Rossman and Rallis (2010) accentuate the reflectivity of qualitative research.

Reflexivity is a term often used within a variety of qualitative research approaches to reference the relational (Kovach, 2009). Reflexivity is the researcher's own self-reflection in the meaning - making process. It is an approach they argue, that demands the researcher to be continually aware of their own biases as a means of consistently locating themselves in the research (Rossman & Rallis, 2009). It is a term that challenges the researcher to explicitly examine how his or her research agenda and assumptions, subject location (s), personal beliefs, and emotions enter into research.

Reflexivity is imperative for qualitative enquiry due to the fact that it conceptualizes the researcher as an active participant in knowledge (re) production rather than as a neutral by stander (Hammersley & Atkinson, 2007; Smith, 1987). This conceptualization premise an interactive and relational research process that recognizes the presence of the informant and challenges a directive, researcher centred epistemological proposition.

The main objective of doing reflectivity in qualitative research is to acknowledge and interrogate the constitutive role of the researcher in research design, data collection, analyses and knowledge production. Because doing reflexivity requires the researchers to examine any pre-conceived perceptions they may hold, reflexivity cannot be learned passively.

The true-value of qualitative research is also affected by the closeness of the relationship between the research participants and the researcher, which develops during the prolonged interaction considered necessary to establish credibility (Krefting, 1991). This closeness creates difficulties in separating the researcher's experience from those of the participants. Reflexivity is a strategy to help ensure that the over involvement of the researcher is not a threat to the credibility of the study.

Reflexivity in this context refers to the assessment of the influence of the researcher's background and ways of perceiving reality, perceptions, experiences, ideological bias and interest during the research (Chilisa, 2012). The researcher is the main data collection instrument. The researcher also analyses, interprets, and reports on the findings. It is therefore important that the researcher's thoughts, feelings, frustrations, fears, concerns, problems and ideas are recorded throughout the study (Chilisa, 2012).

Chilisa (2012), reflexivity as questions such as where do I (researcher) stand with regard to the researched? Am I still a coloniser? Who are the researched? Are the researched still colonial subjects distinct from the coloniser because of their incapability or are the researched active agents capable of generating solutions to their social challenges. The design of the research is discussed briefly in the following section.

4.5 Research design

In social science and indigenous research, critical thinking needs to be applied when it comes to choice of research design. Hence, it is important to note that research can be contaminated by many issues such as sources of bias and error which an expert researcher must address or manage effectively as a tactic to ensure the high quality, validity and reliability of the research.

Research design has several meanings and in this study it is understood as the strategic and systematic planning of any scientific research from the first to the last step. In essence it is a roadmap to guide the researcher in collecting, analysing, and interpreting the observed facts. All research projects require a research design that is carefully tailored to the exact needs of researcher as well as the problem. There are many different designs developed by social scientists over the past years in research. They are more complex and there are different categories that can be distinguished from each other. Designs explain the logic of social science research as should serve as a foundation good research design.

Hence, this study followed the explorative research design due to the fact that it is a fundamental method for qualitative research. Leedy and Ormord (2001) explorative design satisfy the aim of the research to explore and understand the phenomenon. This ensures what is often called internal validity or credibility with regard to whether the methods of data collection and analysis chosen by the researcher addresses the question adequately. The following is about the indigenous paradigm.

4.6 Indigenous paradigm

The indigenous approach may be defined as an ethically correct and culturally appropriate, indigenous manner of taking steps towards the acquisition and dissemination of knowledge about indigenous peoples (Porsanger, 2004). Therefore, the indigenous approaches to research on indigenous issues are not meant to compete with, or replace, the Western research paradigm; rather, to challenge it and contribute to the body of knowledge of indigenous peoples about themselves and for themselves, and for their own needs as peoples, rather than as objects of investigation (Porsanger, 2004). The study used the indigenous knowledge ontological metatheory which provided an opportunity for collection of in-depth information on facts that describe *bolepa-dinaledi*.

A paradigm as stated by Hart (2005) “is a set of beliefs about the world and about gaining knowledge that goes together to guide people’s actions as to how they are going to go about doing their research”. Kovach (2010) posits that the term paradigm as used within a research context includes a philosophical belief system or worldview and how that belief system or worldview influences a particular set of methods. A paradigm is both theory and practice (Kovach, 2010).

The above is supported by Asante (1988) that a metatheory or paradigm is a conception that includes a multiplicity of theories, such, it allows us to develop a better interpretations, fuller understanding and more effective articulations of the meaning of human goals and interactions. Lincoln and Guba expand upon traditional definitions of research paradigms and suggest that a paradigm must include seven considerations: ethics, accommodation, action, control, truth, validity, and voice (as cited in Denzin & Lincoln, 2003).

Thus new research paradigms have emerged in social sciences to break out of the constraints and limitations imposed by positivism (Goduka, 2012). When using the term ‘paradigmatic approach’ in relation to Indigenous methodologies, this means that this particular research approach flows from

an Indigenous belief system that has at its core a relational understanding and accountability to the world (Wilson, 2001).

Ontology is the belief in the nature of reality in the world. Ontology is a theory or set of beliefs about the world (Strega, 2005; Mertens, 2005). The term epistemology is defined as knowledge nested within the social relations of knowledge production (Kovach, 2010). It has been a term used by indigenous researchers to express indigenous worldview or philosophy (Louis, 2007; Meyer, 2001 & Wilson, 2008).

It most closely approximates the term of “self-in-relation” as put forth by Graveline (2000). Epistemology is how we know and think about this reality. For example, based on an indigenous research paradigm, a report is written from the perspective of an involved and passionate scientist, therefore an appeal is made for action to address social problems (Goduka, 2012) and Wilson (2001) as cited in Hart (2010).

Indigenous epistemologies hold a non-human centric relational philosophy (Deloria, 2004) and while tribal groups hold differing relationships with place, as evident in local protocol and custom, (Battiste & McConaghy, 2005) there is a shared belief system among tribal groups (Little bear, 2000). This distinctive Indigenous paradigmatic orientation is a theory of how knowledge is constructed and as such it guides assumptions about what counts as knowledge (Kirby et al, 2006) and offers guidance for research methods.

Such methods include sharing knowledge based in oral history and storytelling tradition (Hart, 2002; Henderson, 2000; Smith, 1999) and is collectivist (Deloria, 2004). It assumes that knowledge is transferred through oral history and story (Archibald, 2008) and that knowledge is co-created within the relational dynamic of self-in-relation (Graveline, 1998). The relational dynamic between self, others, and nature is central.

There are new approaches such as an indigenous knowledge ontological paradigm which have been developed by different indigenous scholars over time. This has emerged to break glass. The indigenous paradigm is holistic in its approach. It advocates for a paradigm that is independent and that acknowledges the fact that indigenous approaches are not a panacea, but there is a need for collaboration, co - existence and opening a window of acceptance in research.

An indigenous paradigm comes from the fundamental believe that knowledge is relational. Knowledge is shared by all creation. As a result of the interrelationship and interdependence among people, the cosmos, the spiritual realm, the physical realm and the environment at large; relational ontology is weaved and build which eventually promotes harmony and accountability among all entities Hart (2010) and Chilisa (2012).

This study is also exploratory in nature because very little is known about *bolepa-dinaledi* from prior research. In fact, limited and unethical research has been undertaken previously into the aspect of Setswana interpretation of physical universe and cosmology. It is used to gain understanding of the underlying reasons, opinions and rationale. It helps us to provide insight into Bakgatla -Baa-Kgafela indigenous astronomy. This design helps the researcher to gain insight into a situation, phenomenon, community or person.

The need for such a design arises out of observation and lack of basic, appropriate, reliable, and current information on *bolepa-dinaledi*. In addition, this study is descriptive because it attempts to describe the type of *bolepa-dinaledi*. Since the study intends to enhance a body of knowledge on *bolepa-dinaledi*, the descriptive research design was identified as more appropriate.

According to Merriam and Simpson (1995), the function of descriptive research method is to systematically describe facts and characteristics of a given population, area of interest and or phenomena. Based on such an understanding, therefore, the descriptive design chosen in this study will allow the researcher to interview respondents verbally. This further will give space for collection of in-depth information on facts that describe *bolepa-dinaledi* which is required in the study. The study uses the exploratory and descriptive research design due to the fact that they are essential methods for a study of this nature. They satisfy the aim of the research to describe and understand the phenomenon (Leedy & Ormord, 2001).

In this study phenomenography was also employed as research design. Phenomenographers adopt a particular (albeit with some variations) methodological strategy for data collection and analysis. This typically involves the use of interviews as a method for collecting data on the phenomenon of current interest; though other forms of data, such as written responses, may also be used.

All of the data collected is then treated collectively for the purposes of analysis, such that the focus is on the variations in understanding across the whole sample, rather than on the characteristics of

individuals' responses (Uljens, 1993). In terms of theoretical framework, phenomenographers operate with the underlying assumption that, for any given phenomenon of interest, there are only a limited number of ways of perceiving, understanding or experiencing it.

Phenomenographers, therefore, have firm ideas about how phenomenography should be practiced (i.e. a methodology); though, as with any research design which has been established for a few decades or more, there are, of course, both variations in practice and controversies. Phenomenographers also have firm ideas about the pattern if, perhaps, not the specific content of what they are likely to find through their research (i.e. a theoretical framework). Taking these characteristics together, therefore, we may refer to phenomenography as a research design (Uljens, 1993). The population of the study is discussed in the following section.

4.7 Population of study

Treece and Treece (1986), a study population represents the entire number of units under the study. Bless et al. (2006) point that the population in a study refers to a set of objects, whether animate or inanimate, which are the focus of the research, and about which the researcher wants to determine some characteristics. Population means the number of people living in an area. The unit of population includes all persons falling within the research area; for instance, a population of people, or a population of households. The selected sample or population in the study comprised of indigenous knowledge expert, who are mostly elders and they are residents or participants from both Mochudi (Botswana) and Moruleng (South Africa).

The target population of this study comprised participants (male and female) who were IK experts, and elders who are men and woman, and who are residents of Mochudi in Botswana and Moruleng in South Africa. They were targeted because they are believed to be IK experts, sources and custodians of kitso ya setso and bolepa-dinaledi in their respective communities and could provide significant data necessary to accomplish the research objectives of the study.

It has to be noted that Moruleng has 30 small villages which are also part of the Bakgatla -Baa-Kgafela with one administration based in Moruleng called Bakgatla -Baa- Kgafela Traditional Authority under Kgosi Nyalala Pilane. Therefore, through the assistance of the IKS Unit, Bakgatla -Baa- Kgafela Traditional Council, most of the participants who are IK experts were identified in Moruleng.

In addition, Mochudi also has more than 33 villages, each with its own headman but all report to the Bakgatla -Baa- Kgafela Tribal Authority which is based in Mochudi under the leadership of Kgosi Segale. Through the assistance of the Bakgatla -Baa- Kgafela Tribal Authority and officials at Phuthadikobo Museum most of the IK experts were identified in Mochudi.

Bless et al. (2006) state that the unit of analysis is the person or object from whom the social researcher collects data. The data from such unit can only describe that unit, but when combined with similar data collected from a group of similar units, provides an accurate picture of the group to which that unit belongs. The brief description of Bakgatla -Baa- Kgafela in Moruleng is discussed below.

4.8 Brief discussion of study communities

4.8.1 The history of Bakgatla Ba Kgafela, Moruleng (South Africa)

The Bakgatla -Baa- Kgafela people of Moruleng, Moses Kotane West Region (Bojanala Region) North West province have been through centuries of trials and tribulations, conflict and scattering, finally establishing themselves in both South Africa and Botswana. Because their lands proved to be part of the platinum-rich Bushveld Igneous Complex, they now have access to mineral wealth.

According to Stats, S.A., (2012), Moruleng covers an area of 14.76 km², with a population of 11, 220 (759.92 per km²), households is 3,714 (251.54 per km²). With regard to Gender, there is a high number of male at about 50.54 %, and followed by Female is 49.45 %. With regard to population groups, Moruleng tend to be dominated by Black African at 99.46%, Indian is 0.14%, Colored: 0.10%, White: 0.02% and other at 0.29% (Census, 2011). There are also a number of first languages spoken in Moruleng dominated by Setswana: 84.42%; followed by English: 3.28%, IsiZulu: 2.06%, IsiNdebele: 1.46% and SeBasotho: 1.43% (Stats, S.A., 2012).

Bakgatla is a derivative of the word *kgabo* which means monkey, the totem animal of the Bakgatla. The Bakgatla -Baa- Kgafela people are a sub-group of the Batswana. The timeline of the history of this clan is punctuated with alliances and conflict, as it was forged during the era of the *Difaqane* (the scattering) in the early 1800s, when southern Africa was in social turmoil.

Oral Traditions indicates that the Bakgatla is one of the Batswana cultural groupings that take its name from the paramount king Mokgatla and when he died his people split into three groups namely, the Bakgatla -Baa- Kgafela, Bakgatla baa Mmanaana and Bakgatla ba Moseitlha. Bakgatla

baa Mmanaana are found in Moshupa area of present Botswana, Bakgatla -Baa- Kgafela in Pilanesberg and Bakgatla baa Mosetlha.

According to a wide held theory among the Batswana, the composite name “Batswana” come from the term “*tswana*” which means to come or go out from one another, to separate, a derivation which suggests that the very high incidence of secession and fission in Batswana history. Batswana groups underwent a process of fission that resulted in their dispersal due to population growth, scarcity of land and water resources, succession and disputes within the kingdom.

Bakgatla cultural group are an offshoot of the Bahurutshe of the present day Marico district who are the primary branch of all the Batswana. The Totem of Bakgatla is the monkey (*Kgabo*), however, in times of war, they were formerly called (Ba Kgabo -ya- Mollo, which literally means “the people of the fire flames”) by which name the “*Magopa Kwena*” were also known.

The Bakgatla as many as other cultural groups in South Africa and in the continent at large were involved in the Anglo Boer war and other internal cultural wars in their history and very little has been documented on such an interesting subject. The immigrant Boers deployed the Bakgatla of Saulspoort in the Rustenburg district when they fought against Ba -ga- Mokopane near Potgietersrust in 1854, and the Basotho of Moshoeshoe in 1865-1866. From 1825 - 1830 Bakgatla experienced the Difaqane upheavals and Voortrekker incursions. An investigation into new fields of historical research including the effects of the war on social formation and the experiences of Bakgatla in wars needs to be conducted.

For instance, the role of the Bakgatla of the Pilanesberg in the South African War needs to be re - examined as well as the motive for Bakgatla participation and alliance in the wars. Black people were active shaping agents as well as victims in the war. Bakgatla fought the bore commandos due to some historical grudges such as demand for Labour by boers from Bakgatla and the desire to retain their land in Pilanesberg that they have lost to Boers earlier on. Very little has been documented about the participation of Bakgatla regiments and their involvement in the war.

In the Pilanesberg area the Bakgatla had played a major combat role against the Boers, expelling hundreds of them from their farms and occupying them as their own. One of the objectives of the Bakgatla in their war against the Boers was to regain the land they had lost to the Voortrekker earlier in the 19th century so they were very reluctant to leave the Boer farms when the British

authorities ordered them to. It is important to analyse how the colonialist” (British) used Bakgatla men as soldiers in the Pilanesberg region, both as shaping agents and victims in the conflict”.

Mbenga (2002) asserts that the Bakgatla made substantial material gains in the course of the war by their raids on Boer property, which increased the political authority of their paramount king Linchwe in the aftermath of the war. Mbenga also looks at the ways in which the conflict substantially transformed Boer-Bakgatla relations in the Pilanesberg region for decades to come. It is also important to document the impact or effects of these wars in the history, lives and socio economic conditions of the Bakgatla cultural group. Although such incidents were widespread the African experience during the war have been excluded in historical records.

Respected oral historian, Senye Jafta Matala of Ga-Madimela ward says that the two Bakgatla groups parted at a place called Sefikile near Moruleng and later Bakgatla ba-ga-Mmanaana were invited into present-day Botswana by the Bakwena to assist them during their wars with the Amandebele and the Boers during the Mfecane. Bakgatla-ba-ga Mmanaana continued to live in relative peace until the 1930's when their Kgosi Gobuamang had a scuffle with Kgosi Bathoeng II of the Bangwaketse. Bathoeng, together with the British administration, banished Kgosi Gobuamang from GaNgwaketse and in the process, ba-ga-Mmanaana split into two with one section under Gobuamang going to stay in Thamaga (Seretse, 2007).



Figure 4. 1: Map showing Moruleng

In spite of the documentation of the history of Bakgatla, lot of work and research needs to be done in order to rewrite their history such as the restoration of heritage sites that were neglected by the past colonial and apartheid regime. The following section is based on the Mphebatho museum in Moruleng. This section is also important in the study due to the fact that Mphebatho museum is also responsible for safeguarding the history, culture, traditions and indigenous knowledge of Bakgatla.

4.8.2 The history of Mphebatho museum

The Mphebatho Cultural Museum was established in 1999, the idea was to preserve, remember and pass on cultural practices and tribal policies from the Bakgatla-Ba-Kgafela people. The Mphebatho Cultural Museum offers you a chance to view and participate in the unique culture and history of the Bakgatla-Ba-Kgafela community leaving around the Pilanesberg mountains in the North West province.

This vibrant community centre provides an alternative experience of the Bakgatla-Ba-Kgafela heritage, culture and tradition. The museum is a community based organization located in Moruleng village, a mere 20 minutes drive from world renowned Sun-City and in close periphery to Mogwase town and Pilanesberg National Park.

There is an increasing realization within the country and Africa at large on the importance of cultural museums that depict the history, culture and heritage of indigenous peoples. Cultural Museums could be used to teach African history, languages, literature, customs and promotion of local knowledge systems (IKS).

Since its inception, the Mphebatho Cultural museum has been involved in the collections of objects and artefacts that bear out a relationship with the past left by ancestors of the Bakgatla, and with the aim to protect them and even make them essential to the functioning and sustainability of human society. Side by side with the monumental heritage, such collections now constitute the major part of what is universally known as the cultural heritage.



**Figure 4. 2: Mphe batho Museum, Moruleng, South Africa
(Bakgatla-ba-Kgafela Traditional Authority: 2010)**



**Figure 4. 3: Mphe batho Museum, Moruleng, South Africa:
Totem Media (2010)**

The core function of Mphe batho Cultural Museum is to safeguard, preserve and depict the culture, heritage and history of Bakgatla as a whole. It is also hoped that the study will assist the museum to be viable, understand better, and establish both its meaning and its educational role to the community, especially the youth because we want them to be aware of the value of local knowledge systems, heritage and their history. The following section discussed the Bakgatla -Baa- Kgafela in Mochudi (Botswana).

4.9 History of Bakgatla -Baa- Kgafela, Mochudi (Botswana)

Makgala (2009) states that before the Bakgatla -Baa-Kgafela moved to Mochudi in Botswana they stayed in Transvaal in South Africa where they resided in small villages. In 1870s, Commandant Paul Kruger (later to become President Kruger) went to the Bakgatla -Baa-Kgafela King, Kgamanyane, demanding free labor for a dam he was building.

Kgamanyane refused, Kruger had him publicly flogged and a large contingent of Bakgatla- Baa - Kgafela left the Pilanesberg area and went into what is today known as Botswana (Mochudi). They settled at the base of Phuthadikobo Hill and along the Ngotwane River. Like most major villages in Botswana, Mochudi is a mixture of old and new, traditional and modern, as is best seen through changing architectural preferences in housing. Two Kgatla Kings, Kgosi Linchwe Khamanyane Pilane (who ruled between 1875 and 1924) and Kgosi Molefi Kgafela Pilane (who ruled between 1929 and 1958) are buried here. Also nearby are two traditional rondavels, beautifully maintained, and good examples of how village housing once looked.

In Mochudi, the village did not move but stayed in one area and grew bigger over the years. In Mochudi just the same as in Moruleng the *dikgoro* (clans) of Bakgatla -Baa-Kgafela are grouped into five (05) major sections, which are *Kgosing, Morema, Tshukudu, Mabodisa and Manamakgotheng* (Makgala, 2009). Within this five *dikgoro* falls a constellation of smaller *dikgoro*. Before, Bakgatla left the Transvaal for Mochudi, these *dikgoro* formed separate villages, a few kilometers from each other.

According to Stats S.A (2012), Bakgatla -Baa- Kgafela are found in Mochudi, which is one of the larger villages in Botswana with a population of 44,815 people in 2011. It is situated in the Bakgatla tribal region, in Kgatleng District, about 37 km (23 mi) northeast of Gaborone. The village lies several kilometers from the main Gaborone-Francistown road, and can be accessed through a short turn at Pilane. Mochudi was settled by the Tswana people in 1871. The following section is about Phuthadikobo museum in Mochudi.

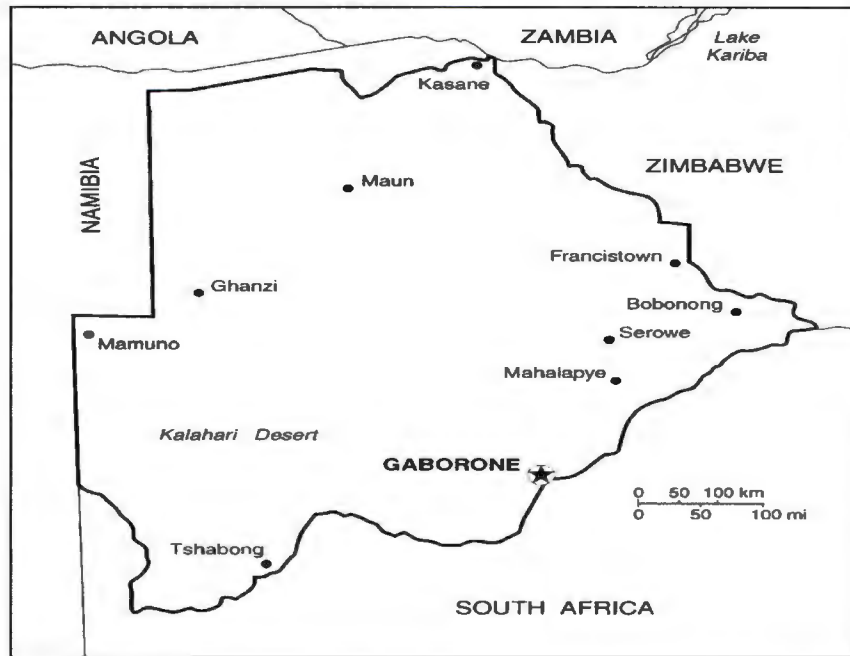


Figure 4. 4: Map of Botswaa (Botswana. Cartography by Book comp, Inc.)

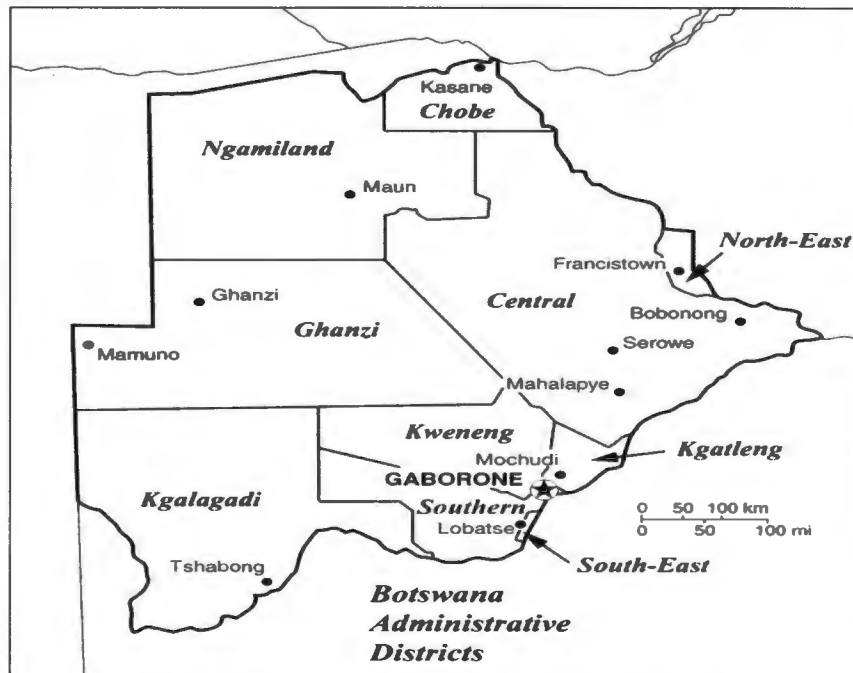


Figure 4. 5: Map of Botswana showing Mochudi
(Administrative districts and major urban areas, villages, and administrative centres.)

4.9.1 Phuthadikobo museum

A small path up the hill from the kgotla leads to the Phuthadikobo Museum. Packed with information about Mochudi's history, the Museum is a reflector of cultural change in Botswana. Its

collection of historical photographs shows woman making pottery, blacksmiths operating bellows, kings making rain, houses being decorated, and boys' and girls' initiation rites. Artefacts include pottery, basketry and other traditional utensils, weaponry, as well as Regent Isang's rain-making pots.

The tourist destinations of note inside Mochudi are the Phuthadikobo Museum at the top of the hill, which contains old photographs and historical texts relating to Mochudi and the history of the Bakgatla people. It is housed in a building that was originally the first school of Mochudi. Nearby is the hulk of the first tractor owned by a Motswana and huge footprints that legend says belongs to "Matsieng", a giant and ancestor of the Tswana, who led his people and the animals from the centre of the earth to inhabit the world.

Mochudi is known for its traditional painted houses and still has a traditional kgotla (tribal meeting place). The building was originally a school built by Regent Isang Pilane in 1921. It was the first school in Botswana to offer secondary education and became a museum in 1976. It has steadily expanded its stock of artefacts and historical photographs. It holds a number of fascinating photographs donated by Professor Isaac Schapera, the world-renowned anthropologist who chronicled in meticulous detail the life and culture of the Batswana, and the changes rapidly taking place in their lives in the 20th century, nearly up to his death in the year 2000.

There is a small shop in the museum selling local arts and crafts, and silkscreen products made there. Another building of interest is the Deborah Retief Memorial Church, administered by the Dutch Reformed Mission, located just after the turn-off to the kgotla. This was built by the Bakgatla in 1903 and is still in use today.



Figure 4. 6: Phuthadikobo Museum, Mochudi, Botswana

Other items on display at the museum include traditional neck rings worn by Bakgatla woman, which date back to before the tribe migrated from the Transvaal in the late 1860's. Also found at the museum are metal "hut tax" discs from the early 1900's, which were used in the days of British colonial rule; an initiation drum from the mid 1800's making it one of Southern Africa's oldest wooden artefacts; and a church bell dated 1896 which was cast in Hildesheim, Germany. The museum also features a craft shop, a silk screen workshop and a traditional blacksmith's workshop. The museum grounds feature two well preserved old ox wagons, which according to historians were last used actively in Botswana during the 1970's, and have remained unaffected by weather and insect damage.

The Phuthadikobo museum is a historic building of exceptional architectural interest and the museum has a range of interesting displays, a craft shop and a silkscreen printing workshop which are unique to Africa. It is a museum, cultural center and silkscreen workshop all forming one successful community development programme providing all its participants with a sense of pride, independence and a place to learn and work since 1975. The emphasis is on the local life, traditions and design of Bakgatla. Sampling technique is discussed in the following section.

4.10 Sampling technique

Sampling procedures are techniques meant to draw a sub section from a whole population in order to use it for obtaining data. It therefore follows that data is collected on a small part of the whole parent population and used to inform what the whole picture is (Creswell, 2003). In statistics and

quantitative research methodology, a data sample is a set of data collected and the world selected from a statistical population by a defined procedure (Peck et al., 2008).

Wellman and Kruger (2001) in the case of the probability sampling, we can determine the probability that any element or member of a population will be included in a sample, e.g. stratified random sampling. Non-probability sampling, by contrast cannot specify this probability by so far, because some elements have no chance of being included in the sample. Therefore, due to the fact that there are few indigenous knowledge experts with knowledge of indigenous astronomy among the Bakgatla -Baa- Kgafela in Moruleng and Mochudi a non-probability sample was used in this study.

The snowball sampling method was used in this study to identify respondents for interviews and focus group discussions. Non-probability samples are effective due to the fact that they are less complicated, more economical (in terms of time and financial expenses) than probability samples. In this approach, the researcher through the help of the *Kgotla-Kgolo ya Bakgatla -Baa- Kgafela* in Moruleng (South Africa) and Mochudi (Botswana) selected a few indigenous knowledge experts who have a wealth of information and knowledge on *bolepa-dinaledi*.

The selected indigenous knowledge experts helped also to identify others who they believe and know that they have a wealth of knowledge or information on the phenomenon under the study. Which means that from the first phase, few individuals were selected from the relevant population. This individuals then acted as participants and identified other members (acquaintances or peers) from the same population for inclusion in the sample.

For this population, the snowball sampling technique was deemed appropriate due to fact that it aims to locate information-rich cases (Isaac & Michael, 1997). Snowball sampling was considered a suitable method for the study, because apparently there are few IK experts and community elders who have knowledge on celestial bodies. Key participants were requested to recommend individuals who are well versed in *bolepa-dinaledi*. In this instance, people, such as elderly people and IK experts played a momentous and pertinent role in the study. The following section discusses the subjects of the study.

4.11 Key participants of the study

4.11.1 Qualitative participants

The term participant is applicable in this research as compared to the term subject of research which have a connotation of a subservient person playing an uninformed role. In contrast, participant connotes active consent, involvement, awareness, control and ownership of research not just as participants.

A research participant, also called a study participant or is a person who participates in human research by being the target of observation by researchers. In accordance with modern norms of research ethics and with the Declaration of Helsinki, researchers who conduct human subject research should afford certain rights to research participants (Coleman, 2005).

The participants of the study were the indigenous knowledge experts who are mostly elders and IK experts who are knowledgeable on *bolepa-dinaledi* in the study communities. A total of thirty (30) participants were interviewed in both communities of study. This was done to give both communities equal chances of participating in this type of research project. A sample of thirty (30) (stratified by females and males) who are mainly key participants in the study on *bolepa-dinaledi jwa sekgatla* were sampled for interviews in order to obtain qualitative data.

With regard to Bakgatla -Baa- Kgafela community in Mochudi (Botswana), a sample of fifteen (15) (10 women and 05 men) was selected through snowball sampling to participate in the study as respondents. In addition, two (02) focus groups discussions of 5 - 10 members stratified on the basis of gender, marital status was selected in the community for discussions. The identification and selection of the participants was done in consultation and cooperation with the community leaders, IK unit and other key persons. Participation in the study was voluntary and consent forms were signed.

With regard to Bakgatla -Baa- Kgafela community in Moruleng (South Africa), a sample of fifteen (15) (10 women and 05 men) was selected through snowball sampling to participate in the study as respondents. In addition, two (02) focus groups discussions of 5 - 10 members stratified on the basis of gender, marital status was selected in the community for discussions.

The identification and selection of the participants was done in consultation and cooperation with the community leaders, officials from Phuthadikobo museum and other key persons. Participation in the study was voluntary and consent forms were signed. The following section is about the data collection methods.

4.12 Data collection methods

4.12.1 In-depth interviews

The researcher collected data by means of in-depth interviews with indigenous knowledge experts (*baitseanape ba kitso ya tlhago*). Indigenous knowledge experts are often well-placed individuals in their communities due to their position and the knowledge they derive from different positions in the community. Indigenous knowledge experts were interviewed in all the study communities as a means of gaining in-depth qualitative information on the research problem.

The researcher firstly identified the participants with the assistance of traditional councils, officials from Phuthadikobo and Mphebotho mesuems and IKS unit in Moruleng. The researcher firstly made appointments with the participants to explain the aim, purpose of the study and to seek their permission to be interviewed. The researcher with the research assistants, interviewed fifteen (15) participants from both study communities using Setswana language. The interviews were intense and they took place at the participant's home and at their own convenient time.

The interviews comprised of 10 women and 05 men and each interview was conducted for one hour with each participant. Where it was necessary, the researcher made follow up visits in order to seek clarity on certain pertinent issues. This was very easy because the researcher had already established relationship and build trust with the participants, hence follow up visits and interviews were also conducted successfully.

Interviews is a traditional method used in culture related studies for extracting knowledge about cultures through well placed individuals in the community. It is applicable and relevant in situations where access to official records or data is weak or non-existent. Hence, the study argued that there is few literature, documents written on *bolepa-dinaledi* in Botswana and South Africa among the Bakgatla-Baia- Kgafela.

Where official records exist, it was used as a means to gain further insight by questioning key people about the specific and cultural problem. Cross referencing with other participants was used

to check the validity and reliability of information obtained. The interviews were done with the help of an interview guide which focus on questions that target information on *bolepa-dinaledi*.

Interview were used in this study due to the fact that they are ease to administrate. They are advantageous due to their flexibility and adaptability. However, they also have disadvantages such as time constraints in the case of vast geographic area or regions. An interview schedule was developed for the participants.

The schedule was developed into sections such as the nature and types of African indigenous astronomy. This section intended to look at perspective, definition and meaning of indigenous astronomy, nature and types of indigenous astronomy, sources of indigenous astronomy and how this knowledge is transmitted from one generation to the other.

Another section of the focused on the value and meaning of African indigenous astronomy. This section looked at the value and meaning of indigenous astronomy in the study communities, how the community preserve and protect this knowledge. Another section addressed the significance of indigenous astronomy from an artistic and scientific levels. It looked at the use of equipment, identification of bright stars, architectural structures, artefacts linked to indigenous astronomy and heritage sites. The following section discusses narratives.

4.12.2 Narratives

The conversational method aligns with an indigenous worldview that honours orality as means of transmitting knowledge and upholds the relational which is necessary to maintain a collectivist tradition (Kovach, 2010). Story is a relational process that is accompanied by particular protocol consistent with tribal knowledge identified as guiding the research (Thompson, 2008 & Kovach, 2009). Thomas, (2005) and Bishop (1999) point that indigenous scholars within and outside the Canadian context have referenced the use of story, through conversation, as a culturally organic means to gather knowledge within research.

Reflecting upon story as method within research, Wilson (2001) suggests that story is congruent with the relational dynamic of an Indigenous paradigm. When you consider the relationship that evolves between sharing story and listening, “it becomes a strong relationship.” (Wilson, 2001). Many scholars such as Thomas (2005) utilized a storytelling methodology in her graduate research on the experiences of individuals who attended Kuper Island Residential School. In reflecting why,

she chose stories as a method for her research, she reminisces on the stories her grandmothers passed along to her, how these stories shaped Thomas's core being, and that such stories were "cultural, traditional, educational, spiritual, and political".

Thomas (2005) posits that storytelling has a holistic nature that provides a means for sharing remembrances that evoke the spiritual, emotional, physical, and mental. In reflecting upon story as a dialogic method that evokes the relational, Maori researcher Bishop (1999) introduces the notion of "collaborative storytelling" which positions the researcher as a participant. As both parties become engaged in a collaborative process, the relationship builds and deepens as stories are shared.

In this study the use of narratives as a means to collect and interpret data was seen as a possible method. Barrett and Stauffer (2009) state narrative is viewed as story and is seen as a "mode of knowing" that is involved in knowledge construction, and has recently been accepted as a "method or inquiry".

The study also collected the narratives from the indigenous knowledge experts in the local language (Setswana), in order to present their views in the original form. The information was later transcribed into English to explain the original context to readers who are not familiar with the Setswana language. Indigenous communities and cultures preserve collections of typical narrative meanings in their myths, fairy tales, legends, histories and stories.

Lillejord and Soreide (2003) point that in order to understand indigenous knowledge, it is therefore important to identify and understand the narratives through which knowledge is culturally constructed, interpreted and shared in the community. The use of narratives in research presupposes certain and consistent perspectives on truth, knowledge and validity (Reissman, 1993). A narrative (or story) is any account that presents connected events. Focus groups discussion is discussed in the following section.

4.12.3 Focus group discussions "*Lekgotla*"

Focus group discussion or what is commonly referred to as *lekgotla* was another form of data collection for this study because it allows interviewing several people together. It allows participants to share their thoughts and strengthen new ideas regarding their perceptions towards *bolepa-dinaledi*. Krefting (1991) a focus group discussion is a semi-structured interview in which the discussant knows in advance the issues to be discussed.

Yates (2004) emphasizes that though the focus group discussion can be seen as a form of group in-depth interview; the difference lies in the fact that it is a group rather than one-to-one interview. The researcher conducted four (04) focus group discussions which means that two in Moruleng and the other two (02) in Mochudi with *baitseanape ba kitso ya tlhago*.

The researcher probed questions in Setswana and the participants discussed among themselves as they normally engage in the *lekgotla* setting. The focus groups comprised of six to ten participants and the venue was organised at the Bakgatla -Baa- Kgafela Traditional Council offices in Mochudi and Moruleng.

Most of the participants in the focus group discussion were drawn from the list of interviews stratified on gender basis. This sample structure and size was applicable for both the study areas. Again, by getting the participants to discuss among themselves, it is fast and an easy way of collecting qualitative data in less time than would be needed for individual interviews. This was one of the most effective method of data collection used in this study and was conducted for one and half hour. The following section is about document analysis.

4.12.4 Document analysis

Documents, literature, books, journals, publications regarded relevant to the African indigenous astronomy were reviewed and analysed. Document analysis is the collection of secondary data from published books, internal sources, the internet, libraries, government agencies, and published reports.

The researcher carried out desk research at the beginning of a study as a stage-gate to see if more costly primary research is justified. Key sources and uses of secondary research are discussed at the beginning of this chapter and in the literature review. The following section is about the steps that the researcher undertook to analyse and make sense of the data collected from the participants.

4.13 Data analysis

The process of data analysis can be time consuming, however it is a critical stage in research. It is about making sense, and involves cleansing, organising of data in order to reach a logical conclusion. Data analysis is used in different disciplines and it involves different approaches, techniques and steps. Data was collected through interviews, focus group discussions and narratives and analysed in order to address the research questions.

The questions were translated from English to Setswana, and were answered in Setswana language by the participants. An audio recorder was used to record, store and retrieve data from the participants. Data was captured as audio files to reduce time constraints of writing down the data and the researcher transcribed the data into written text. During each transcription of data, each record was opened, played, listened to and typed. Where the clarity was needed, the clip was replayed and the researcher retyped the statements. The following section discusses the thematic data analyses.

4.14 Thematic data analysis

The study used thematic data analysis. Berelson (1952, as cited in Berg, 2009) suggests that content analysis is "objective, systematic, and quantitative". Evaluators can do content analysis of video, film, and other forms of recorded information, but in this research study the focus is on analysing words. It is a systematic research method for analysing textual information in a standardised way that allows evaluators to make inferences about that information.

The process of data analysis was rigorous in this study. Firstly, the researcher used relevant data analysis such as mind mapping in order to reduce or break down data into small components. A mind map is hierarchical and shows relationships among pieces of the whole. Secondly, the researcher familiarized himself with the data, he started to organize themes, patterns and trends and issues that are easier to understand.

All interview tapes were labelled randomly according to the participants. All the interview data were organized, according to participants and were stored in lap top and back up created in a hard drive. The process of transcription began during analysis of all the interviews. The data collected were transcribed into specific themes, which were then used to analyse the findings. Major topics were identified and themes developed in main and sub themes. A preliminary list of themes was constructed.

In this study, coding was done and then themes were identified through data analysis. The data that the researcher code was from the text that was transcribed from interviews and narratives. The constant comparative thematic data analysis is a procedure in which newly collected data is compared with previous data that was collected in one or more previous researchers.

This is a continuous ongoing procedure, because theories are formed, enhanced, confirmed, or even discounted as a result of any new data that emerges from the study. Currently, there is only one way in which data can be constantly compared throughout a research study that is by means of coding (Guba & Lincoln, 2005). Training and pilot testing is discussed in the following section.

4.15 Pilot study

The term pilot study is used in two different ways in social science research. It can refer to so called feasibility studies which are “small scale version[s], or trial run[s], done in preparation for the major study” (Polit et al, 2001). However, a pilot study can also be the pre-testing or ‘trying out’ of a particular research instrument (Baker, 1994).

One of the advantages of conducting a pilot study is that it might give advance warning about where the main research project could fail, where research protocols may not be followed, or whether proposed methods or instruments are inappropriate or too complicated. In the words of De Vaus (1993) “Do not take the risk, pilot test first.” These are important reasons for undertaking a pilot study, but there are additional reasons, for example convincing funding bodies that your research proposal for the main study is worth funding.

A pilot study, pilot project, or pilot experiment is a small scale preliminary study conducted in order to evaluate feasibility, time, cost, adverse events, and improve upon the study design prior to performance of a full-scale research project (Hulley, 2007). In sociology, pilot studies can be referred to as small-scale studies that will help identify design issues before the main research is done (Haralambos & Holburn 2000; Van Teijlingen & Hundley, 2001). Although pilot experiments have a well-established tradition in public action, their usefulness as a strategy for change has been questioned, at least in the domain of environmental management (Billé, 2010).

It is argued that extrapolation from a pilot study to large scale environmental strategy cannot be assumed to be possible, partly due to the exceptional resources and favourable conditions that often accompany a pilot study. It should be recognised pilot studies may also have a number of limitations. These include the possibility of making inaccurate predictions or assumptions on the basis of pilot data; problems arising from contamination; and problems related to funding.

Specific pre testing of research instruments was conducted with indigenous knowledge experts among the Batlhako Ba Matutu in Mabeskraal village, North West province (South Africa). This

community falls under the jurisdiction of Moses Kotane Local Municipality, within the Bojanala District Municipality, in the North West Province. The tribal totem of the Batlhako ba Matutu is the elephant (“*Tlou*”). The Batlhako tribe is of Nzunza-Ndebele origin and its praise name was Mahlangu and Matlhako in Setswana (Breutz, 1987).

The identification of IK experts was done with the assistance of the traditional leadership. Research assistants were identified and a workshop was organized with the purpose of training them in methods of conducting research in local communities such as interviews and focus group discussions. All questions and concepts were converted into Setswana.

The interview schedule was piloted on 05 women and 05 men who are knowledgeable in indigenous astronomy of Batswana. One (01) focus group discussion was also conducted with 5 - 7 IK experts in the local community. Small-scale piloting is recommended for feasibility, convenience and cost effectiveness (Harry, Sturges & Klingner, 2005; Punch, 2005; Janesick, 2000).

The people who participated in a pilot study were typical of the people from which the main study intended to collect data. After the participants finished completing the pre-testing interview schedule, they were asked to give their comments or constructive criticism on wording and sequence, redundancy, missing and confusing questions.

These comments were invited to reveal errors in and validate the content clarity of the instrument, improve questions and format, and to refine the research instrument before the main investigation commenced (Delpont, 2005; McMillan & Schumacher, 2001). The participants suggested changes to the instrument, and they indicated that some of the questions were difficult and must be simplified for better understanding.

The amendments of the pilot study were included in the main interview schedule of the study. Pilot testing was conducted to ensure that questions measure the desired attributes, as well as validates cultural and linguistic appropriateness of the wording of the questions. Final changes were made to the research methodology and research instruments on the basis of pilot testing.

It has been said that pilot studies are likely to be “under discussed, underused and underreported” (Prescott & Soeken, 1989). Full reports of pilot studies are rare in the research literature (Lindquist,

1991; Muoio et al, 1995, van Teijlingen et al, 2001). When reported, they often only justify the research methods or particular research tool used. Too often research papers only refer to one element of the pilot study, for example to the ‘pre-testing’ or ‘pilot testing’ of a questionnaire (De Vaus, 1993). Such papers simply state: “the questionnaire or interview schedule was tested for validity and reliability.”

According to van Teijlingen and Hundley (2001), when pilot studies are mentioned in more detail in academic papers and reports, researchers regularly comment that they “had learned from the pilot study” and made the necessary changes, without offering the reader details about what exactly was learnt. Some of these processes and outcomes from both successful and failed pilot studies might be very useful to others embarking on projects using similar methods and instruments (van Teijlingen & Hundley, 2001). The ethical consideration discussed below.

4.16 Ethical considerations

Since the term research is a scary concept associated with colonization and imperialism, it is necessary to discuss the ethics and protocols of doing research in local communities. Research has been a disempowering exercise (Smith, 1999). Ethical consideration has always been a challenge for indigenous communities. It is fundamental that researchers remain sensitive and cognizant of the social and cultural issues of the respondents with the view to consider conflict of interests whenever they arise.

The study argues that ethics in research is about the responsibility of the researcher with regard to knowledge of doing right and wrong, especially to the participants, community members and their environment. Olsen (2016) argues that ethics are about choices and about what lies behind as well as follows the choices you make.

Ethics in research related to indigenous peoples has, over recent decades, been increasingly discussed in a global context (Drugge, 2016). For instance, in New Zealand, Australia and Canada, ethical guidelines for Indigenous research are now integrated into the national systems of ethical review for research (Drugge, 2016).

The study agrees with Drugge (2016) that indigenous scholars have recently published credible articles and there is numerous literature which addresses issues of decolonization of methodologies, application and promotion of ethical awareness in indigenous research. This scholar includes, but

not limited to Porsanger (2008); Battiste (2008); Chilisa (2012); Kovach (2010) and Smith (1999). The study argues that there is a need for emphasise on the development of guidelines and regulations on ethics on indigenous research and demystifying the concept of superiority, othering, dehumanizing, and subjugation and colonizing aspects of research.

The study argues that doing research in local communities is not just about collecting data, and analysing for rigour, it is about responsibilities and accountability. As a scholar, and an indigenous researcher, doing research in local communities, the researcher had to exercise high level of responsibility of my actions, motifs and for the people and communities that might be affected by your research.

This also influenced the choice of the methodologies and methods of collecting data such as interviews, focus group discussions and narratives and through the results of the research. Drugge (2016) argues that the scholar needs to think through and reflect upon both the consequences and the motifs of the research.

Sieber (1992) posits that research should be conducted in such a way that it maintains the integrity of the research enterprise and does not diminish the potential for conducting future research. This implies that research should be sensitive of intrusion into the lives of indigenous knowledge experts and community members.

Rahman (2015) indicates that ethics and ethical principles extend to all spheres of human activity. They apply to our dealings with each other, with animals and the environment. They should govern our interactions not only in conducting research but also in employment and all other inclusive entities. It therefore follows that communication was key in achieving ethical aspects in this research.

In this study the researcher demonstrated a keen and sincere sense of humility and respect not only to the key participants (elders) but also to the community members and traditional authority as well. The researcher was also sensitive issues such as language, culture and traditions as well as conceptual framework of the study communities. The value of respect among indigenous communities is significant, it is shared between the young and the old.

Questions were sensitive to the norms, values and culture of the communities. The researcher showed respect to the communities, their way of life, and dignity of respondents and also listened to what they say. Finally, the researcher also applied for ethical clearance certificate of the project which was approved by the North - West University Institutional Research Ethics Regulatory Committee (NWU - IRERC). The following section discuss process that were followed with regard to permission of the study.

4.17 Permission

The researcher obtained letter of introduction of the project signed and approved by the supervisors, which provide access to the study communities. For instance, the researcher made appointments, formally, officially introduced himself to the kings, traditional councils and asked for permission to conduct research in the areas concerned, presenting the objectives of the research project, requested cooperation in the selection of IK experts and administration of the research instruments.

The traditional councils and the king approved the study and responded in writing which acted as evidence for permission granted. Therefore, the researcher followed all the necessary socio-cultural protocols of conducting research in local communities. This is different from Western researchers who enters the community though the backdoor and disrespect local protocols and violates local ethics. The concept of anonymity is discussed in the following section.

4.18 Informed consent

Participants have the right to an informed consent (Chilisa, 2012). The participants were informed in their own language of the purpose of the study, the anticipated consequences of the research, the anticipated use of material, the possible benefits of the investigation and they were also informed that their participation is voluntary in the study.

They were asked to sign the consent form and the information provided by the different sources was made confidential. Parr (2002) points that the issue of consent in the creative relationship framework is going and is defined by the context and circumstances of the relationship as much as by the participants themselves. Confidentiality is discussed in the following section.

4.19 Confidentiality

Confidentiality was another key element to the research. The researcher had to win communities mutual respect, reciprocity and trust by disclosing that information supplied will be treated in confidence and not used for any other purpose than will be explained and agreed with the

respondents. It follows that the information obtained will be strictly used for the fulfilment of the degree. The raw data was kept in a secure external drive. In this manner honesty and integrity was upheld. The following section discusses the validity, reliability or trustworthiness of the data.

4.20 Validity, reliability / trustworthiness

Validity starts with the call for recognition of conceptual, philosophical frameworks, data collection and analysis methods derived from the researcher's frame and indigenous knowledge (Chilisa, 2012). She goes on to argue that in this context, validity is the researcher's responsibility go beyond banked book research methodologies to imagine other possibilities, to accommodate the researcher's ways of knowing and to wish for the researched what we could wish for ourselves. Guba and Lincoln (2005) points that concepts of fairness, ontological authenticity, positionality, voice, critical subjectivity or self-reflexivity resonate with post-colonial perspective of validity.

Trustworthiness involves ensuring credibility, dependability, conformability and transferability (Polit & Beck 2008). Trustworthiness with regard to data collection was enhanced by conducting a pilot study to serve as pre-test to the interview for the study. Validation checks were made through all phases of the research to ensure the highest level of data accuracy. Coherence of narratives through the research process as well as the presentation of results itself assisted in validating the study.

During the course of data collection, information was checked, missing information was clarified by returning back to the respondents to review issues and concepts. In a nutshell, the researcher argues that information collected from participants through interviews was validated by conducting focus group discussions, which were also later validated by the *maitiso* approach.

Maitiso is an indigenous approach of engaging and talking with the elders in the evening around the fire place. Therefore, the data collected in this study is not a fabrication by the researcher, it is credible, reliable and trustworthy data which is a true reflection of the views of the community with regard to *bolepa-dinaledi*.

4.21 Conclusion

This chapter discussed the methodology followed in this study to supply the reader with information on the methodology and methods that were deemed appropriate for the study. The methodology in this study emphasise the point that research on indigenous astronomy and

indigenous knowledge systems needs to be approached and conducted in a manner that takes into consideration the language and socio-cultural protocols in local communities.

The methodology followed in this study clearly puts forward and supports the initiative of decolonisation of research methodologies, especially in indigenous knowledge and indigenous astronomy research. In research there are different methodologies, however, only those chosen were discussed. An indigenous knowledge research paradigm has been considered, which gave way to the research methodologies. The site of the study, unit analysis, methods of data collection, data analysis, study sample, sample procedures, ethical considerations, the limitations and delimitations of the study were also highlighted. The following chapter discusses the nature and types of African indigenous astronomy in the study communities.

CHAPTER FIVE: NATURE AND TYPES OF AFRICAN INDIGENOUS ASTRONOMY

5.1 Introduction

This chapter presents and discusses the empirical findings of the study. It addresses objective one and two of this study. The first objective of this study was to analyse and document the nature and types of indigenous astronomy found in the study communities. The second objective was to describe the value, meaning and importance which the selected communities attach to African indigenous astronomy.

It is on the basis of this consideration that the study sought to investigate the objectives of the study from the participants' perspective. The study followed and employed narratives, in the form of legends and stories, obtained through in-depth interviews and focus group discussions with the community members and indigenous knowledge experts. A narrative is a story that tells a sequence of events that is significant to the narrator or her or his audience. The research provided the participants with a platform to express their own views on the various issues related to the research problem.

Knowledge, thinking, philosophy and understanding of the participants community members with regard to indigenous astronomy was fundamental in the study. The investigation was important for the study because the success and sustainability of *bolepa-dinaledi* depend on the support, role and systematic engagement of the IK experts, community members and their institutions including relevant stakeholders, especially if they know it, have access to and use it in their daily lives for sustainable livelihood.

Indigenous astronomy and its uses are community, culturally and spiritually oriented. The knowledge resides with the community members who are mostly elders, experts and regarded as custodians. Therefore, the researcher wanted to provide the community members, indigenous knowledge experts with the opportunity to express their views on the various issues in the form of narratives.

In order to avoid distortions of the original ideas presented by the participants, they were given the chance to express their views in the local language, i.e. Setswana, using their own epistemology and worldview. The researcher, who is a Setswana speaking, then translated the views into English for the benefit of readers who do not understand the local language. However, most the data gathered

through interviews and focus group discussions was translated by language experts in order to ensure that the meaning and originality of the work is not lost in translation. The following section provides the understanding, types and meaning of stars.

5.2 Mefuta ya dinaledi

This section provides the findings about *mefuta ya dinaledi* (types of stars). Interviews and focus group discussions revealed that the Bakgatla -Baa- Kgafela had a wide knowledge of stars, moon, sun, comets and other constellations, connected with the local language and culture. Language and languaging was central with regard to *bolepa-dinaledi*. From data gathered in the study communities, the Bakgatla -Baa- Kgafela do not have names for planets and stars like in modern astronomy. From the reviewed literature, Brown (1968) points that Batswana name for stars is *dinaledi* in Setswana language.

There were different types and number of stars which are visible to the naked eye and have value, cultural meaning and significance among the Bakgatla -Baa- Kgafela such as “*Selemela*” (Pleiades), “*Mphatlalatsane*” (Venus), “*Dikolobe*” (Orion’s Belt), “*Naka*” (Canopus), “*Kgogamasigo*” (Arcturus, or Night star), “*Molalatladi* (Milkyway), the different phases of the moon and the sun.

This is unique in the sense that both communities have the same understanding, knowledge of stars and language is at the center of this knowledge. According to Rre Kwape Mogotsi in Mochudi, there are certain stars which are very significant among the Bakgatla -Baa- Kgafela such as *Selemela* primarily due to its importance in agriculture. Bakgatla -Baa- Kgafela *ke balemi ebile ke barua kgomo* which means that they are farmers and cattle herders.

Rre Metsileng, an IK expert in Moruleng points that the stars in the night sky are children of the moon and the sun. He also indicated that the moon is held with high esteem and it is a symbol of woman while the sun represents a man. This is contrary to the idea purported by Glegg (1989) and Brown (1969) that stars are the spirits of the dead. Focus groups with IK experts in the study communities revealed that the knowledge of stars differ according to their nature, inherent characteristics, appearance, their positions, movement and cultural meaning. For instance, there are bright stars, groups of stars and those which appears in different seasons, at different types of the night.

Focus groups discussions with IK experts in Mochudi and Moruleng villages indicated that the appropriate time of observing the celestial bodies is during the dark night sky, where there are no lights, especially during the winter season. However, they also indicated that night sky is visible during all seasons of the year, but winter is more favorable and appropriate for night sky viewing, especially where people rely on naked eye such as in rural communities.

Interviews with IK experts showed that celestial bodies are more visible at night, but if you go to bed early at around 19:00, it is highly unlikely to observe them. Stars are visible at different times of the night. The darker it becomes, the more visible are the celestial bodies. The following section presents the star called *kgogamasigo*.

5.2.1 Kgogamasigo

The name *kgogamasigo* comes from two words “*goga*” which means to pull and “*masigo*” which literally means dark night. Participants in the study communities indicated that different stars are named according to their duty, purpose and often time of appearance. For instance, this particular star comes at night and travels the whole night. *Kgogamasigo* is known as *Arcturus*, or night star in modern astronomy and it is identified as one of the bright star visible to the naked eye.

An interview was conducted with Rre Lebotsang Molefe from Mochudi and he indicated that knowledge of the different types of stars among the Bakgatla -Baa- Kgafela was significant in the old days. He provided information about *kgogamasigo* as follows:

Go na le naledi e e tsamayang le go bonala mo gare ga bosigo. E tswa ntlheng ya botlhabatsatsi go leba ntlheng ya bophirima. Naledi e, e benya ka kganya kgotsa lesedi le lesweu. Naledi e, e bonwa mo bosigong ka selemo.

English version

There is a star that appears in the night. From the east and run towards the north. It is very bright. This star appears at night in summer.

An interview with IK expert in Mochudi, Mme Seitledi Phiri revealed that:

Ka Setswana kgogamasigo ke naledi ya bosigo. ka nako ya 20:30. Bokao ba yone ke gore e goga bosigo bole go fitlha bosigogare. Morago ga bosigogare fa o ka lebelela sentle, Kgogamasigo e bontsha gore e ya go ikhutsa, le yone e tshwana fela le kopadilalelo ole. ikhutsa, e ya go robala le yone ka gore dinaledi

English version

In Setswana *kgogamasigo* is the star called Night dragger. It appears at about 20:30. The connotation is that it “pulls through the night” until midnight. If you look at the sky thoroughly at the sky, after midnight, the star shows

tse, di tlile jaana go romiwa go tla go dira tiro ya tsone. Jaanong le yone Kgogamasigo a ke re wa utlwa gore e na le leina e dira tiro ya yone ya go goga bosigo bo.

signs of going to rest, it goes to sleep like any other person these stars have been sent to come and fulfil their role. The night dragger has a connotative name it does the role of dragging the night.

The above was supported by interview with Mme Joyce Pule from Moruleng who indicated that "Kgogamasigo" was not only a night star but was also used among the Bakgatla -Baa- Kgafela to calculate time in the absence of modern watches. According to Mme Mmapula Rrapekenene from Mochudi:

Kgogamasigo e bonala mo ngweding o o phatsimang mo gare ga masigo. E tla e pagama go tswa botlhabatsatsi e goga le ngwedi fa e ntse e suta a ya bophirima. Ke ka moo ba e bitsang kgogamasigo fela yone ga go itsege gore e wela leng.

English Version

kgogamasigo, is indeed the night star, it travels the entire night and it is also one of the bright stars. It appears from the east and moves towards the west and it is not known what time it disappears in the night sky.

Mme Grace Masuku, IK expert from Moruleng, added and supported the views made earlier by Mme Joyce Pule and she indicated that:

Naledi ya bosigo e bidiwa "Kgogamasigo" mme e bile e bonwa morago ga ura ya borobedi kgotsa borobonngwe maitseboa. Kgogamasigo e bontsha kgotsa go lemosa baagi ba selegae gore ke nako setlha sa mariga kgotsa selemo. Naledi e, e tlhaga e tswa kwa ntlheng ya botlhabatsatsi. Ke naledi e e tsamayang kgotsa go bonwa bosigo jaaka leina la yona le tlhalosa. Kgogamasigo e tsamaya le loapi bosigo botlhe go filha mo mesong. Fa o ka tsoga mo mesong ka makuku a naka tsa kgomo o kgona go bona naledi ya kgogamasigo pele e ka wela kgotsa go nyelela mo loaping. Kgogamasigo e nyelela ka nako ya fa dikgogo di simolola go lela mo mesong.

English version

The night star, "kgogamasigo" appeared at about 20h00 or 21h00 from the east. It predicted the coming of the winter or summer season. It stayed in the sky for the whole night until morning. If one woke up in the early hours of the morning. She or he could see it before it disappeared. Kgogamasigo disappears in the morning as soon as the cock started to crow.

Snedegar (2000) and Alcock (2010) confirms the above statements made by participnats in the study and identifies the star "kgogamasigo" as a well-known star among African cultures in Southern Africa. Literature reviewed indicates that there are mythologies about the star *Arcturus* in many cultures such as the Greeks, Arabic, Asia and other cultures.

The Wotjobaluk Koori people of southeastern Australia knew Arcturus as *Marpean-kurrk*, mother of *Djuut* (Antares) and another star in Bootes, *Weet-kurrk* (Mudrooro, 1994), (Hamacher & David, 2010). Its appearance in the north signified the arrival of the larvae of the wood ant (a food item) in spring.

The beginning of summer was marked by the star's setting with the Sun in the west and the disappearance of the larvae (Mudrooro, 1994). The above examples illustrate that Bakgatla -Baa- Kgafela like any other indigenous communities in Africa and the world were aware of the night sky and celestial bodies. The following section discusses the star known as *Selemela* among the Bakgatla -Baa- Kgafela in the study communities.

5.2.2 Selemela

Among the Bakgatla -Baa- Kgafela, *Selemela* is the local Setswana name which refers to a group of stars and often is also a name of human being. Naming is very important among the Batswana and people are often given names based on the particular event in the family or community or celestial bodies. There are people who are called by the name *Selemela* among the Batswana. According to Rre Kwape Mogotsi, a well known IK expert in Mochudi, the word *Selemela* comes from two words which is *selemo* which means the summer season and *lema* which literally means to cultivate.

Rre Mogotsi further elaborated that, *Selemela* is special, well known and has symbolic meaning among the Bakgatla -Baa- Kgafela. He indicated that *Selemela* is also called *Magwasigwasi*, it symbolizes summer season and used to predict rainfall. Furthermore, Rre Mogotsi stated that *Selemela* is known to be a symbol of food security among the Bakgatla -Baa- Kgafela. Rre Mogotsi indicated that *magwasigwasi* also appears during winter and are shining stars.

Focus group discussion with the participants in Mochudi confirmed the above narratives from Rre Mogotsi and indicated that *Selemela* is used to predict the events of the incoming summer season. For instance, it is a prediction of how much the sun will shine, or how hot it will be? It is also used to predict the harvest period. It has a very significant meaning among the Batswana and other African indigenous communities.

According to Rre Mogotsi, *Selemela* is a group of stars which is known among different cultures. It is a group of stars which indicates that the ploughing season is around the corner. According to Rre Moganelo Rasepae, a well known IK expert in Moruleng:

*Ke nako ya selemo ga Selemela se
Tlhagelela ke nako ya go lema. E raya gore
Mme tlhatswa peo, Ntate baakanya dijoko
re ye go lema. Se tshwanakana le kgwedi e
re tswang mo go yone ya mariga.
Ka nako ya phukwi fa e ka bo e se ka
ngwedi oo gongwe re ne re ka di bona.
Di fa, mme ga se gore di kwa godimo
di tsamaya kafa mo letlhakoreng. Ga di
nne fa gare fa di tsamaya mo letlhakoreng.
Ka jalo ka kgwedi ya phukwi o tlaa bo di
bona di le fa Fa ngwedi o se yo o di
lebelele di le fa di tlaa bo di le
sekgotlonyana.*

English version

It is summer time when Pleiades dawns, it is time for ploughing. It means gentleman, lady prepare the yokes and let us go to Plough. It is the same as the month we have just vacated. It is the same as winter. In August if not of the moon we would perhaps see this constellation. They are near and not very far from the sky they are actually move sideways. They are not in the middle when they move on the sides, hence in this month of August they are seen lower than usual. When there is no moon in the sky they will appear so near and seen as a group of stars.

According to Mme Joyce Pule an IK expert in Moruleng:

*Selemela, ke dinaledi tse ditshesanyane,
ga o ka ke wa di bala. Di dintle, di a
binabina, di kgabisitse loapi gore go
nne gontle e bile di nna fale. Di nna fale
tsotlhe tse, le mariga di nna fale. O tla
bona di riana, di ditshesanyane ga di
na palo. Ee, tiro ya tsone ke go kgabisa
loapi. Di nna foo ka nako tse tsotlhe.
Go kgabisa loapi.
Jaanong re ka se ke ra di bona ka gore
jaanong fo teng fa ngwedi a leng
teng fale di iphitlhile. Di gone fela
fa teng fale. Dinaledi tse di bidiwang
Selemela.*

English version

Selemela, is a group of small stars, you can't count them. They are beautiful, they bounces, and they dress the sky beautifully. They appear on one spot, even in winter. You will see them do this, they are small and you cannot count them. Its duty is to dress the sky and make it look beautiful. We won't be able to see them today because at the moment they are hiding behind the moon. They are hiding there. They are called *Selemela*.

Rre Rasepai from Moruleng indicated that *Selemela* is significant and have meaning among the Bakgatla. He pointed that:

*Jaaka fela Rre a bua a re Selemela o,
lefatshe le tla bo le sisitse jaanong le dusa.
Se raya gore pula, bojang, setlhare,
sengwe le sengwe se se tlhogang ke nako
ya gore jaanong se tswe mo mmung.*

English version

Just like you were saying, this *selemela* means that the earth is full of nutrients and it is gestating. It means that rain, grass, everything which needs to be planted, has to grow from the soil.

Focus groups with IK experts in Moruleng showed that “*Selemela*” (Pleiades) is a group of stars that normally comes on the 25th Lwetse (September) annually. It indicates that it is time for harvesting crops at the farms. During the olden days, anybody who saw “*Selemela*” was supposed to immediately inform the tribal leader and could be rewarded with a cow.

The tribal leader used to organise a thanksgiving ceremony, during the harvest time. This was immediately done after the rain called “*Kgogolammoko*”, which comes as early as kgwedi ya Lwetse (month of September). The ceremony is organised with the purpose of acknowledging and appreciating the clans that had played a role during the growing until harvesting period. An IK expert from Moruleng Rre Moeketsi indicates that:

<p><i>Selemela ke sekgotlho sa dinaledi e bile se amangwa le go fetoga ga ditlha. Fa go nna mariga, se tsamaela ka fa ntlheng ya bokone, ka dikgakologo o se bona ka fa ntlheng ya bophirima. Selemela se na le bokao jwa matsalo a ngwana wa bogosing.</i></p>	<p>English version <i>Selemela</i> is a group of stars associated with seasonal changes. During winter season, it appeared in the West and in spring the stars were seen in the north. Its arrival also signalled the birth of a child in a Royal house.</p>
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Focus groups with IK experts also revealed that the stars were used to determine the different agricultural seasons of the year. Bakgatla -Baa- Kgafela believed that “*Selemela*” also served to send early warning about rainfall in summer and as such referred to as the stars of rain or rain bearers. The following section provides the link between *Selemela* and *Dikgafela* ceremony.

5.2.3 Dikgafela le Selemela

Dikgafela is a first fruit / harvest / thanksgiving ceremony or cultural festival meant to appease the heavens to release the rains. The *dikgafela* celebrations is a symbol of unity of the community and their efforts to share, struggle, celebrate and work together. During this ceremony, elderly woman carried pots of *bojalwa*, the traditional beer on their heads for villagers to drink.

According to Mme Grace Masuku, a well known IK expert in Moruleng, *dikgafela* is an olden sacred ceremony practiced among the Batswana including Bakgatla -Baa- Kgafela, and it is a symbol of receiving blessings of harvest in our cropping efforts and has links with *Selemela*. Mme Masuku further stated that *Dikgafela* is a sacred cultural ceremony practiced from time immemorial until today. Its purpose is to celebrate the good harvest of the year and it is celebrated annually around *kgwedi ya Phatwe le Lwetse* (month of August and September). In addition, it is a ceremony to thank the ancestors and God about good rainfall received.

In addition. Mme Joyce Pule, an IK expert and member of the IKS unit in Moruleng, *dikgafela* symbolizes the happiness of the people, their reciprocal relationship with the land and it is also serves as an opportunity for thanksgiving to Kgosi (Traditional leader or King), ancestors and God for rain. It signifies to the King, the rainmaker, ancestors and God that the people are glad after the good rain and harvest. It is prayer for rain, as well as prayer for the well-being of the people.

Mme Joyce Motlathledi, an IK expert and member of the IKS unit in Moruleng, indicated that the seeds were prepared in Lwetse, during the time of thanksgiving. She remembered the word “*dikgafela*” and the king’s permission to go for harvesting. It is during that time where seeds will be brought to the King by all the clans in the community.

According to Mme Mamotlathledi, the community will be giving offerings / gifts to the King. That is how Bakgatla -Baa- Kgafela demonstrates to their traditional leadership as Batswana. The King is the only one who has the right to give permission during the time of thanksgiving. The above information was supported by Mme Masuku that these thanksgiving gifts were only delivered by woman, they would carry woven baskets on their heads. After the king has received all the gifts then he would give permission for the seeds to be prepared for ploughing and this was done during the month of Lwetse (September).

As illustrated above, the thanksgiving ceremony is associated with good harvesting and is about ploughing. It is a symbol that the soil is fertile, ripe and it is time for ploughing. It is important to note that there were socio-cultural protocols associated with ploughing and harvesting among the Bakgatla -Baa- Kgafela and the Batswana in general. No one was allowed to go for ploughing or harvesting without observing this protocols.

The community leader or king and the council were the custodians of Batswana culture, traditions and customs including cultural festivals and agricultural activities. There has to be an announcement that it is time for ploughing. The seeds are washed first, and when the seeds are washed every household in the village knows that it is time to start preparing for the ploughing season. When the king announces that it is time to wash the seeds, he is opening the ploughing season. The permission and powers of ploughing, harvesting and other important cultural and traditional activities such as initiation schools, rainmaking ceremonies lies with the local king.

According to Mme Masuku, when we wash the seeds, we wash them so that we can plant. She indicated that in Setswana thanksgiving means *ditebogo*. She argued that the word “*gafa*” is associated with thanksgiving and happiness. It is about thanksgiving to the King for his responsibility and duties of ensuring good rain and harvest in the community which is one strategy of ensuring food security.

Mme Masuku indicated that Bakgatla used to plaster using cow dung. On the 1st they would move the soil and plaster with cow dung to make the place clean so that when thanksgiving comes, it will be nice and tidy, so that when you pour, you know where to pour each grain. There are different kinds of grains and melons for thanksgiving. Those things are put together and taken to where the woman are seated at the royal house.

The woman will sort the produce and decide on what to keep and what to throw away. Then they give them to the King. They sit on plastered floors, while they are seated, they show the young woman how things are done including the plastering. There is a way in which the plastering must be done, it is symbolic as well, and then the plastering has patterns which have meaning.

According to Rre Moeketsi, there is a link or nexus between *dikgafela* ceremony and celestial bodies such as *Selemela*. Rre Moeketsi argued that during the thanksgiving time, the little stars called *Selemela*, appear at night and they appear as if they are dancing. They symbolize happy group of stars and they are perceived as agricultural indicators. They are happy because people have harvested and they are going to give thanks to the King, deities and divinity. They are going to give thanks to the King so that he can permit them to start ploughing, but at night we are ruled by *Selemela*. *Selemela*, means you must know that the harvesting has passed and it is time to share gifts.

According to Mme Masuku, *dikgafela* is offered by *morafe* (community) to the King. These thanksgiving gifts, when they arrive they are stored in silos. Then they become food for the King as well as for the community, especially the impoverished families. It was common that impoverished families go to the King for assistance. The King will take a woven basket or a sack and give it to the family to go and put in food from the silo. That is the value of thanksgiving.

Mme Masuku further said, that is my knowledge about *dikgafela le selemela*. She stated that she grew with this knowledge in the royal house. Mme Masuku argued that nowadays *dikgafela* gifts

are stored in granaries and silos such as sorghum and millet including different harvest that have been given to the King as gifts. Beans also, each produce has its own granary. It is the Batswana bank or strategy for ensuring food security among the community members. Mme Masuku explained the difference between seboana and sefalana as follows:

Pharologanyo fa gare ga sefalana le seboana. Ka gore seboana, 'lapa le lengwe le le lengwe ge le lemile le nna le seboana mo lapeng la sone ka go re ga go na ko lo phothelang teng ga o go kotula, o tla ka mabele a, o setse o dirile 'lapa la gago le ge e le gore o phothela ko masimo o setse o na le seboana sa kwa masimong. A seboana se tlhalosiwe gore ke lefelo le go phothelwang mo 'o lona Mme legae le le lengwe le le lengwe le na le seboana sa lona mme diboana tse ga di tshwane, ka gore o ka fitlhela mo Setswaneng, ge motho a bolaile mmopo, before a o kampo ga seno nne a o photha, ka gore one ga o phothiwe, wa kgodiwa. Go bo go sala mmopo o mongwe. O bo o direlwa seo sa dikota bontate ba se itse. Ga kere wa utlwa rra. Se diako tsa mmopo tse dintle di tlhophilwe aside gore tsona di tlile go o nna peo. Ga ke bue Setswana. Ee. Ke batla ke ranole ke utlwe gore rea ikutlwa. La e tlhaloganya. Jaanong ne ke batla gore re tlhaloganye between seboana le sefalana. Sefalana, go o tlo ya ko kgosing, le yaanong go o kaya ko godimo fa o tla fitlhela gore, ga sesengwe, nne di ka nna pedi tsa nna tharo, kafa di ka nna kana, e le difalana tse dintsi gore e tle e re le tsatsi le ge morafe o na le thobo, storage, fa dilo tse di tlo bewang teng go bo go le teng. Batho ba ge ba tlo kopa. Masika a sa kotulang sentle, ko go nang le tlala, dijo tsa bone di ntshiwa mo diboaneng, di ntse di tshetswe morola, di ntsi pila. Ga ke itse gore a lea tlhaloganya. Ee, ke raa gore di'o tse di tlhalose gore, di ntse di ntse

English version

The difference between a storage tower and a small granary. A small granary, every family have one in their yard. It is where the grains are threshed. When you come back from harvesting, you bring sorghum, when you have already plastered the floor with dung. Even when you thresh at the fields. You already has a small granary to keep all the grains. It is the small granary always free to accommodate new grains. Every household has a small granary. These granaries are not the same, sometimes when you have left over maize, you store it in the granary. After selecting the beautiful ones which will be used as seeds. According to Mme Masuku a silo is found at the royal village. They are normally found in three's or two's so that when the community brings thanksgiving gifts, there is enough storage where all the gifts will be stored. When needy people come to ask for food, they will be given food from the silos.

molora, di ntse di ntse pila. Ehe, ante go dirwa jaana.

The above was supported by Rre Piet Koitsiwe in Mochudi, pointed that:

Dikgafela di na le tsamaiso ya tsone. Difalana di tsenya mabele, a mangwe a dira bojalwa jwa Setswana. Bontsi ba mabele bo tsengwa mo difalaneng bo be bo sala kwa kgosing. Maikaelelo e le go thusa batlhoki, ba ba se nang dikgomo kgotsa ditonki le ga e le tshimo ya go lema. Jaanong borra dikgotla ba tla ka motho kgotsa mongwe yo o nang le mathata humanegile mo Kgotleng a bo a begiwa. Motho yo o neelwa ditlatlana di le pedi kgotsa kgetsi ba lebile palo kgotsa bakae mo lapeng le tshotlego ya bona ka kakaretso. Dikgafela e ne e le tsamaiso ya go kopa pula mo kgotleng. Pele ga Dikgafela, go ne go rapelelwa pula. Bana ba bannye kgotsa diola melora ba ga metsi kwa nokeng ka dinkgwana. Dikgafela di raya gore thobo e ntsi jaanong e ya kwa difalananeng. Setlhare sa se amana le pula. Se bitsa pula. Dikgafela di tliisa boitumelo mo bathong le go leboga Kgosi, badimo le modimo. Ke kamano ya batho, Kgosi, badimo, modimo le tikologo le loapi la bone. Moologa o tliisa boitumelo e bile o amana le pula.

English version

Dikgafela have their way of operation. Granaries contain corn and corn breed liquor. The bulk of corn is preserved in granaries and then left at the king's palace. The reason behind this is to help the poor who do not possess cattle or donkeys and do not even have ploughing fields. From the councillors they bring the poor or people with problems to the kgotla and these people get introduced for their plight. The affected person is given two baskets or a sack depending on the size of the family as well as their hardship in general. Dikgafela was one way of requesting rain from the kgotla. Before Dikgafela are given or offered, the first step was to pray for rain. Young children still in their puberty stage fetch water from the river in buckets. Therefore, *Dikgafela* spell out abundant harvest and will be preserved in granaries. The *moologa* tree (wild camphor or *Tarchonanthus camphoratus*) is associated with rain, it calls for rain.

Dikgafela brings happiness among the people and to thank the king, the deities. It is a connection of the people, king, deities and the surrounding including the sky. The *moologa* tree brings happiness and is associated with rain.

Focus groups with indigenous knowledge experts in Moruleng and Mochudi revealed the king was responsible for receiving *dikgafela* which is organised by the community members. This ceremony was organised immediately after harvesting season, after the first rain which symbolises the end of winter called *kgogolammoko*.

This is the rain that cleans the earth just after winter season. The purpose of the ceremony is twofold in the sense that the community thanks the King and the deities and on the other hand the king will thank the community for good harvest. The following section provides the findings about *naledi ya mariga* (winter star) known as *Naka*.

5.2.4 Naka

According to the majority of interviews with the participants, there is a star known as *naka* or “horn”. *Naka* appears from early *Motsheganong* (May), *Seetebosigo* (June) and *Phukwi* (July) month and regarded as the winter star by the IK experts in Moruleng and Mochudi villages. It usually appears at dawn, and it shines very brightly like gold. According to interviews with IK experts most people do not know about this star because they are regularly asleep during cold seasons or indoors due to the fact that nobody normally walks during those hours of the morning.

Rre Metsileng, an IK expert pointed that during that time it is still very cold to be walking outside so most people would be sleeping. The young ones do not know it at all because nobody wakes up early anymore even the newly husband (*mokgwenyana*) does not wake up early anymore. *Bana ba gompiano ba fisiwa marago ke letsatsi* which literally means the young generation generally wake up very late when the sun is already up in the sky.

Furthermore, Rre Metsileng indicated that in the past, they used to wake up very early, especially if you slept over at your girlfriend’s home. You would wake up very early so that the owners (elders) of the house do not see you, this was a sign of respect for the elders. According to Rre Metsileng, nowadays, these ones wake up very late, they do not care anymore. The “horn star” appears in winter. Before it comes out, it is led by the *morwaaphefo*, the coldest strong wind.

An interview with Rre Rasepae indicated that the star called *naka* is a winter star. According to Rre Rasepae, this small star appears in the West, it goes across the earth just like an equator. This star, appears in winter, from the beginning of *Motsheganong*. It appears in *Motsheganong* or May but it appears very low. When it appears in May, around the 15th, it is accompanied by harsh winds, which scorches the sorghum or plants for the first time.

It will be preparing for what it left behind, to scorch the rest of the plants. It scorches sorghum, and it scorches trees, sometimes it scorches people. The Horn, and then the winter will be rife until it fades to the north. It moves swiftly from May until July. It only sets in August at around the 25th during the beginning of spring season.

Immediately after the Horn has set, the community will begin with the harvesting. They would then thresh what they have ploughed. They then winnow, to clean it. After a month, in August, when they are done, they move on to September. The Horn is associated with harsh winds. When winds

has passed, the Horn has passed the equator. Then something else follows, like clouds, rain, this rain is called a cleansing rain or kgogolammoko. When the star *naka* is done, it is now the season for the cleansing rain.

In addition, Naka is one of the bright star that shines in the night sky. It has got its own aesthetic beauty and it is significant among the Bakgatla -Baa- Kgafela. Its main symbolic meaning is to welcome or introduce the winter season, it separates the seasons, spring, winter and summer. Furthermore, an interview with IK expert, Mme Masuku explained “*naka*” as follows:

*Naledi ya naka e bopegile jaaka lonaka.
Ke naledi ya serame kgotsa mariga. E
bonala gantsi fa Seetebosigo a tlhola 25
mo gare ga mariga. Motswana fa a bua ka
ga naledi e, a re “borwa bo a be bo phintse”
ka go re ke naledi e e phunyang serame.
Naledi ya naka e bonwa gantsi ka nako ya
makuku a naka tsa kgomo mo mesong.*

English version

Naka is shaped like a horn. It is regarded as the “cold star” or a winter star and appears around 25th June, when it is very cold. It is usually seen early in the morning, around dawn. It is locally believed to bring cold weather.

The above is supported and confirmed in literature by Snedegar (1995) the Basotho, Batswana and Venda people traditionally knew Canopus, the second brightest star in the night sky, as *Naka* or *Nanga*, “the Horn Star.” It is also a well-known star among the amaZulu as attested by authors such as Kunene (1981). For instance amaXhosa people used the star to mark winter initiation schools and the Northern Basotho used to reward the first person to see it rise in the early morning with a haifer.

The calendrical significance of Canopus is more clearly discerned among the Basotho and Batswana people than with the Nguni (Snedegar, 1995). The Basotho and Batswana initiation schools commenced upon morning sighting of the *Naka* star (Canopus), this happened during the month of May, at the beginning of winter (Snedegar, 1997).

Naka was said to break up the year and to burn up anything green in nature as it heralded the winter season and the browning of the veld. *Naka* should be visible in the pre-dawn sky by the third week of May. Among the Basotho in particular, *Naka* is often associated with year of plenty or famine, misfortunes, good luck and fortunes (Snedegar, 1995). The following section discusses the star known as *kopadilalelo* or evening star, normally called Venus in modern astronomy.

5.2.5 Kopadilalelo

The IK experts in focus group discussions in the study communities indicated that, *Kopadilalelo* is normally known as the evening star and it appears immediately after the sunset. The name *kopadilalelo* is derived from two words namely “*kopa*” which means to ask and “*dilalelo*” which literally means supper or dinner. According to Rre Metsileng in Moruleng, *kopadilalelo* is one of the first and bright evening star. It is a symbol of indicating that the soil is ripe and fertile for ploughing.

According to an interview with Mme Ntikoe Motlotle:

Naledi ya kopadilalelo e bonla fela ga letsatsi le phirima, e bonala gape mo bophirima.
Ka Sekgatla e supa go re ngwaga ke o montle, jaanong e ikopela dilalelo / dijo. E suta fela fa go tsena leuba.

English version

The star of kopadilalelo appears after sunset and in the West direction. According to knowledge, worldview and culture of Bakgatla -Baa- Kgafela it is a symbol of the year of prosperity and it comes to ask for dinner. It only disappears when there is famine.

An interview with Mme Masuku in Moruleng showed that, *kopadilalelo* means that when the soil is ripe it gives us food, but this food we eat them every day for dinner. The food is the one that we prepared in the evening. Every evening, old woman would put the pot on the fire because the evening star has already risen. But with “*kopadilalelo*” know that the food that you are cooking shows that we are ready for ploughing season.

Mme Masuku adds that that’s why *kopadilalelo* when it is 16:00 or 17:00, if you are very vigilant you will see it. It shows that it is time for cooking dinner. It also explains again that it is time for the soil to be ploughed. It also teaches us that when it turns 16:00 the dishes are clean. We used to wash the dishes at 15:00. If you washed dishes at 16:00, your mother would have punished and ridiculed you.

Mme Masuku showed that they used to wash dishes at 15:00 so that by the time it is dinner they will be clean and ready. She would also make you aware that even *kopadilalelo* is out, it shows you that it is time to put the pot on the fire. We put the pot on fire at 16:00. It has two fold meaning, firstly it is about the soil which is ready and secondly, it is about the dinner time.

According to Rre Gouwe, an IK expert in Moruleng, this star called *kopadilalelo*, is a bright and big star. We looked at this star without a telescope, gazing from 16:00 during the day. You will see it, it

will go on slowly, following or coming behind the sun. When the sun sets at around 16:00 you will see it with the naked eyes.

According to Rre Gouwe, *kopadilalelo* symbolizes the season of spring and time to go to the fields. Secondly it means that the girls must prepare the pots for dinner so that by 18:00 dinner will be served, and when the sun sets, you are able to see it clearly. After dinner people would sit on the fire place and observe the celestial bodies. It is a summer star, not a winter star. That is when grandfathers and grandmothers would be telling the children folktales about stars during *maitiso* (evening session around fire place).

According to Rre Moeketsi, a Motswana Traditional Healer and IK expert in Moruleng, *kopadilalelo* appears in the evening and it symbolizes the fertile soil and time for ploughing. In the evening *kopadilalelo* appears very small and grows as the evening progresses. Now the time for ploughing has arrived and evening star has begun to shine brightly. It is time for us to prepare the seeds for ploughing in the fields. We are thinking that it means the pots must be ready for dinner but it actually starts with the soil.

Interviews with IK experts in Mochudi and Moruleng revealed that *naledi ya kopadilalelo, e bontsha go re ke nako ya dijo tsa go lalela kgotsa maitseboa. Batho ba bogologolo ba ne ba itse nako ya go rulaganya dijo tsa maitseboa tsa lelapa ka go lepa ka kopadilalelo. Fa naledi ya kopadialelo e bonala, bagologolo ba ne ba itse go re nako ya dijo tsa maitseboa e setse e gorogile.*

According to IK experts, “*kopadilalelo*” is the star that appears at supper time. In the olden days the setting of this star, shortly after sunset, indicated to the people that it was time to start gathering firewood and prepare for the evening meal. This is consistent with Snedegar (2000) identifying this star with evening appearance of Venus.

Interview with Rre Metsileng indicated that *kopadilalelo* is one of the bright star which moves from south to north and appears on the dark night sky throughout the year. The star of *kopadilalelo* is used to calculate time among the Bakgatla -Baa- Kgafela. A Motswana girl or woman associate with this star and they knew that when it sets, it is the evening time for dinner and so the name of this star means "to ask for dinner". The following section discusses the morning star known as *mphatlalatsane*.

5.2.6 Mphatlalatsane

Interview with indigenous knowledge expert Mme Pulane Motswasele had the following knowledge about the the star known as “*mphatlalatsane*”:

Bogologolo, Bakgatla -Baa- Kgafela ba ne ba dirisa mphatlalatsane, go lepa nako ya meso. Mphatlalatsanae e bonwa go simolola ka ura ya 02h00 go fitlha ka 04h00 mo mesong. Bakgalta -Baa- Kgafela ba ne ba dumela gore naledi e ke letshwao la tshimologo ya letsatsi le lešwa. Mphatlalatsane e ne e dirisiwa ke badisa ba dikgomo, batsomi ba diphologolo le balemi le dingaka tsa setso go tsweletsa ditiro tsa bone mo metseselegaeng, jaaka go bolotsa dikgomo le go batla ditswammung.

English version.

Long time ago the Bakgatla -Baa- Kgafela used the star Venus to mark the morning times. The star Venus is visible from 02:00 until 04:00 in the early hours of the morning. The Bakgatla -Baa- Kgafela believed that this stars is a mark of the beginning of a new day. Venus was used by shepherd’s animal hunters, farmers and traditional healers to administer their work in villages, for example driving.

An indigenous knowledge expert, Rre Nelson, a traditional healer and IK expert in Moruleng, indicated that in the olden days, Bakgatla -Baa- Kgafela used the star “*mphatlhalatsane*” (Venus) to determine the morning time. *E bonala sentle fa bosa bo lebile gotla. E ntle thata, e a galalela, e bega go re jaanong bosa bo gaufi, e a bonesa. Yona e ka fa boithabatsatsi.* The above means that this is a beautiful star that appears in the early hours from the east. This star appears from 02h00 until 04h00 in the morning and the Bakgatla -Baa- Kgafela believed that this star signified the dawn of a new day.

Snedegar (2000) identifies this star with morning appearance of Venus. “*Mphatlhalatsane*” was used by cattle herders, hunters and traditional healers to determine their community activities, i.e. taking cattle to the veld, going on hunting expeditions and collecting medicinal plants (in the case of traditional health practitioners). *Dikolobe* is discussed in the following section.

5.2.7 Dikolobe

There are little stars called *dikolobe* or Pigs. According to focus groups discussions with IK experts in Moruleng and Mochudi, these are little stars which normaly appears in summer season. They appear during the time of preparation of seeds for ploughing during the month of Tlhakole (February). They rise from the East and sets in the West, and they are three with one that is bigger than all of them.

According to our elders, those little stars are seen in autumn, from Tlhakole (February) until Moranang (April). In April you will no longer see them, they have already disappeared. They shine brightly and visible to naked eye. They appear side by side and if you count them, they are 3 and then 6. They are a group of stars, a cluster.

According to the narratives provided by Rre Metsileng, ‘when I was enjoying the bonfire while I was still a shepherd, we were taught about the stars by our grandfathers. I remember that they are 3 “star-pigs”. They appear like this. There is one which is higher than the others. They are a bit different. There is one amongst them which shines brighter than the others. It shines very brightly that even when there is no moon, it can help you walk through the night. They are the stars which decorate the sky. They do not shift, they are just like this. As the night falls at around midnight they start to diminish and become smaller. At around 01:00 - 02:00 am they are completely gone. They are 3 in nature, that’s how I know them”.

Interview with indigenous knowledge expert in Mochudi, Rre Magae Molefe talked about *dikolobe* as follows:

Dikolobe ke dinaledi tse tharo bangwe bare ke losagaripa lwa dinaledi e bile di itira sefapaano mo loaping. Bakgatla -Baa-Kgafela ba ne ba dumela gore dinaledi tse di na le seabe mo go ateng ga leruo. Dinaledi tse di kaya go re ke nako ya diphologolo go re di tsale. Diphologolo ga di tsale ka nako tsothle. Diphologolo di na le nako ya tsona e e kgethegileng ya go tsala.

English version

Dikolobe (Orion’s Belt) is three stars while other indicate they the cluster of stars that forms a cross in sky. The Bakgatla -Baa- Kgafela believed that this star was associated with the reproduction domestic animals and that animals did not simply give birth at the same time or season, but had specific times or seasons for reproduction.

Rre Mogotsi provided a narrative and he pointed that:

Dinaledi tsa dintsa le dikolobe ke tsone tse go tweng ke Orion ka sejathlapi. Dintšwa le Dikolobe, ga go mafaratlhatlha jaaka Selemela. Ke naledi, e dirilwe tlhogo go bo go dirwa lebogo. Bo go dirwa lebogo. Jaanong fa ke mmele. Bo go dirwa e le mme bo go dira leoto ha. Go bo go dirwa leoto le lengwe ha. Fa go bo go dirwa Seraka se bo se kgaola tharo, one, two, three. Ke gore ke one moitlamo. Mme o bona gore motho o o ntse jaana, o phatlaladitse mabogo o kaname. Ke Orion. Monna yo

English version

The stars of dogs and pigs are what is called Orion in English. Dogs and pigs, are not confusing as Selemela. It is a star, it has a head and hands. This is its body and these are its legs. Here they made a cross and it’s divided into three parts. It is a belt. You see that this person is spreading his hands and laying on his back. It is Orion. He used to be a hunter. In Setswana, when the elders were teaching us, they called these things dogs and pigs.

e ne e le motsomi. Jaanong mo Setswaneng, bannabagolo le basasdibagolo ha ba ruta ba re dilo tse di Dintšwa le Dikolobe ba di bitsa jalo. Bone ga ba di bitse Orion, ba di bitsa Dintšwa le Dikolobe. Jaanong ka e ne le motsomi, go a tshwaragana.

The Bakgatla -Baa- Kgafela used animal world to explain and understand the celestial bodies. The little stars of *dikolobe* were associated with the ploughing season and reproductive cycles of domestic animals. They are also significant and well known for their natural beauty. There are interesting stories about *dikolobe* told by the IK experts in the study communities. The following section is about *molalatladi*.

5.2.8 Molalatladi

Focus group discussions with IK experts in the study communities revealed that there is often a confusion between the understanding, symbolic meaning of *molalatladi* and *motshe wa godimo*. One of the IK experts, Rre Magae argued that *molalatladi ke tsela ya badimo* which means that the Milky Way is a pathway of the ancestors. He said it symbolises that the earth is separating. He says that even the sky is divided like that. When they turn like this, then it will be dawn.

Another version was provided by Rre Mogotsi in a focus group discussion with IK experts, he argued that *molalatladi* indicates the four seasons of the year. He said that at some point, the pathway is not as clear as it is this time of the month which is summer. In winter, season, it looks clear. If you pay attention during winter there are days where the Milky Way will appear like its twisting or dancing.

The absence of Milky Way in winter, it is an indigenous early warning sign of drought season. On the contrary, when it appears to be very bright and clear, it is a sign of rain. Sometimes when you see it facing the other direction during winter, it is changing. When it has turned the other direction then the big stars called *Dikolobe* will emerge. These stars are controlled by the Milky Way. The Milky Way will turn and then they will fall by the side. They do not fall by the East. When you turn like this, you will see them falling there but they will appear again. *Serogabolopo* is discussed in the following section.

5.2.9 Serogabolopo

During the focus group discussions held in the Makoba Boardroom at the Bakgatla Baa- Kgafela Traditional Office in Moruleng, the IK experts mentioned and explained clearly the star known as *serogaboloko*. Makoba is one of dikgoro (clans) of Bakgatla -Baa- Kgafela. The narratives about *Serogabolopo* were provided by the IK experts as follows:

Serogaboloko ke naledi e e bontshang baagi ba selegae gore pula e tlaa nna teng. Dipuisano le batshwarakitso ya tlhago di totobaditse ntlha ya go re dingwe tsa dinaledi tse ga di sa tlhole di bonala go lepa pula le tsa bolepi. Se ke ka ntlha ya go ikgatolosa meetlo le tsa semowa tse di gokaganyang baagi ba selegae le badimo. Dintwa tsa bogosi di na le seabe ka ntlha ya fa bogosi e le jone bo tshwanetseng go gokaganya baagi ba selegae le badimo ba ba itlhagisang ka metsamao ya dinaledi ka go farologana. Batho ba ne ba na le tumelo ya go re badimo ba dira go re dinaledi di nyelele.

English version

The star of “*Serogabolopo*” (unidentified star) was associated with rainfall and sent early warning signs about rainfall. Focus group discussions with indigenous knowledge holders and practitioners indicated that some of the stars were no longer visible to predict rainfall and weather patterns. They attributed the invisibility of the stars to the community’s neglect of tribal customs, especially spiritual ways of life linking the community to the ancestors. The conflicts of succession among traditional leaders also contributed to this, because they were supposed to connect people to the ancestral spirits who revealed themselves to the community through the various types and movements of stars. People believed that the ancestors kept the stars away from the community.

The above narrative indicate that Bakgatla -Baa- Kgafela had a clear understanding of the celestial bodies. The IK experts attributed some of the invisibility of celestial bodies to the neglect of community customs, especially the belief systems that has to do with the ancestors. IK experts indicated that the conflicts of succession among the traditional leaders also contributed to this because they were supposed to connect people the ancestors who revealed themselves to the community through the various types and movements of stars. Community members, especially IK experts had a belief that the ancestors kept the stars away from the community. The following section provides information and knowledge about *motshe wa godimo*.

5.2.10 Motshe wa godimo

Mme Ntikoe Motlote indicated that *motshe wa godimo* is known as the rainbow. It is caused by the reflection of the sun. Bakgatla -Baa- Kgafela used to believe that the rainbow is a symbol that chases the rain away. The rainbow normally comes in pairs or threes. It appears in the East. When it

appears, especially when it's time to go collect livestock. It shows that the rain has stopped. An indigenous knowledge expert from Moruleng, Mme Malatji talked about the rainbow known locally as *motshe wa godimo*:

Motshe wa godimo o phatlhalatsa pula. Molalatladi o na le mebala e le supa jaaka (bohibidu, mmala wa namune, botala jwa legodimo le jwa naga, serolwana, "indigo", Mebala e ga se mebala e e bontshang bontle ba tlhago kgotsa loapi fela. Mebala ya Motshe wa godimo e na le bokao jwa setso le ngwao ya baagi ba selegae. Ke motshe wa godimo kgotsa lefelo la tladi / magadima.

English version

Motshe wa godimo signalled that rainfall would come to an end. *Motshe wa godimo* has seven types of colours (red, orange, yellow, green, blue, indigo and violet). The colours are not just wonderful images in the sky, they also conveyed deep cultural meaning among the people. It normally signifies the end of rain.

The above narrative indicate that Bakgatla -Baa- Kgafela had a clear understanding of the difference between the rainbow and MilkyWay, including serogaboopo. The rainbow was admired due to its natural or aesthetic beauty and its magical appearance in the sky which symbolised the end of rain. The study also argues that many indigenous communities admired this phenomenon in various ways. The Bakgatla -Baa- Kgafela believed that "*motshe wa godimo* was the village of the ancestors and was also known as "*Motshe wa godimo*". They also referred to it as "a place where lightning rests". *Motshe wa godimo* or often referred to as *motshe wa badimo* has been clearly explained by IK experts and it is different from the Milky way or *molalatladi*. The following section discusses sedumedi.

5.2.11 Sedumedi

According to Mme Ntikoe Motlotle, sedumedi is a form of meteorites. She indicated that:

Matlapanyana a a welang mo lefatsheng ga meteorites o phatloga. Sedumedi se a duma, goes on a flesh light with a big bang going bophirima. Kwano kgatleng sedumedi sa bofelo se utlwagetse ka 1958 ga kgosi Molefi rrago Kgosi Linchwe wa bobedi a tlhokafala. Se ne se utlwiwa le ke ba ba kwa masimo. Ga buiwa go re kgosi nngwe e tlhokofetse.

English version

Small stones falling when the meteorites breaks. The meteorites makes noise with a flesh light going towards the West. Here in Kgatlang, the last meteorite was last heard and seen in 1958 when Kgosi Molefi, the father of Kgosi Linchwe II passed away. It was also heard by those who were at the farms. The message came across that one of the Kings has passed away.

Bolepa-dinaledi is knowledge from our grandmothers who taught us how to observe and understand different examples of celestial bodies. This knowledge was transmitted by elders at home and even at the farms, they showed us the examples of the stars that when you see this type of star falling that side, breaking into pieces, it is reporting. It is reporting that there is someone within the ruling tribe who is leaving, with the elders.

According to Rre Sefara, an IK expert in Moruleng:

Go na le naledi e e bidiwang Sedumedi. Ke naledi ya dikgosi. Ke naledi e e begang loso lwa Kgosi. E gasa motse otlhe fa Kgosi e ragile thokolo. Bogologolo e ne e bidiwa "naledi ya dikgosi".

English version

The star "Sedumedi" was associated with the death of a traditional leader and informed the community that a king/tribal leader had passed away. very bright through the whole village. In the older was referred as the "the royalty star", indicating that the Bakgatla -Baa- Kgafela had knowledge about star associated with royalty.

The participants explained that the star of "Sedumedi" was no longer visible in the night, even if a tribal leader had died because most of the traditional leaders have abandoned their customs and traditional ways of observing rituals and tribal ceremonies to their ancestors. The latter was the result of the increasing influence of Western values including Christianity in tribal lives and royal families. *Tlala le kgora* is discussed in the following section.

5.2.12 Tlala le kgora

Interviews with IK experts, Mme Mmapula Rrapekenene provided information about *kgora le tlala* as follows:

Ka nako ya pula e le gaufi le go phaila dinaledi tse di nna ka fa Bophirima ba letsatsi. Di bonala maitseboa ka nako ya dilalelo. Kgora e mo letsogong le le jang. Ga tlala a le mo molemeng. Ga o di leba di supa ngwaga wa leuba tlala e nna kima thata, kgora e nna senyedimane se se nye thata. Ka ngwaga wa kgora ya tlala yaa bopama go nna ya lebogo la moja. Ngwaga o montle.

English version

They appear mostly towards the west or direction just before rain seasons. Kgora appears on the right hand side and tlala is on the left. They are used to determine the year of famine and prosperity among the Bakgatla -Baa- Kgafela. During the year of famine, "tlala" becomes very big and "kgora" small.

An interview with Rre Mogotsi supported the above statement and revealed that *tlala* and *kgora* are doing the same work exactly like the other stars, and they are on the left and right hand side. According to Rre Mogotsi during the night at around 20:00, *tlala le kgora* will be leading the

Southern Cross. They will be ahead, *tlala* will be over there and *kgora* will be there. According to Rre Mogotsi during the focus groups discussions, giving example, said that *kgora* is a little smaller, it is the size of the table, and *tlala* is the size of this classroom. Mme Ntikoe Motlotle elaborated further that *tlala* is very huge, *kgora* is a little smaller. The following sections provides information and knowledge about *dipaka tsa ngwedi*.

5.3 Dipaka tsa ngwedi

The moon and the sun were given high status in olden days and even perceived as human beings, deities and supernatural beings among the Bakgatla -Baa- Kgafela. It was generally believed that among the Bakgatla -Baa- Kgafela the moon represented the symbol of a woman and the sun, the man. The Bakgatla -Baa- Kgafela regarded the moon as the woman, because they believed that both possess the same qualities, values and attributes such as giving birth to new light, wisdom and protection.

The different phases and their meaning to the livelihood of the Bakgatla -Baa- Kgafela community is important. During the olden days, the Bakgatla -Baa- Kgafela knew that each lunar phase recurred every twenty nine days. They developed local names for the different phases of the moon, including their meanings and interpretation. They, for instance, knew that two weeks after seeing a full moon, there would be a new moon (absence of moon). Interviews and focus group discussions with participants explained the different phases of the moon as more than half-lit, quarter (half-lit) and less than half-lit to be the phases between full and new moon.

There was also a phase when the moon grew (waxing moon) and when it became less (waning moon). The Bakgatla -Baa- Kgafela determined rainfall, human fertility and seasonal changes, etc. according to the moon and, for example, displayed the symbol of the moon in their wall paintings inside the traditional homestead. Another example is how the Bakgatla -Baa- Kgafela used to believe that when the horn of the moon faced up, it was an indication or early warning of rain. They also believed that when the horn faces down, it is an indication of lack of rain.

The researcher observed that this knowledge was not documented, but disseminated orally by the elders to the youth. This poses a challenge for the present and future indigenous knowledge researchers, conducting research on the mainstreaming of the indigenous knowledge on Setswana indigenous astronomy in the community.

Among Bakgatla -Baa- Kgafela phases of the moon are called *dipaka tsa ngwedi* in Setswana. The researcher observed that like in many African tribal groups in South Africa and Africa in general, the moon and its phases played a fundamental role and had significant meaning in the livelihood of the Bakgatla -Baa- Kgafela. For instance, full moon was associated with happiness, because the children sang and rejoiced over the appearance of the new moon, because the Bakgatla -Baa- Kgafela believed that full moon gives birth to new light that signifies the future. The moon symbolizes the beginning of a new month.

Interviews with Rre Lebotse Molefe, an IK expert from Mochudi elaborated that:

Ngwedi fa o tletse kgotsa o tlhatswitse, Bakgatla Ba Kgafela ba ne ba dumela gore o tliša kgora mo baaging ba selegae. Bakgatla -Baa- Kgafela ba ne ba dumela go re ngwedi o ntse jalo, o bonesa sengwe le sengwe, e bile o kgona go bona le fa o tsamayang gone bosigo mo motseng. Ka nako e ya ngwedi batho ba kgona go itisa mo motseng e bile o utlwelela le dipina tsa bana ba opela bosigo.

English version

Interviews indicated that the appearance of the full moon symbolised prosperity to the Bakgatla -Baa- Kgafela community. The Bakgatla -Baa- Kgafela believed the full moon to be an indication of the purity of the earth. During full moon, people, animals and nature were happy. People also stayed up late at night before going to sleep. Young children and people sang songs of happiness and joy. There would be no adverse weather conditions and diseases that would attack the community and livestock at full moon.

An IK expert in Moruleng, Rre Metsileng indicated that:

Ke gore ha a le potokwe, re e bitsa re re ke ngwedi. Ga a le lekele, ra re ke kgwedi, kgwedi ya rogwa, kgwedi ya selwa. Go tshwana le ha e setse e tla go selwa mo mesong, e nna lekekenyana. Jaanong maina a ngwedi re a dirisa gabedi. E rra. Ke kgwedi, ke ngwedi.

English version

When it is round, we call it the moon. When it is uneven, we call it month or full moon, the beginning of the month or full moon, the month, full moon is late.

An IK experts in Mochudi, Rre Piet Koitsiwe indicated that:

Ngwedi o kgona go mmona go fitlhelleng a timetimetswa ke lesedi la letsatsi le mogote wa letsatsi. Ne e tle e re re le basimanyana be go twe re kaname kafa tlase ga ga setlhare, mo meriting. Go a tthole go le, lesedi le tla be le fokotsegile. E ise e nne sethoboloko, o batle ngwedi. Ee rra. Nna a bonala ... o le mo meriting pele ga setholoko.

English version

One is able to see the moon until it disappears from the brightness of the sun and the heat from the sun. When we were still young boys, we were told to lie on our backs underneath the shade of the trees. The light would have decreased. Before it is midday, look for the moon.

During the in-depth interviews and focus group discussions with participants community members, it was revealed that the Bakgatla -Baa- Kgafela used their knowledge of the phases of the moon and the sun to determine phenomena such as changing seasons, drought, rain and menstrual cycle of young girls and woman. The Bakgatla -Baa- Kgafela, like many other African tribal groups, depended on rain fed agriculture and they held the sun and the moon in high esteem, because they were believed to predict rain.

Community elders in Mochudi and Moruleng village indicated that calendars among the Bakgatla -Baa- Kgafela were usually set based on knowledge of the different lunar phase cycle. They used their knowledge of the different phases of the moon and the sun to measure the day, month and year. This was important for community activities, such as rain fed agriculture, because the period for harvesting depended on planting at the correct time of year. *Ngwedi wa ditshwene* is discussed below.

5.4 Ngwedi wa ditshwene

An IK expert, Mme Maluti Modibedi in Mochudi pointed that the moon never appears small, only when it begins to come out. When the moon rises it is just like the stars. When it is still down, we see it from a far distance, which is why they call it the moon of the baboons (*ngwedi wa ditshwene*), it is seen by the baboons which are on top of mountains and it is not visible to human beings or naked eye. It is still rising and then the next morning we see it clearly, it grows bigger as it gets closer. When it appears it looks beautiful and round but if look closely it is not really round. According to Mme Maluti Modibedi, there is a link between the cosmic bodies and animals. Many indigenous communities view animals as powerful spiritual entities wick also have strong connection with the cosmic bodies. The following section discusses *ngwedi le pula*.

5.5 Ngwedi le pula

Bakgatla -Baa- Kgafela in the study communities used *ngwedi go lepa pula* which means that they used the moon to predict rainfall. The moon has got different phases and meaning. There is another example of reporting / announcing rain, which is a meeting / *Pitso*. *Pitso* / meeting or circles in the moon and looks like a group of people in a discussion. It reports that the clouds will be visible in the sky. *Pitso* is a signal that there is enough water in the clouds for rain to fall. According to Rre Mogotsi, *Pitso* is the sun rays or moon rays that has made a green thing on the moon.

IK expert, Mme Joyce Motlhatlhedhi indicated that:

Ka nako ya fa ngwedi o tlhatswitse, le diphologolo di tshela sentle. Ga se nako ya diphefo le malwetse mo motseng. Pula e e nang ka nako ya fa ngwedi o tlhatswitse e bidiwa pula ya “Ramoriana”. Ke pula e e tlhagang ka fa ntlheng ya bokone, e bile ga e na diphefo, ga e kotsi mo matshelelong a baagi ba selegae. Ke pula e e tshololang metsi a le mantsi ebile a tlatsa dinoka le melapo.

English version

When there is a full bright moon, even animals lives healthily. This is not the time for blowing winds and diseases in the village. The rain that falls after the appearance of the full moon is called “*Ramoriana*” or man of medicines. This is the rain coming from the North, and it has no winds, it is also not hazardous to people’s health or citizens residing in the villages. It is a rain with heavy downfalls and it bursts the banks of the river and fill up the wells.

Interviews with Mme Malebogo Monametsi revealed that:

Kwatara ya ntlha ya ngwedi ke nako ya go solofela pula ya “nokaditlatse”. Pula ya nokaditlatse ke pula ya medupe e e tlhagang ntlheng ya botlhabatsatsi. Pula e, e na sebaka kgotsa lobaka lo lo leele, mme e sa tlatse dinoka kgotsa melapo. E kolobetsa lefatshe, mme diphologolo di itumele le go tshela sentle. Baagi ba selegae ba dumela gore ke pula ya mabele le batho.

The first quarter of the moon signalled the possibility of local rainfall, known as “*Nokaditlatse*”, meaning the rain which comes from the east and rained for a long period of time, and it does not fill the rivers and streams. People believed that this particular rain brought happiness, prosperity and life among animals.

The above narratives provides evidence that the Bakgatla used their astronomical knowledge of celestial bodies such as the moon to predict rainfall. The following section discusses *ngwedi and boitekanelo*.

5.6 Ngwedi le boitekanelo

Data collected from the participants in the study communities revealed that *ngwedi* or the moon was also important in issues of community and animal health. This means that the Bakgatla were also aware of the concept of the role of astronomy in community health. The following is some of the reflections from the participants in the study about the moon and health.

An IK expert in Mochudi, Rre Matlhaga pointed that:

*Ee ke gore ga ngwedi e lebile kwa godimo,
ka kitso ya sekgatla bare e huparetse bolwetse.
Ee, ke gore ga e thulama, e tsholola bolwetse go
ya kitso e re e neilweng ke bagologolo.
Ke raa gore nna ne ke utlwa ba rialo.*

English version

According to knowledge of Sekgatla, the moon which is facing upwards symbolises that it prevents or holds diseases. When the moon faces down, it poors or brings down the diseases.

The above was supported by focus group discussions with IK experts in Mochudi. The IK experts explained the following about the moon:

*Bakgatla Ba Kgafela ba ne ba na le tumelo
ya go re fa ngwedi o lebeletse kwa tlase
kgotsa ka fa letlhakoreng la molema
kgotsa moja, o tsholola bolwetse. Bakgatla
-Baa- Kgafela ba ne ba dirisa ngwedi go
lepa malwetse le phetogo ya loapi.
Sa bobedi, ngwedi fa o lebeletse kwa
godimo, o a be o hupile bolwetse. Ka ga
jalo, fa ngwedi o ntse jalo, go na le tumelo
ya go re ga go ne go nna le malwetse le
botlhoko jo bo ka tllhaselang baagi mo
motseng. Go hupa bolwetse go bontsha
gore ke nako kgotsa kgwedi ya boitumelo
mo baaging, e bile ga go kitla go nna le
diphefo tse di ka tlisang matlosedi.*

English version

The Bakgatla -Baa- Kgafela used to believe that if the moon was less than half lit and faced down or sideways, it signified diseases and adverse weather conditions. In those days, the Bakgatla -Baa- Kgafela used the different phases of the moon as warning systems of diseases and adverse weather conditions. Accordingly, if the moon was less than half lit and faced upwards, it signalled the absence of diseases and adverse weather conditions in the community.

Interviews with Mme Joyce Pule, an indigenous knowledge expert from Moruleng, elaborated as follows:

*Bogologolo, Bakgatla -Baa- Kgafela
ba ne ba na le tumelo ya gore ngwedi le
letsatsi di kgona go tlisa boitumelo le
kutlobotlhoko mo baaging ba selegae.
Ba ne ba dumela go re ngwedi le letsatsi di
kgona go tlisa malwetse le dipharagobe.*

English version

The Bakgatla -Baa- Kgafela believed in the olden days that the moon and the sun could bring good and evil into the community. Because of this, there used to be spiritual professionals who had the knowledge

Ka ntlha e, go ne go na le bomaitseanape le dikgeleke tsa tumelo ya Aforika ba ba neng ba kgona e bile ba na le maitemogelo a go buwa le badimo le go thibela malwetse a a ka tlišiwang ke letsatsi kgotsa ngwedi. and skills to communicate with the ancestors to protect them against evil that the sun or the moon might bring.

Among the Bakgatla -Baa- Kgafela in Mochudi and Moruleng, the moon was also used to predict or determine the well-being of human beings and animals. When the moon is facing upwards, it is holding sickness. Yes, and when it is facing downwards it brings the sickness. This is what nowadays is called medical astronomy. Bakgatla had mythologies, legends, narrative and cultural conceptions about the moon. For many years, they had a belief that the celestial phenomena has influence of day to day life of human beings including health. *Ngwedi le pelegi* is discussed in the following section below.

5.7 Ngwedi le pelegi

Among the Bakgatla baa Kgafela the moon also was used or linked to issues of *pelegi* or fertility. Focus group discussions and interviews with community members revealed that despite the use of the moon to determine the calendar of time and changing seasons, the Bakgatla -Baa- Kgafela used the moon to determine human fertility.

The above mentioned example clearly shows that, indigenous astronomy had a long and rich tradition in Africa and a far more extensive cultural impact (Holbrook, 2008). For instance, an interview with IK experts revealed that if a woman missed her menstrual period on a certain month, then the following month she could carefully look at the shape of the moon (whether it is full, half, quarter or half-quarter) and its direction (whether it is in the south, north, east or west). The moon was counted nine times and the 9th time was the time or month to conceive.

Interview with Mme Mmapula Rrapekenene revealed that:

Ngwedi o bidiwa gape gotwe ke Kgwedi. Ka kitso ya sekgatla ngwedi ke selo sa basadi, o tsamaya le mosadi, setswalao sa mme. Ngwana ga a na le 12 years, o bona setswalo ga ngwedi a palama, e seng wa ditshwene. Ngwedi ke mme, ke mosadi. Dikgwedi ga ditshwane. Le bomme ga ba tshwanela go bona setswalo ngwedi a tswa bosigo. Bagologolo

English version

The moon is also called month. According to knowledge of the Bakgatla, the moon is associated with woman, it goes along with the menstrual or reproductive cycle of woman and young girls. In the olden days, a young girl start menstruation at the age of 12 years and she was taught to read and understand the phases of the moon and

bare motho o a ithalega. Motho wa mme o ralwa ka boloko ke basadi bagolo mo letheheng le mokokotlo. Ga ba seke ba go dira jalo, ga go na sepe se o ka se dirang ka gore o itobile. Ga o tshwara dikopi di a thubega. Mme ga ba go lemogile, o nna malatsi a le mararo mo ntlung ba go tshasa ka boloko pele o tswela kwa ntle.

Mme Rrapekenene added that:

Mosadi ga a tshwanela go bona setswalo fa ngwedi o tswa bosigo, kgotsa a le motona. Ka nako enngwe ke bokoa ba bokoa jwa popelo e e sa amogeleng. Fa mosadi a gola a sa tshware, ke bolwetse jo bo bidiwang "some". Ke bolwetse ba popelo e sa tshware, e amogela, e lesa. Mosadi o tsamaya a ithaya a re kgwedi e mo tlotse, o tlaa solofela ngwana, kgotsa go nna moimana, mme magapele phiri e bo e tshwamoga, a be a tlhatswa gape. Mosadi o tshwara a lesa seo se kaya go re ga a tsoga sentle. Mme fa go ntse jalo o botoka, a ka fiwa melomo le go sidilwa ke basidibagolo mme a tshola bana. "Some" ke bolwetse ba popelo e amogela, e lesa. Ga o na le losika le le tsholang, wena o sa tshole, o batla ngwana kgotsa o se na thari, mosadimogolo, o ne a go neela onoroko ya gagwe gore o e apare, mme o tla nna le ngwana. O ne a go fa letheke la gagwe, gore o tshole bana.

its meaning. Months of the year are not the same. Woman are not supposed to go experience their menstrual circles when it is full moon and during the night.

According to Mme Rrapekenene that is a sign that the woman has or will encounter fertility challenges.

In the olden days, grandmothers used to do what is called *go ithalega* which means that old woman used to apply cow dung on the woman's back and she was supposed to stay three days inside the house.

English version

The above means that a woman should not go into menstrual cycles when the moon appears at night or when it is big in the night sky. Sometimes this is a weakness of a statement that it is not acceptable. When a woman continues to miscourage, this disease is called "some". This is when the womb cannot capture or conceive, it actually "catches and loose" grip. A woman normally thinks that she had skipped a month, and hopes to have a child or become pregnant, but at the end nothing comes to fruition because a miscourage occurs again. This is also a sign that a woman is not reproductively healthy. She may be subjected to cure or to take medicine and to be massaged by elderly woman and will ultimately bare a child. "Some" as explained earlier is a disease of the catch and lose womb. When you are in a family that has good fertility or bares lots of children, and you have challenges of conceiving, the remedy will be for the elder woman to give her a coat to wear, and she will ultimately conceive. In other words it may be said that that the elderly woman has given her, her waiste for her to conceive a child.

The logic of the above is that old woman used the moon to teach young girls in order to determine their menstrual cycles. Young girls were taught also to speak to the old mothers and disclose if they have done anything wrong such as engaging with boys for sexual intercourse. This was very significant due to the fact that old woman who acted as midwives could intervene medically through the use of herbs and indigenous massage. The following section discusses *letsatsi le nako*.

5.8 Letsatsi le nako

Among the Bakgatla -Baa- Kgafela the sun (*letsatsi*) is known as the man and has been observed with great interest. *Nako* means time among the Batswana. The Bakgatla observed the sun's predominant motion as it rise in the morning from the east and set in the west. Bakgatla -Baa- Kgafela just like any Batswana, have a way of reckoning or conjecturing the time. They use natural things such as celestial phenomenon to estimate time.

According to Mme Masuku "*go na le nako ya letsatsi le tswa le ga le wela*". There is time between sunrise and sunset. This time is also broken into different parts from morning until midnight. The word *letsatsi* is also used to measure time, for instance the 24 hour day or between sunrise and sunset. Therefore the word *letsatsi* is a word which is very important in measuring or judging time in Setswana. The sun played a very important role and its meaning among the Bakgatla -Baa- Kgafela as explained in interviews from Moruleng village by Rre Rrasepae that:

Bakgatla -Baa- Kgafela ba ne ba dirisa letsatsi go lepa nako ka ntlha ya fa ba ne ba se na ditshupanako tse di dirisiwang gompieno. Ka ga jalo, ba ne ba dirisa letsatsi go itse le go lepa nako. Re ne re lepa nako ka letsatsi, re lebeletse meriti ya dintlo kgotsa ya ditlhare. Fa re ne re tsena sekolo, re ne re tlhola re gakolola morutabana go re ke nako ya dijo re dirisa letsatsi. Re ne re kgona le go lepa gore ke sethoboloko (12h00). Fa ke ne ke tsena sekolo ke ne ke lepa nako ya gore sekolo se tsena nako mang le go re, nako ya dijo kwa sekolong e tla leng le gore sekolo se tswa nako mang.

English version

The Bakgatla -Baa- Kgafela tracked time according to the sun in the absence of modern watches and estimated the time by observing the sun's position in the sky and the shade of a tree or the shadow of the houses / buildings. IK expert related that when they were at school, they would always remind the teacher when it was time for lunch by checking the sun's position in the sky. They could tell when it was 12h00 (midday) by the fact that a person's shadow would be directly beneath them. During school days, the sun and shades or shadows of trees would indicate the time to leave for school, the time for lunch and the time for school to end and return home.

This was further elaborated by Rre Piet Koitsiwe, an IK expert, community elder and traditional health practitioner (*ngaka ya Setswana*) in Mochudi village:

Bogologolo, Bakgatla -Baa- Kgafela ba ne ba dirisa letsatsi jaaka tshupanako ya bona. Bakgatla -Baa- Kgafela ba ne ba dumela gore go na le nako ya sethoboloko e e neng e tlotliwa ke baagi ba selegae. E kaya gore ke motshegare thata. Nako ya sethoboloko e bua gape ka badimo. Sekai, ka nako ya sethoboloko, Bakgatla -Baa- Kgafela ba ne ba na le tumelo ya go re baagi ba selegae ga ba a tshwanela go tsamaela gaufi le mafelo a badimo, go tsamaela kwa dirapeng tsa baswi, go tsamaela kwa melapong, go phepafatsa lelapa, e bile ga go tserwe mo lesakeng la dikgomo ka Sethoboloko. Botlhokwa ba tlhaloso e ke go re, sethoboloko ke nako ya badimo.

English version

In the olden days, the Bakgatla -Baa- Kgafela used the sun to determine time. The sun was used to determine the midday time, locally known as “Sethoboloko”, which was respected by people in the village. It signified that it is the middle of the day and also believed to be the time of ancestors. For instance, during the time of *Sethoboloko*” the Bakgatla -Baa- Kgafela used to believe that people were not supposed to go near sacred heritage sites, burial sites, clean the yard or go to the cattle kraal because it was believed to be the time of ancestors.

In conclusion, the above exposition emphasises the important role and meaning of the sun to the Bakgatla -Baa- Kgafela. They created their own mythological tales, stories, etc., through their knowledge of the sun. Like in many African tribal groups, the Bakgatla -Baa- Kgafela considered the sun to be the main source of energy for human beings, plants, animals, etc. They knew that in the early morning, birds welcomed the sun with a lovely and chirping song and indicated to the community the arrival of a new day. The following table provides a summary of how Bakgatla -Baa - Kgafela used their local language and celestial phenomenon such as the sun to estimate time.

Table 5. 1: Concepts of time in Batswana Cosmology

Setswana	English	Meaning
<i>Makuku</i>	Dawn	This the early morning times before sunrise.
<i>Mahube a naka tsa kgomo kgotsa makuku a naka tsa kgomo</i>		
<i>Naledi e tswa kgotsa letsatsi le tswa</i>	When the star or sun rise	Time after sunrise. When the stars called <i>mphatlalatsane</i> rise.
<i>Fa kgomo di tlwaela mafulo</i>	when the cows are grazing	
<i>Ka sethoboloko</i>	Midday Time	It is called time of the ancestors.

<i>Tadi e amusa</i>		It shows the link between the ancestors and cosmos.
<i>Ka selebalo</i>		
<i>Maitseboa</i>	Afternoon / evening	After daytime has passed then comes the afternoon or early evening.
<i>tshokologo</i>		
<i>Thapama</i>		
<i>Mampa a kolobe</i>		
<i>Kopadilalelo</i>	Evening	When the sun has set, and darkness has arrived, this time is called nighttime. The stars seen during the evening is called <i>kopadilalelo</i> and during the night time is called <i>kgogamasigo</i> .
<i>Maitiso</i>	Evening	
<i>Bosigogare kgotsa masigo a kgaogana</i>	Midnight	

The above table dismisses the myth and stereotypes that Batswana do not have any respect for time. Information gathered through interviews and focus group discussions with IK experts in the study communities, shows that time was not limited to hours, days, minutes like in the Western framework. Among the Bakgatla -Baa- Kgafela, time was linked with particular social and cultural events and there was a strong link with the cosmos. For instance, the time of sethoboloko is a sacred time which is associated with the ancestors. In Setswana it is referred to as *nako ya badimo* which means time of the ancestors. Bolepa-dinaledi le matlhotlapelo a tlhago is discussed in the following section.

5.9 Bolepa-dinaledi le matlhotlapelo a tlhago

Matlhotlapelo a tlhago or natural disasters such as floods, earthquakes, etc are not a new phenomenon among the African indigenous communities including the Bakgatla -Baa- Kgafela. The Batswana used their knowledge of bolepa dinaledi (indigenous astronomy) to predict natural disasters (matlhotlapelo a tlhago).

Bakgatla -Baa- Kgafela in Mochudi and Moruleng used their local knowledge to address and manage disasters within their environment. They had a vast knowledge of celestial bodies which was used on prediction and early warnings systems. From time immemorial, they devised coping and mitigation strategies of natural disaster such as heavy rains or floods, hail, cyclones and thunderstorms. According to interviews with the IK experts in the study communities, Bakgatla knows how to interpret celestial bodies to predict weather conditions.

The Batswana used their astronomical knowledge or sky knowledge to predict the weather. However, due to modernization and the impact of climate change, it is very challenging to predict

the weather using local knowledge. Interviews with Rre Moeketsi indicated that the sky is contaminated. Some of the things that used to be in the sky are not there like before in our times. He argued that Yes, normally we predict the year using trees. The sky does not look the same anymore.

The sun was also used to predict the weather. For instance, there sun can be used to determine overcast in the evening. When it is too hot during the day, our elders told us that it was an indication that there is going to rain that evening or in less than two days. Before there would be very hot sun during the day which will melt the clouds and then there will be a drizzle. Those are the things we used to predict with like our elders taught us.

Rre Kwapeng Mogotsi argued that nowadays it hardly ever rains in Kgatleng. He indicated that the weeping wattle trees (*mosetlha*) blooming, is an early warning system and indication that there will be scattered or little rain to be expected. According to Rre Kwapeng, towards the end of the month, the trees would have blossomed and then the rain will start falling. People have always been saying that if the weeping wattle trees (*Mosetlha*) starts blooming first and in abundance then it means there won't be much rain that year.

Rre Kwapeng argued that he has experienced that this year (2017), the weeping wattle was blooming but this whole area has been experiencing massive rainfall. It is only in the Kgatleng area where there is no rainfall. This whole area from the North in Kweneng to the Kgalagadi area, there has been receiving massive rainfall except for Kgatleng. Rre Kwapeng Mogotsi stated that he was asking someone yesterday, if the weeping wattle is also blossoming like this in their area, which is surprising because normally it blooms in Sedimonthole (December). Nowadays it blooms in Seetebosigo (June), it has blossomed and looks beautiful.

Rre Kwapeng Mogotsi indicated that he was taught by the elders that the weeping wattle is an indicator or to predict rainfall. If it blooms without falling into the water, it makes it hard for the rain to fall. It is referred to as a stake. It makes the land arid. If the flowers of the weeping wattle falls into water, it means we will stay dry for a long time. The weeping wattle means that the land will be arid and dry. There is a bird called a honeyguide, Rre Kwapeng indicated that he heard it a few days ago when it was drizzling. According to Rre Kwapeng, drizzling honeyguide. it indicates that rain is coming. It is called "*Tshetlho*".

The Batswana had a wide knowledge of climate monitoring indicators such as birds, plants, animals as well as celestial bodies. They used the knowledge of constellations which enabled them to tell the right time for planting in anticipation of the rains. This would assist during times of natural disasters, such as floods, drought to mention a few, effects of a natural hazard (Svensen, 2007). Virtually every culture in the world had already established a relationship with the Stars, Moon and Sun hundreds if not thousands of years ago (Hosbawn, 2000).

Interviews with Mme Ntikoe Motlotle indicates that the absence of "Kopadilalelo" in the night sky is an early warning system of drought or famine. Selemela: "...this is a group of stars, they never set or go down. They stay on the sky until the sun rises". Focus groups with IK experts in the study communities indicates that "Selemela" is a group of stars that predict the weather, is a signal to prepare for and manage natural disasters. Interviews with Rre Matlhaga in Mochudi indicated that Dikolobe: "...it appears during winter season, and is surrounded by other. He added that Dikolobe is often associated with drought.

An interview with Rre Lebotse in Mochudi revealed that from time immemorial the community members especially the IK experts had knowledge of certain types of celestial bodies that were used to predict, prepare and manage natural disasters in their communities. However, due to the influence of modernization and dependence on modern technologies, this knowledge is in danger of extinction.

According to interviews with IK experts, the young generation do not have the local expertise to cope and mitigate the effects of natural disasters. For instance, in the past, the traditional leadership worked hand in hand with the traditional healers and rainmakers who could predict famine or heavy rainfall. Focus group discussions with IK experts indicated that the rainbow, phases of the moon and the direction of the wind were used as early warning systems among the Bakgatla -Baa-Kgafela.

5.10 Maina a ditlha le dikgwedi

Bakgatla -Baa- Kgafela in Moruleng and Mochudi have their own local names for *ditlha* or seasons and *dikgwedi tsa ngwaga* which is translated to months of the year. Interviews with IK experts and focus group discussions revealed that the Bakgatla know four seasons of the year which includes *selemo* (summer), *mariga* (winter), *dikgakologo* (spring), *letlhafula* (autumn). This seasons have

their own unique meaning and different celestial bodies which can be observed by naked eye.

According to Rre Mogotsi in Mochudi:

*Letlhafula kana re raya gore o na le
letlha-fula. Tota ga se letlha-fula.
Puo ya teng e e tlhamaletseng ke "di tla
fula". "Di tla fula dikgomo." Ee, di tla fula.
Jaanong rona ra re "letlhahula." Mme ga
re bue se tota e leng sone. Lone ke di tla
fula, ke letlhafula di tla fula. Ee, go ntse
jalo, ditlha tse tsa ngwaga di kwadilwe ke
tse ke a di bona. Go kwadilwe dikotara tsa
ngwaga. Kotara nngwe le nngwe e na le
boitseanape ba yona le kitso ya yone. Di
nne. E nngwe le e nngwe e na le kitso ya
yona, le tiro tsa yone, le ditlhaloso tsa
yone. Ka ha batho ba ba maloba
ba, ba di tlhalogantseng ka teng.*

English version

Autumn is called *letlhafula* in Setswana. It means the time to graze. According to the elder, the correct wording is "they will graze". The cattle will graze. Yes, they will graze. But now we say "letlhahula". He emphasised that nowadays people are not using the correct explanation and meaning of the words in Setswana. This season means animals will graze. The four quarters of the year are well known among the community members. Each quarter has its own meaning, duty and knowledge. That is how the elders have understood the cosmic knowledge.

Autumn has a lot of taboos, some of the things that modern or civilised people do in recent times are prohibited and discouraged during autumn. They are not supposed to be done at all but people do not observe local protocols and disrespect culture. African people, especially Batswana follow other peoples` s way of doing things.

According to the focus group discussions with IK experts, *mariga* or winter has a lot of meaning among the Bakgatla, it is not only about cold weather. Among the Bakgatla -Baa- Kgafela, winter signifies the end of the year due to the fact that all things dies or hibernate due to cold weather. The last month of the year among the Bakgatla -Baa- Kgafela is *Phatwe* or August. In addition, there are cultural and traditional activities that are conducted during the winter season such as the institution of *bojale* and *bogwera*. Mme Joyce Pule indicated that the month of May is very significant that is why Bakgatla have songs such as *kgwedi ya Motsheganong* which means the month of May. This song was only sung by woman who come or attend the institution of *bojale*.

The month called *Motsheganong* / May is the beginning of winter and it means laughing at an eagle. Mme Pule argued that if you listen to the woman when they are initiating young girls at the initiation school they say, "What is this month called?" they will say "it is *Motsheganong*, it is *Motsheganong*". They will explain it. The celestial bodies that are associated with this month include *senakane* and *naka* which are winter stars.

The IK experts also indicated that winter is a good season for observing the night sky such as molalatladi, etc. As indicated earlier, the months associated with the winter season includes May, June and July. For instance, June is called seetebosigo in Setswana which means:

“Ke kgwedi e e maruru ga o ka ke wa eta ka yone, it is the month of cold weather, and people are not supposed to visit. Jaanong ke gore o itshomarele, o somarele mmele wag ago o se ka wa tsenwa ke serame se se feteletseng. Ke jaaka e reng go twe nonyane e go tweng Mmasilanoka, ga twe bopelonomi bo bolaile mmamasilanoka. Mmasilanoka a etelwa ke ditsala go le mariga.

English version

You must preserve yourself from the cold weather by being indoors. You must not be like a bird called Mmamasilanoka who was killed by being kind. Her friends visited her during winter.

Below is the narrative about the kindness of Mmamasiloanoka:

A tshwannwa ke gore a ba tsenye mo ntlong mo ba robale ene a ba a re ke tla robala ha ntle. A bo a bolawa ke mariga because go ne go le tsididi-tsididi. Ka moso ha ba ya ba tswa go hitlhela Mmasilanoka a sule. E be e nna sekai sa gore re rutwe gore bopelonomi jo bongwe ke jo bo feteletseng. Jo bo sa siamang. Jo e bileng bo bolaile Mmamasilanoka, mong wa lapa.

English version

She had to move out of her nest to make space for her visitors. She was killed by the winter cold while sleeping outside. The next day when they woke up, they found her dead. That's how she became an example to people that over kindness is not good. It is not good to be overly kind because it will disadvantage you like Mmamasiloanoka.

Summer is a wonderful season. When summer starts in September (*Lwetse*), the clouds starts being sick (*lwala*), it is *Lwetse*. When the clouds are sick, the plants starts to grow and bloom, the weather starts to warm up and we are leaving winter and entering summer. It is September, it is spring. The year is beginning to ripen, it is starting to bear fruit. It is bearing fruits that will be ploughed after the rain. Local community members will go on letsema ploughing the fields for food which we will eat in summer.

Rre Mogotsi in a focus group discussion, provided a narrative about summer as follows:

Selemo se e leng gore ha o labelela kwa horizoneng kwa, ko diithare di kokoanang teng kwa, Ke go kopanang legodimo le lehatshe, o tla hitlhela go na le mouwane mo motshegareng, midday,

English version

In summer, when you look at the horizon there, the trees are gathering there. It is where the sky and the earth meet, you will find it misty during

gonna le mouwane, mo e kete maru a a kgomile ditlhare. Mme ge e ka re go ntse jalo, letsatsi le lela, ge o ka re o leba kwa teng wa bona mouwane ole, le ka moso wa o bona, le ka moso o mogwe wa o bona ge e le gore o ela tlhoko wa lebelela, ka fa ke godisitsweng ka teng ke bannabagolo le basadibagolo, pula e tla na.

According to Rre Mogotsi:

Ge o bona mouwane ole o le le kgomaretse leru, ha e ka re re le mo Kgotleng mo, mo selemong, wa bona e thibile mouwane, e thibile mosi ditlhare tse o sa di bone tse, o bona mouwane, pula e tla na.

the day at midday, and it will look like the clouds are touching the trees. When it's like that and the sun is scorching hot, and if you look up, you will see the mist, even the next day you will see it and the next day, it shows that it will rain, that's according to how I was raised by my grandparents.

English version

When you see the mist touching the sky, when you are sitting by the courtyard, in summer, and you see it cloudy and overcast with smoke, it is a sign of rain. Selemo sa nkgakgaria ke ge pula e seyo. Summer of drought "nkgakgaripa" is when there is no rain.

With regard to the months of the year, IK experts in the study communities indicated that the months of the year were initially not twelve but thirteen. The thirteen month was called *morule* which followed *sedimonthole* and during this month, the fruit called *morula* is ripe and ready to be eaten. Among the Bakgatla -Baa- Kgafela, the month of the year is linked to the movement of the moon which is 28 days not 30 days.

The reasons why the 13th month is no longer visible or known in the Batswana communities is not well known. However, an interview with Rre Piet Koitsiwe indicated that the 13 months was removed from the Batswana calendar in order to appease the colonial masters and to conform to the Gregorian calendar which promoted foreign cultures and values.

According to Mme Masuku, the months of the Bakgatla are not based on the Gregorian calendar and the first month which signifies the new or beginning of year is *Lwetse* or September, not January. This is similar to the concept of New Year among the Ethiopians which is also September and among the Basotho is August. During September, everything including fauna and flora start to grow up which signifies the new beginning or life. The main challenge is that due to the influence of western astronomy, Africans, especially Batswana are using the Gregorian calendar with 30 days due to the fact that our conception, meaning, and significance is undermined and not mainstreamed.

Table 5. 2: Months of the year

Kgwedi	Month	Meaning
<i>Lwetse</i>	September	Legodimo / leratamadima is sick which means clouds start to gather rain or the clouds are brewing rain. During this time of the month, the clouds are full of rain which also causes diseases to animals and human beings.
<i>Diphlane</i>	October	This is the time when Impalas give birth. The <i>Mosetlha</i> tree or African weeping wattle (<i>Peltophorum Africanum</i>) is becoming ripe.
<i>Ngwanatsele</i>	November	<i>Moretlwa</i> or cross berry begins to become ripe. The month means children must take for themselves whatever the wild fruits are there.
<i>Sedimonthole</i>	December	Is the time for <i>morula (sclerocyrya birrea)</i> fruit ripens.
<i>Ferikgong</i>	January	Planting season begins and we plough.
<i>Tlhakole</i>	February	It is time to plough. sorghum grows
<i>Mopitlwe</i>	March	Sorghum grains multiply
<i>Moranang</i>	April	Is the month of beans. Dithotse di a be nama
<i>Motsheganong</i>	May	Winter begins and harvesting begins. The stars that are related to this month is senakana and naka.
<i>Seetebosigo</i>	June	It is winter, It is very cold and winter intensifies. Hence, people are advised not to visit at night due cold weather of winter. The stars that are related to this month is senakana and naka.
<i>Phukwi</i>	July	The wind blows and leaves fall off the trees. The star that is related to this month is naka.
<i>Phatwe</i>	August	Trees start to grow and some bear fruits.

Table 5. 3: Seasons of the year

Setlha	Seasons	Meaning
<i>Lethafula</i>	Autumn	Time of harvest. People eat what they have harvested at the field.
<i>selemo</i>	Summer	The sun is very hot, it's sunny, and it is the season of rains such as <i>Medupe</i> , etc. Trees begin to grow. Most celestial bodies are visible but not as clear as in winter. The stars are of <i>selemela</i> , <i>kgogamasigo</i> , <i>mphatlalatsane</i> and other celestial bodies are visible during this season.
<i>Mariga</i>	Winter	This is the winter season. One should not visit at night. Leaves fall off from trees and some plants die. This is the time when people finish threshing. This is the time of stars such as <i>senakane</i> . The initial star is called <i>Senakana</i> (unidentified star) and it looks very thin. It is the one which is a leading star for all the stars through the year. It emerges on of April. There are lot of stars still to emerge after it such as <i>naka</i> . Most of the stars are visible to the naked eye during this season such as the milky way. Rain is not expected during this season.
<i>Dikgakologo</i>	Spring	It becomes warm because winter has just ended and some trees are blossoming. This is the season just after winter and the weather becomes warm.

The above figures provided the data from the participants with regard to the knowledge regarding the months and season of the year. The study argues that literature indicates that the Batswana like any other communities in Africa and worldwide developed their own calendar systems. Many rituals and important events in the communities were performed and determined from a calendar.

Medupe (2010) indicates that the people of Swaziland perform the incwala (first fruit) ceremony each year on the 21 of December during the summer solstices. The Batswana people of Botswana needed to know the beginning of the rainy season in order to prepare rituals to cleanse their land. The following section is about the meaning and value of African indigenous astronomy.

5.11 Bokao le Botlhokwa jwa bolepa-dinaledi

One of the objectives of the study was to describe the meaning and value of African indigenous astronomy. In-depth interviews with participants mainly indigenous knowledge experts revealed that traditionally the Bakgatla -Baa- Kgafela in Moruleng and Mochudi were careful observers of

the sun and night sky, especially on the complex motion of the sun, stars, moon and other constellations. In this study the concept of “Bolepa-Dinaledi” is translated as Indigenous Astronomy.

Interviews with IK experts in Mochudi and Moruleng revealed that there are different types of stars and their meaning, for instance, the star called kopadilalelo (evening star), when it appears bigger in one year, it means that is the year of great wealth, happiness and prosperity. According to the IK experts, after the sun has set, a star would rise and was called the evening star. *Mphatlalatsane* (morning star) is the star which appears early in the morning hours.

IK experts in Moruleng and Mochudi point that the purpose of the morning star is to spread darkness or to obliterate darkness. This is how the elders named and provided meaning of the different types of stars. There are also groups of stars that are well known and visible to the naked eye. There are stars that signals the rains fall, and its ploughing season. During summer time there are groups of stars known or called ‘Selemela’. It means the soil is fertile and ready for planting or ploughing. Another one which appears in the mornings during winter time when it’s still chilly is called a horn-star “Naka”. It is the star that comes with the coldest wind of the season.

According to IK experts, celestial bodies are natural phenomena in the night sky that are from *Lowe*. In the past our elders used the knowledge of *bolepa-dinaledi* because it was significant in their day to day basis for sustainable livelihood. Indigenous astronomy is a way that we used to predict seasons in our lives. In ancient times, indigenous astronomers used this knowledge to help guide the day-to-day affairs of their communities (Canadian Heritage Information Network, 2003). Indigenous astronomy is more than just a naked eye peripheral exercise. It is a science in its own right, deeper, broad knowledge, understanding, meaning and value of different celestial bodies in the night sky. There are stars that explain whether a particular year will be of good harvesting or a year of famine.

An interview was conducted with Mme Grace Masuku, who is an IK experts, *Rakgadi* of Bakgatla - Baa- Kgafela and former teacher in Lesetlheng indicated that *bolepa-dinaledi* is “kitso” (knowledge), kakanyo (thinking) and understanding about how Batswana in particular interpret the sky in their daily lives and apply it to activities such as time keeping, agricultural seasons, human fertility, navigation and religious rites. In broad terms it is a multidisciplinary field that promotes the mainstreaming of knowledge.

Interviews was also conducted with indigenous knowledge experts in Mochudi, for instance, Mme Ntikoe Motlotle agreed with Mme Masuku and their definition can be summarised as follows. *Bolepa-dinaledi* or indigenous astronomy is knowledge, philosophy and thinking about the stars, moon, sun and other constellations from a community perspective. In their view it is not just general knowledge about constellations, stars, moon and sun, but natural knowledge, wisdom or science of the universe or sky.

Mme Masuku in Moruleng and Mme Motlotle in Mochudi emphasised that *bolepa-dinaledi*, in particular with reference to the Bakgatla -Baa- Kgafela, encompass all constellations, meaning in the universe all things are connected and have mutual relationship. It is interpretation and analysis based on previous gained knowledge and experience. It is knowledge passed from mother / father to son / daughter and the experience gained from oral instruction during the evening around the fire. This concept is called *maitiso* in Setswana. This is a special time where the young set around fire and listen carefully to an elder narrating stories, riddles, poems and singing local songs about indigenous astronomy.

Mme Joyce Pule in Motlhabe community, explained the importance of the stars and other constellations from a community perspective in the following words:

Kitso ya dinaledi, ngwedi, letsatsi le legodimo e botlhokwa thata mo matshelong a baagi ba selegae. Kitso ya dinaledi ke ne ke e rutiwa ke mosadimogolo fa ke santse ke gola. Ga se kitso e ke e rutilweng kwa sekolong, e bile go botlhokwa thata go re bana ba segompieno ba rutiwe ka ga dinaledi, ngwedi, letsatsi le legodimo. Kitso e e tlhoka go re e kwalwe mo dibukeng mme e golagannngwe le mananethuto ka ntlha ya go re bagolo ba ne ba sa kgone go kwala le go buisa. Gape ga ba na go nna ba le teng ka dinako tsotlhe.

English version

Knowledge of stars and other constellations was vital to the livelihood of the people. According to Mme Pule, her grandmother taught her this knowledge when she was very young and that she did not get the knowledge from any formal educational institution. This knowledge was part and parcel of her upbringing as a child and it started at home. It is, therefore, important that children or the youth of today receive instruction in this knowledge and its uses.

5.12 Conclusion

Chapter five discussed in detail the empirical findings of the study. The chapter discussed the nature and types of African indigenous astronomy found in the study communities. The concept of the moon and the sun including its uses to calculate time were discussed in this chapter. Furthermore, the concept of African indigenous astronomy was unpacked from the perspective of the participants.

The different types and meaning of stars were discussed as some of the findings including the role of celestial bodies in natural disaster management.

CHAPTER SIX: ARTISTIC SIGNIFICANCE AND INDIGENOUS ASTRONOMY

6.1 Introduction

There is an existing body of knowledge of stars, moon, sun and other constellations among the Bakgatla -Baa- Kgafela (Alcock, 2010). Throughout history, indigenous astronomy (*bolepa-dinaledi*) played a significant role in sustainable livelihood of communities especially in rainmaking rites, developing seasonal calendars, navigation, food economics, human reproduction, art, ceremony and social structure (Nakata et al, 2014).

The study argues that the Bakgatla-Baa- Kgafela in Moruleng (South Africa) and those in Mochudi (Botswana) have passed down using indigenous sayings or oral traditions their indigenous astronomical (*bolepa-dinaledi*) and cosmic knowledge to the young. Oral traditions and local language were at the center of knowledge transmission in African indigenous communities. Using their own local Setswana language, Bakgatla-Baa- Kgafela developed stories, songs, poems and riddles to indicate their high scientific knowledge of the sun, moon, stars and other constellations.

Wa Thiongo (1986) argues that oral art of Africa are rich and varied, developing with the beginnings of Africa indigenous cultures and they remain living traditions that continue to evolve and flourish today. The above sentence is supported by Majola (2012) that since time immemorial indigenous cultures in Africa had developed a wealth of indigenous astronomy, which can be found in myths, legends, poems, proverbs, songs and fascinating stories created about them.

The following section provides the oral traditions, specifically songs and poems found among the Bakgatla -Baa- Kgafela in Moruleng (South Africa) and Mochudi (Botswana). The songs and poems below are not just a mere collections of indigenous sayings or oral traditions, but a classical case to provide uncontested evidence that Bakgatla-Baa- Kgafela, especially old women and men have and they are the custodians of *bolepa dinaledi*. This is very important due to the fact that, there are few IK experts in the study communities who have knowledge of *bolepa-dinaledi*. However, one of the findings of the study is that, there is a rich oral traditions among the Bakgatla-Baa-Kgafela which encompass knowledge of *bolepa-dinaledi*, therefore systematic and collective efforts is needed in order to document, preserve these knowledge for present and future generations.

6.2 Dipina tsa bolepa-dinaledi

Bakgatla -Baa- Kgafela have since time immemorial used *dipina* (songs) as food for thought. There are different types of songs among the study communities. There are songs for kids, regiment,

clans, marriage and celestial bodies. Hence, this section provides the findings with regard to dipina tsa bolepa-dinaledi or songs of indigenous astronomy. Indigenous knowledge experts from Moruleng, Mme Joyce Pule, explained the significance of songs with regard to the importance of stars to the community:

Bogologolo fa re ne re santse re le bana, re ne re tlhola re opela le go rutana dipina ka mefuta ya dinaledi le botlhokwa jwa tsona mo matshelong a baagi ba selegae. Ke gopola go ne go na le pina ya "naledi ya mariberibe" e re neng re e rutilwe ke bagolo fa gae. Pina e e ne e re ruta ka botlhokwa jwa dinaledi le kamano ya tsona mo matshelong a baagi ba selegae, tikologo ya bone, diphologolo le dimela. Dipina tse di ne di re ruta go somarela kitso ya dinaledi e bagolo ba re rutileng yone. Ka jalo ke rotloetsa barutegi le baiithuti go re ba botse bagolo dipotso ka ga dipina, dinaane, le kitso Bakgatla -Baa- Kgafela ya dinaledi, ngwedi, letsatsi le loapi

English version

In the olden days, when they were still young, they used to teach each other and sing about the different stars and their importance in the community's sustaining their livelihood. They spoke about the song known as the star of "mariberibe" that the elders taught them. The song used to teach them about the names, uses and importance of stars in their relationships with people, the immediate environment including the fauna and flora. Indigenous knowledge expert from Moruleng encouraged the educators and learners to ask the elders questions about the use, significance and meaning of these indigenous songs and myths about bolepa-dinaledi jwa Sekgatla.

The above reflects how the Bakgatla -Baa- Kgafela had different methods, including songs, to educate the young on the knowledge of the different types of stars and their functions in the community's livelihood. The use of community songs in the local language was a powerful tool to ensure that this knowledge was understood and remembered by the youth that they may pass it on the next generation. The following sections provides the contextual commentary of songs and poems of bolepa-dinaledi from Mochudi, Botswana. The songs and poems were recorded in Setswana and later translated into English.

6.2.1 Contextual commentary on star songs

The following two (02) songs below were sung by elder woman of Mochudi (Botswana) and there are no instruments involved, only clapping of hands, whistling or go duduetsa or illulating is often allowed. Sometimes they blow a seswerre / phala or whistle just to create the melody. In many instances, Batswana woman were the ones who embraced the artistic skill of creating and singing songs about the cosmos as part of teaching, nurturing and upbringing of young girls. However, the

songs of *bolepa-dinaledi* among the Bakgatla -Baa- Kgafela were not gender insensitive and not a prerequisite of woman only. There were oral arts or traditions that were composed by men and young boys or by both man and woman.

Moreover, the second song is very short but with very warm message related to stars and the passion for love. There were songs about stars which embraced romantic relationships among man and woman or spouses. The second song, speaks about Semakaleng who is an attractive and astonishing woman in the community. Among the Batswana there is a proverb that says “*mosadi tshwene o jewa matsogo*” which means a woman is honored not due to her looks but her cordiality, kind heartedness and mostly important her achievements and works.

Animals such as “*tshwene*” baboon, cosmos and woman were regarded with high esteem in African indigenous communities including Bakgatla -Baa- Kgafela. In the past Batswana used natural things including celestial bodies to express their friendly and romantic relationship among each other. Gorgeous women were also compared to bright and shining stars in the night sky and songs were composed to appreciate and show compassion to them.

Naledi

Naledi ele x 2

A e tswa botshabela/bochabela?

Mmalo rona

Eya bophirima

Bagolo bare x 2

A e tswa botshabela / bochabela?

Mmalo rona

Eya bophirima.

Star

That star x 2

Is it coming from the North?

Oh! Poor us

It's going west

The elders say x 2

Is it coming from the South?

Oh! Poor us

It's going West.

Naledi

Naledi ele

E nkgopotsa

Semakaleng.

Star

That star

Reminds me of

Semakaleng.

6.2.2 Contextual commentary of mphetlalatsane songs

The following four (04) songs below were also sung by women from Mochudi. They all embrace or talk about the star called *mphetlalatsane*, *naledi ya moso*, which is the morning star or Venus. The content of the songs about the morning star confirms the information that was obtained from interviews and focus group discussions about the meaning and significance of this star. It is one of

the most well-known, bright, visible to the naked eye and it appears very early in the morning hours. It is a star that was used to calculate time among the Bakgatla -Baa- Kgafela in Mochudi and Moruleng.

Mphatlatsane

*Go bosigo re a tsamaya
Naledi e
Naledi e tlang ka masa.*

The morning star

Its night we are leaving
This star
The star that comes at dawn

Mphatlalatsane

*O ka e bona e phatsima
Mphatlalatsane naledi ya moso.*

The morning star

You may see it glitter
Venus the morning star.

Mphatlalatsane

*Naledi ya masa
Ke mphatlalatsane
Re bona ka yona
He masigo a sele
Tshwarisa ditshwabi
Swabi le swabile
Ngwana re mo tsere
Ke mosadi wa rona.*

The morning star

The morning star
is Venus
We see thereby
When nights have disappeared
Get hold of dried berries
The berries are dried
We have taken the lady
She is our daughter-in-law.

Mphatlalatsane

*Go bosigo r'a tsamaya
Naledi ena
Naledi e e tlang ka masa
Naledi e e tlang ka masa
E tshaile ra tsamaya
Naledi ena
Naledi e e tswang ka masa
Naledi ena
Naledi e e tswang ka masa.*

The morning star

Its night we are leaving
But the star itself
The star that comes at dawn
The star that comes at dawn
It's time up we are leaving
This star
The star that rises at dawn
This star
That rises at dawn.

6.2.3 Contextual commentary of kgogamasigo song

The song below is about the setting of the stars called *mphatlalatsane* (morning star) and *kgogamasigo* (night star) and they are known as two significant stars among the Bakgatla -Baa- Kgafela. *Kgogamasigo*, is the star that travels the whole night and it is also used to calculate time and set towards the early hours of the morning.

It is followed by *mphatlalatsane* which chases away darkness and indicates the morning time. The Batswana also had knowledge of the star such as Venus (the morning and evening star). This knowledge was transmitted by the elders to the young. Venus was known as *Mphatlalatsane* at sunrise and *kopadilalelo* at sunset. The stars were also used to measure time among the Batswana.

Mphatlalatsane le Kgogamasigo

Ke tsele dinaledi x 3

Di a wela

Ka re mphatlalatsane

Le kgogamasigo

Ke tse di tona x 2.

Venus and Night dragger

There are the stars,

There they are descending

I say Venus

And night dragger

Here they come to drop x 2.

6.2.4 Contextual commentary of naledi ya mariberibe song

Elders in Moruleng and Mochudi sung about *naledi ya mariberibe*. Most of the elders interviewed and those who participated in focus groups discussions indicated that this was a common song in the community. Some of the elders indicated that *naledi ya mariberibe* is actually the one that is called *kopadilalelo*. However, other elders indicated that they were not sure about whether this is *kopadilalelo* or not.

The researcher tend to agree with the version of the elders who argue that *naledi ya mariberibe* is *kopadilalelo*. This is because *kopadilalelo* is the special star that is associated with food security and it sets very quickly in the evening. The song also embraces the knowledge of natural fona and flora among the Bakgatla. For instance *kgaupe*, *masilonyana* are highlighted in the above song.

Naledi ya Mariberibe

Naledi ele

ya mariberibe

Ribela tlase

Ro nwa metsi

Metsi ga a yo

A nolwe ke Kgaupe

Kgaupe ga kemo rate

Ke rata Masilonyana

Kgatlhano di merafe

Tsa bannabagolo

Ba epa kgelegetla

Kgelegetla

Moloko, Moloko

Tšhiololo!

Overchanging star

That very star

Of ascending nature

Move downwards

To go and drink water together

There's no water

Water has been drained by an ogre 'Kgaupe'

I don't like Kgaupe

I love Masilonyana

Convergence of tribes

Of old men

They dig continuously

Continually

Moloko, Moloko

"Tšhiololo".

6.2.5 Contextual commentary of selemela song

The following two (02) songs demonstrate the knowledge and understanding of *selemela* normally known as the Pleiades. In the past the elders used Setswana indigenous astronomy to predict planting time, especially the *selemela* stars. It indicates planting time and there will be enough to harvest. *Selemela* is a group of stars which are very close at each other. It shows that there is enough rain people can go and plough.

Selemela emerges during the planting season, and it symbolically, it means that there will be great harvest for a particular harvesting time. They are on the left hand side of the sky at night. They are white as ash, they only appear at sunset. After harvest they move to the West side. They are a group of stars that symbolizes a year of great harvest, its appearance is a warning to the community members to start preparing seeds.

Selemela

Mosadi ga a betswe
Selemelamela
O bokwa ka letlhare.

Pleiades

A woman is not beaten
Like a constellation
You only waive over her by a leaf.

Selemela

Iyo iyo selemela
Bomma re tsile fano
Go opela dumelang lotlhe.

Pleiades

Ay! Ay! Constellation
Woman we have come here
To shout, sing all you the choirs.

6.2.6 Contextual commentary of rain songs

Rain is very important among the Bakgatla -Baa- Kgafela due to the fact that as the community they rely on agriculture for their survival. The rainmaking rituals and ceremonies was the responsibility of Kgosi (traditional leader) and *moroka wa pula* (rainmaker). The Bakgatla -Baa- Kgafela had a clear understanding of the fact that rain comes from the sky, however, there are certain rituals and ceremonies which needs to be performed as a strategy to mitigate and adapt to harzadous climatic conditions. Drought was a common climatic conditions well known among the Batswana, however, they had strategies to ensure that there is abundant rainfall. The following three (03) songs below indicate that rainfall played an important role among the Batswana. Rainmaking ceremonies (*go fetlhela pula*) and rainmakers (*baroka*) including traditional leaders (dikgosi) were very significant for the sustainable livelihood of the society. When the sky or heavens open, raindrops will fall which brings happiness and prosperity.

Pula

Ga legodimo le ka bulega
Pula e ka na ka marothodi
Pula e ka na
Pula e ka na
Pula e ka na ka marothodi.

Rain

If the sky would open
 Rain would fall in drops
 Rain would fall
 Rain would fall
 Rain would fall in drops.

Pula

Mmangwane mpulele
Ke nelwa ke pula
Mmangwane mpulele
Ke nelwa ke pula
Le ga di le pedi
Le ga di le tharo
Ka nyala mosadi
Mmangwane mpulele
Ke nelwa ke pula.

Rain

Antie open for me
 I am soaked in rain
 Antie open for me
 I am soaked in rain
 Even though they are two
 Even though they are three
 I am marrying a woman
 I am soaked in rain.

Pula

Ka re nnana wa me x 4
Nnana wa me wa lerato
Ke mo ratile x 3
Ke mo ratile
Nnana wa me
wa lerato
Marakanelo x 3
Marakanelo ke kereke
A pula e ne x 3
A e ne ka modumo.

Rain

I say little darling x 4
 My darling of love, I have loved her x 3
 I have loved her
 My little darling of love
 Intersections x 3
 Intersections in the church
 Let the rain fall x 3
 Let it rain with thunder / noise.

6.2.7 Contextual commentary of sun songs

The following four (04) songs below are well known among the Bakgatla -Baa- Kgafela in Mochudi and Moruleng. Among the Bakgatla -Baa- Kgafela the sun and the moon are the most obvious or visible celestial phenomenon. The sun is known as a symbol of a man. From time immemorial the Bakgatla -Baa- Kgafela observed the sun with great interest due to the fact that is such a powerful natural phenomenon that we all depend on its solar energy.

Therefore the word *letsatsi* is a word which is very important in estimating or judging time in Setswana, this one of the reasons why they composed the different songs to honor it. Various

African indigenous communities were aware of the summer and winter solstices, however, there were no songs or riddles that were found among the Bakgatla -Baa- Kgafela that made any references to the solstices.

Letsatsi

*Mpepu ngwana mme
Discovera
Letsatsi le a phirima.*

Letsatsi

*Sethunya sele sa majeremane
Nna e rile ke se bona ke letsatsi
Ngwana o tshwana le naledi x 3
Ke letsatsi.*

Letsatsi

*Sethunya sele sa Majeremane
E rile re se bona ke Naledi
Ngwana o tshwana le Naledi
Ke letsatsi
Sethunya sele sa Majeremane
E rile re se bona ke letsatsi
Sethunya sele sa Majeremane
E rile re se bona ke letsatsi
Ngwan' o o tshwana
Ngwana o o tshwana le Naledi
Ke letsatsi
Ngwana' o o tshwana
Ngwan' o o tshwana le Naledi
Ke letsatsi.*

Letsatsi

*Letsatsi ke lele
Ba le beile kgakala x 3
Bomme, basadi ba le beile kgakala
Letsatsi ke lele ba le beile kgakala
Borre, banna ba le beile kgakala
Letsatsi ke lele ba le beile kgakala
Letsatsi ke lele
Ba le beile kgakala x 3.*

Sun

Climb on my back child
of discovery
The sun is going down.

Sun

The gun of the Germans
When I saw it I saw the sun
The child resembles the star x3
It's the sun.

Sun

That gun of the Germans
When we saw it, it looked like a star
The child resembles the star
It's the sun
That gun of the Germans
When we saw it, it's like the sun
That gun of the Germans
When we saw it, it looked like a star
This child is like
This child is like a star
It's the sun
This child is like
This child is like a star
It's the sun.

Sun

There's the sun
They are looking afar x 3
Ladies, woman have put it far
There's the sun they are looking far
Gentlemen, men have put it afar
There's the sun they are looking far
There's the sun
They are looking far x 3.

6.2.8 Contextual commentary of moon songs

As indicated earlier the sun and the moon are the most visible celestial phenomenon to the naked eye. Among the Bakgatla, the moon was a symbol of woman and the sun represents the man. The Bakgatla calls the moon with different names such as “kgwedi” or “ngwedi” and had soci-cultural significance. The moon has always been a dramatic celestial phenomenon with its changing shapes and phases. The Bakgatla knew that in one month the moon moves eastward among the stars all the way around the stars.

According to Mme Joyce Motlathledi from Sandfontein, most of the songs about the moon were directed to young girls and to guide them regarding their reproductive health and to know how to handle and control themselves. The Bakgatla -Baa- Kgafela the moon was an impressive celestial phenomenon and took advantage of the full moon to extend daily activities such as indigenous games and leisure activities. Some of the songs about the moon were used to express romantic relationships between partners and married couples. Below is three (03) songs about the moon with the English translation on the right hand side.

Ngwedi

Ngwedi le letsatsi o rata mang?

Ngwedi le letsatsi o rata mang?

Moon

The moon and the sun

Who do you love?

Ngwedi

“Ga le a re ngwedi o sule

Marapo a ngwedi a kae

Banyana, iyeiyelela x 3

Kgabe-kgabe

Ka kwa morago

Marapo a ngwedi a kae

Banyana Iyeiyelela x 3.

Moon

“Didn’t you say the moon is dead?

Where are the moon’s bones?

Girls, Iyeiyelela x 3

Diligent dressing

At the back

Where are the moon’s bones?

Girls Iyeiyelela x 3.

Ngwedi

The moon was se-shining

The mooning was se-shining

The moone was a very darkness

The moone was se-shining

The moone was a very darkness

Nka ikela motlhakeng

Helele dali wam

Nka ikela motlhakeng

Helelele dali wam.

Moon

The moon was shining

The moon was shining

The moon was very dark

The moon was shining

The moon was very dark

I would rather go wild

“Helele” my darling

I would rather go astray

“Helele” my darling.

6.2.9 Contextual commentary of Motsheganong song

The following song indicates that Bakgatla -Baa- Kgafela in Moruleng had knowledge about different months of the year. There are different versions among the Bakgatla with regard to the number and meaning of the months. There is a version that says there are 12 months, other versions speak of 13 months, while other speak of 14 months. The 13 month is regarded as “*morule*”. However, the African calendar system was based on the observation of celestial bodies has been dominated and regarded as primitive and irrelevant due to the influences of the Gregorian calendar.

The song is about the “*kgwedi ya motsheganong*” or the month of May which is regarded as the beginning of the winter season. *Motsheganong* is made of two words “*motshega*” which means to laugh and “*nong*” which refers to an eagle. According to Mme Joyce Pule, Bakgatla -Baa- Kgafela used to conduct institutions of girls initiations and they sung this sings during the initiation ceremonies in the mountains. Among the Bakgatla, the beginning of the year is not January but is *Lwetse* which is September. This is similar to the Ethiopians who also celebrate their new year in September which is called “*ankutatatash*” while Basotho observes their new year in August.

Kgwedi

Basadi kgwedi e ke mang e?

Ke Motsheganong

Kgwedi e ke mang e?

Ke Motsheganong

Motsheganong wa Sedimonthole

Kgwedi ya Sedimonthole

Basadi kgwedi e ke mang e?

Ke Motsheganong

Kgwedi e ke mang e?

Ke Motsheganong

Ke Motsheganong wa Sedimonthole

Kgwedi ele, kgwedi ya Sedimonthole

Motsheganong.

Month

Woman which month is this?

It's the month of May

Which month is this?

It's the month of May

May of December

The month of December

Woman which month is this?

It's May. Which month is this?

It's May

It's May of December

May month.

6.2.10 Contextual commentary of stars poem

The following poem is about knowledge of the stars among the Bakgatla -Baa- Kgafela in Moruleng. It shows that Bakgatla had knowledge about the constellations or group of stars such as *selemela* including the shooting stars. They had meaning for different constellations and other celestial phenomena. The above poem also indicates that stars such as *kopadilalelo* or the evening star were well known. Stars such as *kopadilalelo* were not only about preparation of food but were

also used to predict drought. The poem also mention the morning star known as *mphatlalatsane*, which is one of the bright stars used to calculate time. It is regarded as the dress belonging to *Mmakgathi-Marantha* the giant star. Batswana regarded the moon with high esteem and it is one of the wonders of nature.

Dinaledi

Stars

*Tsa tlalopa loaping tsa tlisa kgalalelo
Kgalalelo 'sedi la lebopo tshokologo
Selemela sa lelemela 'sigo bo roropa
'Sigo bo roropa thethe e tloga e ralala
Se bega loso la kgosi mong wa mmu
Ya re tsatsi go dikela nko e kolomela
Kopadilalelo e tlhagelele ka bokgabane
Dilalelo tsa maitseboa di rulaganngwe
Gale Loaping naledi e dira matshetshe
e galalela mongwe a fetse a re tshwene
kotama bana ba tshege Bosigo-gare
kgogamasigo ya rena Marang a anama le
bokgatho jwa lefatshe Lesedi la
sedimosetsa batho beng Jaaka lephutshe
ngwedi e ikadiile e re twaa!
Tiro e le ya mogagamola, mhata sediba
ka leuba Ngwedi kana ga e tshubiwe ka
lookwane
Kana yona ga e tlhokomelwe seka
namane Ka e le nngwe ya bokgabane ba
tlhago Tlhago e go se ope lefatsheng go e
Go tswa ga Lowe re tsalwa re e bona
loaping Leba ya masa mphatlalatsane n
Naledi ya meso e e kgalalelo seka mosese
Mosese wa mmakgathi-marantha
naledi-kgolo Lebone la Batswana
bana ba thari e ntsho E gorosa
moso wa le le letaleng letsatsi.*

They glitter in the sky and bring forth brightness
Brightness light of the cast in the afternoon
The constellation glittered when night progressed
Night progresses when the shooting star is about to
traverse
It reports the death of a king, owner of land
When the sun sank and the nose dived
The evening star Kopadilalelo appears in brilliance
The evening meals are prepared well in advance
In the sky a star does wonders by shining
And someone would acclaim, let us dine and be merry
At midnight the dragger reigns
Sunbeams spread across the breadth of the land
The light shines for people, owners of the land
Like the pumpkin the moon stretches wide in brilliance!
The work is a mammoth task, same as for the
welldigger during drought
By the way the moon is not lit by oil
By the way it's not tendered like a calf
As it is one of the wonders of creation/nature
Nature that no man on earth can create
From our origin we have always seen it in the sky
Look at Venus the morning star
The morning star of a brilliance resembling a dress
The dress belonging to Mmakgathi-Marantha
the giant star
The lamp of the Batswana children of the black
Backstrap It ushers the morning of the day to follow.

6.2.11 Contextual commentary of bolepa-dinaledi poem

The following poem was resided by Rre Tsheole, a praise poet for the King, an IK expert from Mochudi. Rre Tsheole spent a lot of his time in the farms looking after livestock and this is where he learnt the cosmic knowledge of Bakgatla -Baa- Kgafela from the grandfathers. Among the Batswana, the word "*Tsheole*" refers also to the name of the rain. As indicated earlier, there are

different types of rain and their meaning. Rre Tsheole expresses his knowledge about *selemela* which also called *magwasigwasi* especially in Mochudi, *naka*, *kopadilalelo*, *mphatlalatsane*, etc. He also mentions the season of winter and the importance of rain among the local community.

Bolepa - dinaledi

*Jaanong nte ke re nna,
Ke bidiwa Tsheole wa Mmatshaka
patla matsoga bosigo
O tsogile ka la tubane Matshaka
Matshaka a tsoga ka matlhaba a dinaledi
A ba a tsoga ka mahube a tllhabile
A ba a tsoga ka Magwasigwasi a tllhabile
O bua ka botlhale
Monna yo o kileng a rutwa go loga maano
A bo a ruta banna segwenegwene
A ba a ba ruta go tllhasela
A ba a ba ruta le gone go kolopa marumo
Ke boka naledi
Ke boka Mphatlalatsane
Ke boka Kopadilallo
Ke disana tsa lefatshe
Kana ke disana tsa legodimo le lefatshe
Ge e tllhaba ka masa Magwasigwasi a tllhabile
Ge e tllhaba ka masa motho o tshwarwa ke sega
Motho o tshwarwa ke segagane
Motho ke serame sa mariga
Kana ke raya Naka,
Ke raya 'naledi tse tharo
Ke raya Naka
Ke raya Naka
Ka raya 'naledi tse tharo
Ke raya Kolojwane
Ke raya Kolobe
Ke raya Magwasigwasi
Ke raya Selemela
Ke raya Kopadilallo
Ke raya Kgogamasigo
Kana ga di tllhaba masa a sele mariga
Kana batho ba tshwarwa ke segagane,
Motho o tshwarwa ke serame sa mariga
Motho le go tsamaya a sa tsamaye
Motho a ntse a re tlang lo nthuseng
Ke tshwerwe ke serame ka ha*

Bolepa - dinaledi

Now let me say
I am called Tsheole of Mmatshaka a
fanatic of early rise
He woke up by the left leg Matshaka
Matshaka woke up when the stars emerged
And also woke up at dawn
And also woke up a galaxy had shown
He speaks with wisdom
A man that was taught to coin plans
And also taught man tricks
And also taught them how to attack
And also taught them how to throw spears
I am praising the star
I praise the morning star
They are the stumps of the earth
By the way they are the stumps of heaven
and earth
When it rises at dawn a person freezes
A person get frozen
By the way I refer to the bright morning star
I mean the morning star
I am referring to the three stars
I mean the piglet
I mean the pig
I mean the galaxy
I mean the constellation of Pleiades
I mean the evening star
I mean the dwindling morning star
When they depict the dawn in winter
By the way people get frozen
A person catches the winter cold
A person can hardly walk
A person shouts for help
Crying I am stuck by freezing cold here
This is a person's life and for what else
For what else
The bird and the water
And what else

<i>Ke botshelo ba motho le eng?</i>	If the rain falls
<i>Le eng?</i>	The rain shall have fallen
<i>Le nonyane</i>	The rain chaff remover cause damage
<i>Le metsi, le eng?</i>	May attack
<i>Ge pula e na</i>	Having jumbled the water
<i>Pula e tla bo e nele</i>	It has dropped stones and also jumbled
<i>Pula ya Tsheole e ka nna ya tubaka</i>	water
<i>Ya tlhasela</i>	Stones and spleens
<i>E tlhakatlhakantse metsi</i>	I took the hole and dug therein
<i>E digile matlapa ya bo ya sala e tlhakatlhakant</i>	In a season of winter which does not
<i>Matlapa le mabete</i>	disgust.
<i>Ya tsaya mosima ya katela</i>	
<i>Mo pakeng ya mariga a a sa fediseng pelo.</i>	

6.2.12 Contextual commentary of bolepa dinaledi song

The Batswana understands the significance of safeguarding, protection and promotion of astronomical and cosmic knowledge. It illustrates that from time immemorial, the Bakgatla -Baa-Kgafela had knowledge and they developed and produced local songs on the star such as Naka which is the star that appears in May, June and July during the winter season.

The following song also provides evidence that Batswana had knowledge of constellations and asterisms such as *Selemela* normally called the Pleiades or seven sisters which is a group of stars used as agricultural markers. They also had great understanding that different types of stars appears at different seasons of the year and with much significance to their day to day live.

Tlaya Mokgatla o rute batho ka bolepa - dinaledi	Come Mokgatlha and teach people about astronomy
<i>Tlaya Mokgatla o rute batho</i>	Come Mokgatlha and teach people
<i>Ka bolepa-dinaledi jwa sekgatla</i>	About astronomy of the Bakgatlha
<i>Gore dilo tsena</i>	That these things
<i>Re di somarele di seke tsa nyelela</i>	We should preserve them from extinction
<i>Naledi e le ya mphatlalatsane</i>	That star of Venus
<i>Ke naledi ya masa ga a sa</i>	Is the morning star that comes at dawn
<i>Selemela selemela naledi</i>	A constellation of stars
<i>Ke sekgotlo sa dinaledi</i>	They are a cluster
<i>Tsa selemo</i>	Of stars
<i>Naledi e le naka</i>	Of summer
<i>Naka e bonwa ka mariga</i>	That star is called "Naka"
<i>Sa re nyedi sa re tseke</i>	Naka is seen in winter
<i>Tlaya o le bone loapi bosigo</i>	It shines and resembles lightning
<i>Le kgabile ka mebala ya nkwe</i>	Come and see the sky at night

Ga re bona ngwedi e epile pitso
Rona re a itumela rea itumela
re solofela kgora
Tshutshu re a tsha ke mogote
wa letsatsi
Kgosi kgolo Kgafela
Re kopa pula ya medupe
Kgosi kgolo Kgafela
Re kopa pula ya Medupe.

It's decorated
 In colours of a tiger
 When we see the moon in a circle
 We become happy and expect abundance
 "Itch!" We are scotched by the heat of the
 sun
 Paramount King Kgalefa
 We request continual rain
 Paramount King Kgalefa
 We request continual rain.

6.2.13 Contextual commentary of my children come home song

The title of the song below is called my children come. It demonstrates that oral traditions such as songs was common among the Bakgatla -Baa- Kgafela and the elders were the custodians of culture and traditions. Indigenous games such as morabaraba and koi were used not just for entertainment, but also for developing the intellect among the children.

Among the Bakgatla- Baa- Kgafela, agriculture was important and a cow was a sign of wealth. The traditional leader played a significant role in agricultural activities and other such as "Letsema". The traditional leader gave permission for letsema and rainmaking ceremonies. There were taboos which were used as a vehicle for instilling sense of good and evil among the children.

Rain was significant among the Bakgatla, hence the elders taught the young also about names and meanings of types of rains such as *kgalagadi*, *nokaditlase*, *medupe*, *modikela* and *matlakadibe*. Animals such as swallows and the moon with its phases were used to predict rain. Stars such as *kopadilalelo*, *kgogamasigo* and *mphatlalatsane* were common celestial phenomenon.

Bana ba me tlayang gae

Bana ba me tlayang gae,
lona letlo rutwa tshipitonto (clarify)
Lona le tlo rutwa maele a Setswana
Silasila melemele/mmidi mmidi nwana wa batho
Gamang dikgomo
Silang mosoko
Bona ba re ruta morabaraba Bo koi
Bona bare tlhabela mainane
Bona ba re sidila tlhaloganyo
Ka e le makolwane mmaka pula
Bankanya/baakanya dipeo
Bolotsa letsema Kgosi

My children come home

My children come home to be taught songs
 To be taught idioms of Setswana
 Grind mealie meal poor child
 Milk the cows
 Grind stiff porridge
 They teach us traditional games by Bokoi
 They tell us fairy tales
 They train our minds
 Because they are locust birds initiators of rain
 Prepare the seeds
 Commission teams King
 It's time for ploughs

Ke nako ya megoma
Ga dipula di na
Di nela thobo
Retlo dika re jele mabele mabelega batho
Ka nako ya letlhafula
Bonkoko ba re tlhabela mainane
Ba re ruta meila ya Setswana
Ba re bontsha molemo le bosula
Matlhogo tshweu ka botlhale bona ba re ruta
Maina Bona bare ruta ka maina a dipula tse
Bare go na le kgalagatsana le modikela le
Matlakadibe Dipula tse bo nokaditlase
Ga go lekidi le le tlang le lengwe
Sheba ko godimo le bone ngwedi o epile pitso
Peolwane tsa pula di a phaphasela
Tsona di supa go re go pula e kgolo ya Medupe
Bokopadilalelo, kgogamasigo
Le mphatlalatsane di tsamaisa bosigo
Mahube o na a supa gore tsatsi le a tswa.

When rain fall
 They fall for harvest
 We are coming to enjoy corn,
 carrier of the people
 In autumn
 Grandmothers tell us fairy tales
 They teach us taboos of Setswana
 They show us good and evil
 They grey-heards with their wisdom
 teach us names
 They teach us names of rains
 They say there are “Small kgalagadi”,
 Modikela and thunderstorm
 These rains with low waists
 There is no well that fills another
 Look up and see the moon forming a circle
 Swallows of rain are fluttering
 They indicate great continual rain
 The evening star, the fading star, Venus
 Drag on the night
 The Red sky indicate the rising of the sun.

6.2.14 Contextual commentary of creations of God song

The song below is some kind of a tribute to *Modimo kgotsa Lowe* who created the celestial bodies or phenomenon. Through his skill he created *lefatshe* (earth) and *legodimo kgotsa leratadima* (celestial vault). The concept of *modimo / Lowe* should not be confused with the concept of the Christian or white God who is the omnipresent with an element of hegemony or supremacy.

Basotho and Batswana creation stories shows that *lowe / modimo* is a moulder of people in communities who came out of the earth, caves and rivers. *Modimo / lowe* is associated with celestial bodies such as stars, sun, moon, wind, rain, hail and lightning. *Lowe* is the provider of everything and including rain. In Gikuyu, a Kenyan language, Kenyata (1979; 237) posits that when it thunders it is believed that *Ngai* (God) stretches his bones and that lightning in *Ngai*'s visible weapon.

Tema (1995) states that *legodimo* is not a separate natural phenomenon from *lefatshe*. This is evidence of cosmic knowledge among the Bakgatla -Baa- Kgafela which is different from Western cosmology and religion. Different stars were like decorations in the night sky due to their natural beauty. In this song kopadilalelo is used to predict rain, it also makes reference to the morning stars, Orion belt and the cluster of stars or constellations. Finally the song talks about the moon and its

phases and how it was used to determine drought, especially the moon when is casting a red shadow.

Tse ditlhodilweng ke Modimo

Selo sena talent eke
nnete ea tsalelwa x 2 (Mme)
Bona Modimo o tlhodile legodimo
le lefatshe x 2 (turner)
Ka botsipa jwa gagwe modimo
O agile lebebe tlase ga legodimo x 1
Bare ke loapi
O agile lebebe tlase ga legodimo
Mo loaping
Go makgabisanyana ka go farologana
A benyabenya bosigo x 2
A re dinaledi
A re naledi e na ya kopadilalelo e supa
Ke ngwaga wa kgora ka dipula
Tse di namagadi x 2 (Mme)
Tshiki-Tshikitshiki ke a sitwa (Base)
Ke paka ya mariga (turner)
Wena o bona ka eng (Base)
Naledi ya mmanaka e a benyabenya (turner)
E supa go re ke paka ya mariga (all)
Utlwa (turner)
Naledi tsele tsa Selemela
Tse dingwe ke Selemela
Tse dingwe ke dikolobe
Mphatlalatsane (turner)
Mphatlalatsane le kgogamasigo ke tse diton
Fa o bona ngwedi e dirile moriti o
Mohibidu itse gore ngwaga o ke ngwaga
wa leuba
Modimo o ratile lefatshe mo go kalo (turner)
Ka go bane
Sengwe le sengwe se se dirilweng
Ke modimo se na le bokao mo
Matshelong a rona
Sena le bokao mo matshelong a rona.

Creations of God

This is talent and it's true it comes as
blessings x 2 [But]
Behold, God created heaven and
earth x 2 [Turner]
By His skill God
Built a crust below the sky x 1
They say it's the sky
He built a crust below the sky
In the sky
There are mini decorations in
diversity
They glitter at night x 2
He says the stars
He says this star, this night star indicates
It's the year of abundance with rains
Through what you conclude [Base]
The early morning star is flickering
[Turner]
It indicates the winter season [All]
Listen [Turner]
That constellation of stars
Others are a cluster
Others are known as pigs
Venus [Turner]
Venus and the morning star are
primary ones
When you see the moon casting a
red shadow
Know that that's the year of drought
God so loved the world [Turner]
Because everything that has been
created
In our lives it has meaning in our live.

6.2.15 Contextual commentary of come and teach the children song

The song below was sung by Bakgatla -Baa- Kgafela in Mochudi. It emphasized the role of elders in teaching of children about African oral arts such as Setswana idioms, culture and indigenous astronomy. African children were taught about knowledge of natural resource management, the cosmic phenomenon such as stars, sun and different types of rains among the Bakgatla -Baa- Kgafela.

The first fruit ceremony is also highlighted in the song. The First Fruits festivals was common among the indigenous peoples of Southern Africa (Snedegar, 1998) which is a type of sacrificial ceremony of giving the first fruits in a harvest to God. The Setswana Astronomical Nomenclature is woven in culture and language of Batswana (Leeuw, 2007). There are specific names for different stellar patterns including the value and significance.

Tlayang ka bana le tle le rutwe

*Chaba e ntle re a le laletsa tlayang lotlhe
Tlayang ka bana le tle le rutwe manatetsa puo
Le moribo ka tsa ngwao ka tsa tepo
loapi/bolepa-dinaledi
Rona re tlo ruta setshaba ka tsa tlholego
Tse di tshwanang le dinaledi le letsatsi le dipula
Ka le rona re rutilwe ke mabutswapele
Bare ruta gore maina a dilo tsena a raya eng
Kopadilalelo kgogagamasigo mphatlalatsane
Dinaledi tsena di laola bosigo
Selemela dikolobe molalatladi
Tsone di bua ka tsamao ya paka eo
Sekai: kgora le leuba tsa ngwaga oo
Dipula tsa medupe ga dina
Di na le thobo
Matlakadibe ga etla
Etle ka tshenyo
Rona re batla kgalagatsana modikela
kgogolammoko
Dipula tse ga di na di nela kgora kgolo
Motshe wa badimo ga o tswa o supa go re pula
E kgaoditse
Letsema le bolotse
Tlayang setshaba
Re ileleng loapi
Re tle re bone go re dilo tsena di a Bereka*

Come and teach the children

Beautiful nation we invite you, come all
Bring along children so as to be taught
idioms of language and the rhythm about
culture and astronomy
We shall teach the nation about nature
Such as the stars and the sun and the rains
Some as we have been taught by the first fruits
Who taught us what the names of these things
Mean The evening star
Nightdragger Venus
Kopadilalelo
Kgogamasigo
Mphatlalatsane
These stars control the night
Constellation of pigs, rainbow
They talk about the spell of that season
Example: good harvest and drought of
that year When continual rains fall
They have good harvest
When thunderstorms come
It comes with destruction
We want mini Kgalagadi, short rain,
chaff remover
These rains will not fall for abundant harvest
When the rainbow comes out
It shows that the rain has stopped

Ka ditsamaisana le Ngwao.

The teams are on course
Come you nation
To sanctify the sky
So as to convince ourselves that these
things work
Because they go hand in glove with culture.

6.2.16 Contextual commentary of the elders and bolepa-dinaledi song

The song below is a tribute to the the ancestors and their wisdom of *tepo-loapi* or *bolepa-dinaledi* which can be translated as indigenous astronomy. Among the Bakgatla -Baa- Kgafela the ancestors do not exist in isolation, but there are part of the holistic African traditional religion. Despite their encounter with missionsries who introduced Christian cosmology, the Bakgatla -Baa- Kgafela still live in harmony with nature and the cosmos.

The use of Setswana astronomical nomenclature is highlighted in the song. There is a Setswana riddle that says “*mosese ya ga mmakgathi, maranthatha*” which literally means the dress of the painter, is a myriad. It highlights the significance of constellations which are regarded as the kings of the sky. The song also indicates that the Milky Way and *Dikolobe* is a symbol of prosperity while *Selemela* is about good harvest among the Bakgatla. Months were given specific names which were significant, for instance, the month of *impalas*. Birds such as *tlhotlhamedupe* were also used to predict rain.

Bagolwagolwane ba lepile tepo loapi

Bagolwagolwane re a leboga
Le lepile dilo le di bone tadi e amusa
Tepo loapi lo dirisa go supa nako x 2
Fa letsatsi le huhumela kolobe
Mahube la naya banna le basadi
Maabanyane letlatlana go letobo x 2
Mosese wa mmakgati maranthatha
Dinaledi lesagaripana
Magosi a lefaufau x 2
Ga le kotlomela phirimane
Kopadilalelo bomme ba baya
dipitsa tsa maitisiboa mo isong
Kgogamasigo e lepanana le lefifi x 2
Mmanaka e itsiwe ke bagale
E phunyega mahube a naka tsa kgomo
Mphatlalatsane naledi ya masa

Elders and bolepa-dinaledi

Ancestors we are thankful
You have observed things and saw them
in daylight
You use astronomy to indicate time x 2
When the sun creeps under “the pig”
It gave men and woman the Dawn
In the late afternoon at dusk its dark x 2
Mmakgati’s dress has dots
A constellation of stars
kings of the sky x 2
Kopadilalelo the evening star
Woman put pots on fire
Kgogamasigo the nightdragger
counteracts the darkness
Mmanaka the early morning star is
known by the heroes

<i>E gagaba go sutela letsatsi x 2</i>	It pierces through early dawn of morning
<i>Molalatladi dikolobe di supa kgora</i>	Venus the star of morning
<i>Selemela botlhaba temo e ntsi</i>	Crawls to give way to the sun x 2
<i>Ga e le bophirima temo</i>	The rainbow
<i>Ga eyo gotlhelele x 2</i>	The pigs indicate abundance
<i>Lona le lepile dilo</i>	The constellation at East
<i>Kgweredi ya phalane phala tsa tsala</i>	Indicate extensive farming
<i>Tlhotlhamedupe peolwane</i>	As for the West
<i>Di kaa pula x 2.</i>	There is no rain at all x 2
	You have observed things
	In the month of Augustus
	The Impalas give birth
	Tlhotlhamedupe the swallows
	They spell rain x 2.

6.3 Mafelo a ngwao le bolepa-dinaledi

Mafelo a ngwao or heritage sites related to the night sky knowledge needs to be preserved and protected for future generations. Like any other cultural group in South Africa and the rest of the continent, Bakgatla -Baa- Kgafela in Mochudi and Moruleng have preserved and promoted some of their heritage sites which have astronomical significance. Some of this sites are sacred, have significance to their culture, traditions and history. The traditional leadership institutions in both study communities in general have the passion in indigenous knowledge including the protection and preservation of African heritage.

According to Mme Grace Masuku, in Moruleng, Bakgatla -Baa- Kgafela have cultural and natural heritage which depicts their history, culture, indigenous knowledge inherited from ancient times and these needs to be transmitted from one generation to another. Mme Masuku points that raising awareness about the significance of heritage to the young generation and the public at large is very fundamental in the global knowledge economy.

Meskel (2015) posits that indigenous heritage preservation and management serve as a convenient vehicle in the forging of national identity, since post-colonial states did not accommodate cultural and tribal allegiances functions and powers. The study found that the Bakgatla -Baa- Kgafela in Moruleng and Mochudi have heritage sites or sacred sites that are historical, have cultural, spiritual and astronomical significance. Among the Bakgatla, there are sacred sites that has been deemed to be of historical or cultural and astronomical importance by the community. Planesas (2011) argue that astronomical heritage of indigenous peoples, cultures and countries takes many forms. The following section provides the discussion of Phuthadikobo hill and its astronomical significance.

6.3.1 Phuthadikobo hill

Rre Tladi Bojelo, an IK expert in Mochudi indicated that in the olden days there were no planetariums and modern equipments such as telescopes or special site for observation of the celestial bodies and the night sky. Instead, Bakgatla -Baa- Kgafela Batswana had their own heritage sites or sacred places that were connected or had a link with indigenous astronomy and cosmology. Rre Tladi Bojelo, indicated that when he was a young boy, he used to climb on top of Phuthadikobo hill which looks like a strategic site for night sky viewing.

The above narrative was confirmed by IK experts in the focus group discussion that was held at the Bakgatla -Baa- Kgafela Traditional Council in Mochudi which is situated few metres below Phuthadikobo hill. Secondly, this was also confirmed by the researcher (Koitsiwe) who also visited and used to work with officials, researchers at Phuthadikobo Museum which is located on top of Phuthadikobo hill. At Phuthadikobo museum, there are historic, authentic and significant materials including artefacts about the Bakgatla -Baa- Kgafela.

The researcher witnessed and also used to climb some of the big and long rocks at Phuthadikobo hill just next to the museum. Some of this rocks that are in strategic positions and when you are on top of them, you have a good view for celestial bodies from all direction. Climbing this rock is a very dangerous exercise which needs one to be carefull. Although there is no hard core evidence to proof any astronomical activities at Phuthadikobo hill, but one can actually agree with the statements made by Rre Tladi Bojelo and other elders who participated in the study. Their statements are not far fetched and it is an indication that *bolepa-dinaledi* among the Bakgatla -Baa- Kgafela was more than just oral traditions in the fire place during the evening and was not introduced by missionaries or colonizers.

Bolepa-dinaledi was connected to the people's heritage site and any other natural phenomenon in their specific enviroments. Some of the IK experts have provided mythologies and narratives that in the olden days the rain snake used to reside in Phuthadikobo hill and it communicated or linked with the rain snake that was at Modipe Hill. Bakgatla -Baa- Kgafela did not have a special place which they called the observatory, however, there is a house in Mochudi just below the Phuthadikobo hill which is called the "Observatory".

According to Mme Ntikoe and Mme Ditshaba, this house was used as place for hosting visitors who come to Mochudi. It was not used or there is no evidence of it being used as house for astronomical

activities even though it was called “Observatory”. In the reviewed literature, an “Observatory” is where the stars are projected for public viewing. The following figure provides a picture of a large stone at Phuthadikobo hill and on top of it is Motheo Koitsiwe. The picture was taken by Aobakwe Morohe, a research assistant at Phuthadikobo museum. This stone provides a good view of cosmic bodies during a dark night sky in Mochudi. The following section provides the astronomical significance of Thaba ya Modipe.

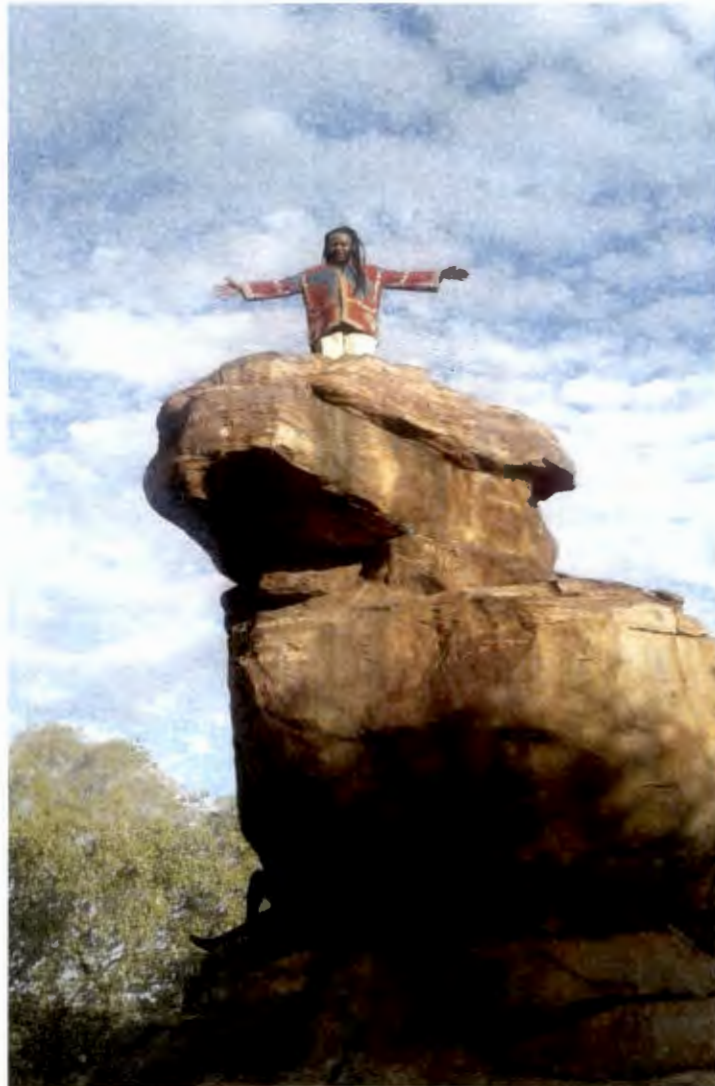


Figure 6. 1: Stone at Phuthadikobo hill.

Picture by Aobakwe Morohe, 20 May 2017

6.3.2 Thaba ya modipe

Modipe hill lies approximately thirty kilometres south of Mochudi. It is an imposing granite outcrop and is one of the chain stretching across the border from South Africa. Evidence found at the hill

put forward an argument that people may have lived there for the past 50 000 years, or more. However, the greatest use of the hill took place between 1450 and 1800 AD. The remains of the old houses, kraals, and compounds tell archeologists that a sizeable community lived there during that time. There are large complexes of stone walled enclosures mid way up the east side of the hill and a village at the base where many “daga” built houses were found. It was evident that the people who lived there were agro - pastoralists. They kept livestock, grew crops, and made pottery. They were also skilled at making artefacts out of both copper and iron. For this reason the site is said to belong to the African Iron Age.

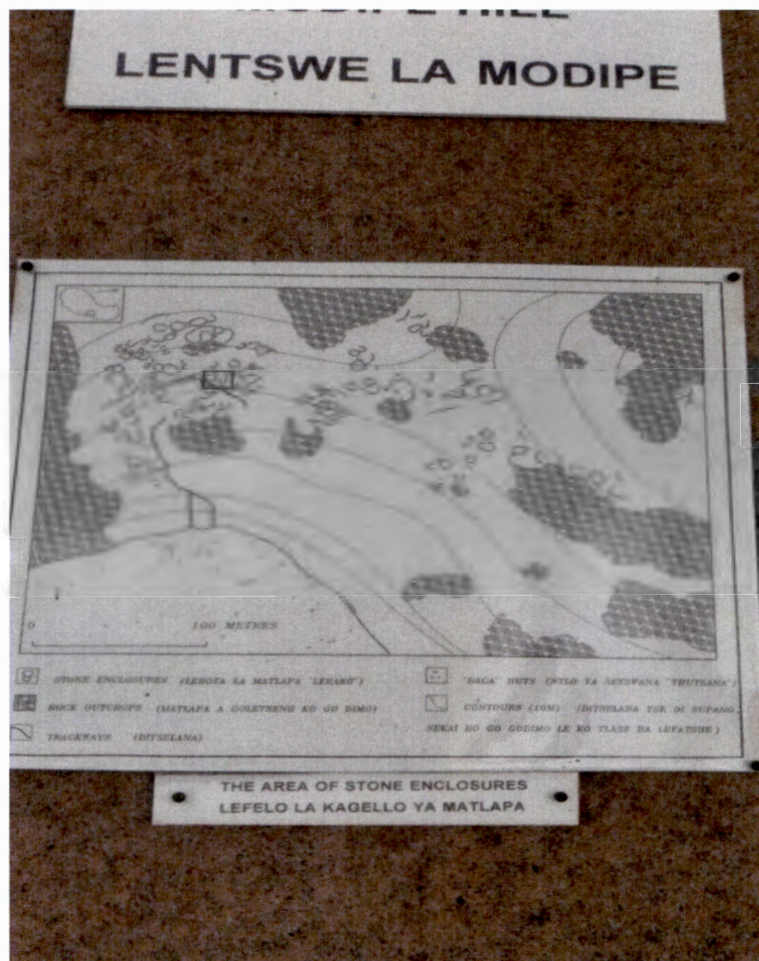


Figure 6. 2: The area of stone enclosure at Modipe hill.

Picture by M Koitsiwe, Phuthadikobo Museum, 20 May 2017

Interviews and focus group discussions with IK experts in Mochudi indicate that modipe hill is a sacred heritage sites where in the old days the Bakgatla traditional leaders used to conduct rain making rituals and ceremonies. The participants in the study from Mochudi argue that everytime when a traditional leader comes from the mountain of modipe, there will be rainfall in the

community. It is argued that the traditional leader was working with the rainmaker and they used different medicines such as “*ledutla*” and they also applied their cosmic and astronomical knowledge to ensure that rain comes.

One of the evidence to support the above remarks by the IK experts is the remains of the displayed “*lengetane*” at the Phuthadikobo Musuem. *Lengetane* is the pieces of a broken earthenware pottery. This pottery is part of the collections dispayed at the Phuthadikobo Museum to illustrate the rich heritage and culture that was happening at Modipe hill over the past years. It is argued that the displayed *lengetane* at the museum is the remains of the pottery of ancestors that was used by the Bakgatla -Baa- Kgafela especially the rainmakers working with traditional leaders to conduct rituals and ceremonies for rain.



Figure 6. 3: Lengetane from Modipe hill.

Picture by M Koitsiwe, Phuthadikobo Museum, 20 May 2017

6.3.3 Matsieng creation site

Bakgatla -Baa- Kgafela in Mochudi have their own belief about their origin and creation. Matsieng is a creation site which is now a National Monument administered by the Botswana National Museum and protected by the revised Monuments and Relics Act (2001). Interviews conducted with the expert who looks after Matsieng indicates that Matsieng is believed to be the ancestor of the Batswana people.

However, there are contradictions with regard to the two worldviews of modern science and the narratives of the community members with regard to creation stories. Scientists have their own theories about creation and African indigenous communities also have their own myths, legends and stories of creation. One of the well known scientific theories of evolution is the one propelled by well known Charles Darwin and Alfred Russel Wallace in the 19th century. This led to a publication called the Origin of the Species by Charles Darwin. One of the most controversial aspects of evolution theory is that human beings share common genes, ancestry with apes or monkeys.

Despite its creation significance, there is also evidence of cosmology and astronomical knowledge at Matsieng which attest that the Batswana, especially the Bakgatla -Baa- Kgafela had for many years practiced knowledge of celestial bodies. Bakgatla have a belief that Modimo created the sky and earth. At Matsieng, there are limestones or petroglyphs at the site with light and dark colours on it which looks like symbols drawn by human beings.

According to interviews with the heritage official, the dark colour on the petroglyphs is a symbol of the blue sky. The light colour round circles implies the different stars in the night sky. The light big, round circle is the symbol of full moon and there are patches on the rocks which represents the clouds. It is also believed that Matsieng came out of the hole during the night when the moon was full and there were bright stars in the night sky, hence we see evidence of celestial bodies in the petroglyphs.

According to the heritage official, there is a myth among the Batswana that in order for god to prove that he is the creator of everything on earth including the knowledge of cosmology and astronomy, god himself, created this scenery depicting knowledge of celestial bodies and footprints in the rocks. The symbols that are found or depicted on the rocks at this heritage site are not man made but natural.

The community narratives about the creation site of Matsieng were disputed or criticised by natural scientists such as geologists who argue that the petroglyphs at Matsieng are as a result of the volcanic eruptions that occurred more than 15 million years ago. During that time there were volcanic events which were not that big or long and they created volcanic craters. Some western researchers have a hypothesis that the symbols of celestial bodies and different footprints were as a result of rock art or rock engravings or paintings that were done by the Bushman during their settlements at the site which was later occupied by Kgosi Mochudi and his people.

In addition, Matsieng was also regarded as the site for ancestors. According to interview with Rre Mogotsi, community members used to collect water at Matsieng very early in the morning and they also performed rain making rituals and ceremonies at the site. According to IK experts, community members respected the myths about Matsieng, for instance, no one was allowed to go or do anything at the site during the 12 o' clock sethoboloko hour, which is regarded as the time of the ancestors. The following pictures shows the hole of Matsieng, celestial bodies such as the moon and symbols of stars.



Figure 6. 4: The hole where Matsieng and animals came from.

Picture by M Koitsiwe, 20 May 2017

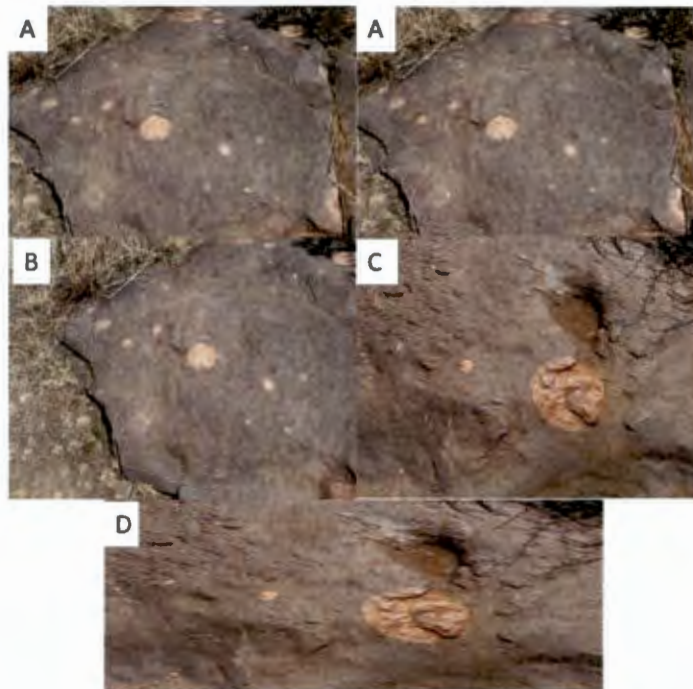


Figure 6. 5: Symbols of celestial bodies at Matsieng.
Picture by M Koitsiwe, 20 May 2017.

6.3.4 Bothhapela bojale

Among the Bakgatla -Baa- Kgafela, *bojale* is an initiation institution for young girls or *thupiso ya basetsana*. Young girls in the community were taught special indigenous education which prepared them to become responsible and accountable woman in the community. Initiation schools were common among the Bakgatla -Baa- Kgafela in the study communities. Young girls were taught education about household activities, relation between man and woman, mischievous behaviour, good manners, respect, how to handle themselves as woman at home and in the community.

Young girls were taught indigenous songs including those about the celestial bodies and other natural phenomenon. Young girls were also taught how to become resilient to challenges of life, to observe the proscriptions and taboos of the Bakgatla -Baa- Kgafela. Young boys were not allowed to come next to the initiation institution or at “*bothhapela bojale*”.

Just like at the initiation institution for boys “*bogwera*” most of the things that happens at “*bothhapela bojale*” are sacred or secular knowledge that cannot be divulged to any one who does not form part of that particular Community of Practice (Cop). Young girls were taught that

“botshelo ga se ntlhatlhelele peipi” which means that they have to be prepared to deal with and transcend all the encounters and adversities they face in life.

An interview with Mme Grace Masuku revealed that:

Botlhapela bojale, ke thabana ka mo serapeng sa Pilanesberg. Bojale ke go aloswa ga basadi le basetsana kwa nageng. Dialogane di ne di tshasiwa ka ditlolo tse di dirang gore ba tsee monko wa dijalo le diphologolo tsa naga. Seo se ne se direlwa gore dialogane di se tshose diphologolo thabaneng eo go na le motswedi o metsi a a neng a dirisiwa ke dialogane go tlhapa ditlolo tseo pele ga ba ka boela mo motseng.

English version

Botlhapela bojale is a hill in the Pilanesberg Game Reserve where female initiates used to be initiated. When the initiates lived in the wilderness, they had specific lotion mixture applied to their bodies. This mixture enabled the initiates to adopt the smell properties of the wilderness, and that ensured that they did not alarm the animals in the area. The initiates used the water found in the spring found on the hill to wash off the lotion before they returned to the settlement.

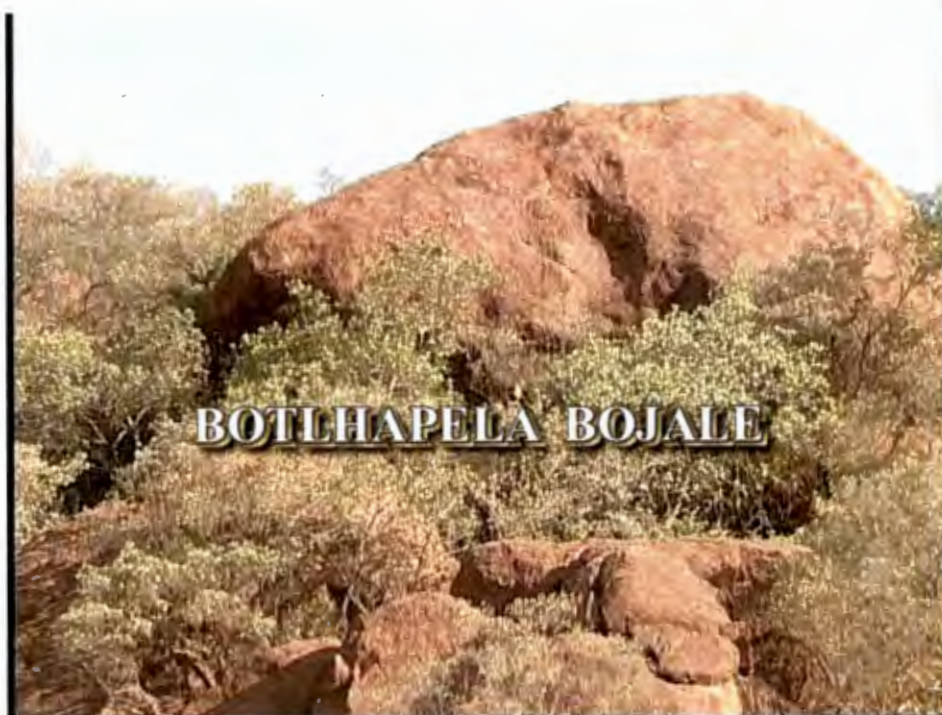


Figure 6. 6: Botlhapela bojale at Pilanesberg National Game Reserve
Picture by M Koitsiwe, 10 November 2017

6.3.5 Thaba ya ditshwene

Thaba ya ditshwene or the baboon hill is found inside the Pilaesbeerg National Game Reserve. This is a sacred hill that has cosmological and astronomical significance. This mountain is regarded as

one of the heritage site of the Bakgatla -Baa- Kgafela in Moruleng. Animals such as baboons and monekys are regarded as sacred and spiritual hence they are often totems of the communities. The researcher travelled with Mme Masuku, tour guide and the photographer inside the Pilanesberg Game Reserve to take pictures of the mountain. We were only allowed to take pictures while we stand a distance from the hill and before midday.

IK holders and practitioners in Moruleng points that Thaba ya Ditshwene is the mountain close to the aforementioned Bakgatla Ba Kgafela settlement before the area was converted into a game reserve. Members of the community never climbed or hiked on the mountain as only baboons lived on it. It is believed that if one can come close enough to the mountain at a certain time, one would hear noises analogous to the noises that the populated settlement emitted.

In terms of astronomy of Bakgatla, the hill is linked to the new moon which is often called the moon of the monkeys or kgwedi ya ditshwene. This means that the new moon cannot be seen by a naked eye, it is only the baboons who can be able to see it, hence, Bakgatla says that ke kgwedi ya ditshwene which have significance to the reproductive cycle of woman and young girls during the month of baboons.



Figure 6. 7: Thaba ya Ditshwene
Picture by M Koitsiwe, Pilanesberg Game Reserve,
10 November 2017.

6.3.6 Letlapa La Rramono

This is one of the heritage sites of the Bakgatla -Baa- Kgafela in Moruleng in the middle of the village, where there are dwellings settlements in all the directions of the Site. Ik experts in Moruleng indicate that Letlapa la Ramono was used for rainmaking rituals and ceremonies by the community members. Letlapa la Ramono is perceived as ancestral memorabilia in the community, something like a reminder of the sacred past, a notion which somehow provide respect and dignity towards these sites, hence they remain not tainted.

Mme Masuku argued that during the rainmaking days, woman in their menstrual cycle periods and pregnancy were not permitted to be anywhere around the site. This was believed to can lead to the disturbance of the ritual process and would result in rain not falling as wished and hoped for. Such myths led to people to view the seriousness of this site and its spiritual relation.

This myth was also linked to the disrespect or disregarding the sacredness of the place, which may also result to the taboo that rain would fall, as spirits which dwells in these places could be disturbed. The following section provides discussion on the link between architecture and *bolepa-dinaledi*.

6.3.7 Architecture and *bolepa-dinaledi*.

Interviews and focus group discussions with IK experts in Mochudi indicated that the observation of stars was done during the night time. In addition, Batswana used their architecture to showcase their rich knowledge of celestial bodies. For instance, some of the Bakgatla -Baa- Kgafela were building houses, they were using their astronomical knowledge. For instance, Batswana traditional homestead is round in shape which epitomise the symbol of a moon. The Batswana traditional homestead looks circular like the moon.

When the moon is full it looks round. Many people, in Kgatleng, constructed their houses guided by the position of the sun, the moon and other celestial bodies. For instance, when they were building their houses, normally their doors would face the east because they were looking for the sun rays, some will build their houses in a pattern that shows that they were aware of natural disasters such as floods and heavy winds. The link between astronomy and *dinkgwana* is provided in the following section.

6.4 Dinkgwana le bolepa-dinaledi

Among the Bakgatla -Baa- Kgafela, the art of pottery or go *bopa dinkgwana kgotsa dinkgwana* is a special art which was mastered by old woman in the community who often used their knowledge of celestial bodies in pottery making. Hence, dinkgwana means pottery. According to interview with Mme Mmapula Rrapekenene in Kgwarape farm, who is an expert on pottery making but she is originally from Mochudi. Bakgatla -Baa- Kgafela have a heritage of pottery making which is a gift, important part of culture and traditions of Batswana which needs to be preserved, protected and promoted to the future generations. She indicated that they used to make different pottery that depicts the culture of Bakgatla and Batswana in general.

Mme Rrapekenene said that she can make any type of pottery, including the ones that shows that Bakgatla have long time practiced knowledge of bolepa - dinaledi. She made pottery which shows stars such as *kopadilalelo* (evening star), *mphatlalatsane* (morning star), *tlala le kgora* (large and small Megallinic clouds), *magwasigwasi*, *ngwedi* (moon), *letsatsi* (sun). Mme Rrapekenene indicated that stars are not just in the sky for aesthetic beauty only. She argued that stars talks, sends message to people and they were used to predict rain and even to tell if the year is of famine or prosperity.

Mme Rrapekenene indicated that the earthenware pottery making skill has been practiced among the Bakgatla ba Kgafela community since 1871. Earthen pottery making involves indigenous methods of making different earthenware pots that are classified according to their size and use. To make earthenware pots, the practitioners use moshalakane and letsopa which are found at the foot of Phuthadikobo hill, Tsope hill and Modipe hill. According to Mme Rrapekenene Moshalakane is a stone which they used to grind, mix with letsopa for pottery making. There are different types of letsopa which include:

- *Letsopa la Mmatafatshe*
- *Letsopa le le setlha*
- *Letsopa la leforomo*
- *Letsopa le leshibitswana*
- *Letsopa le lentshonyana*

Mme Rrapekenene pointed that “*Kato*” *kgotsa “mootlwane” e dirisiwa go photha letsopa, o beile letsopa fa fatshe kgotsa mo diphateng*. She also indicated that they used a tool called “kato” *kgotsa “mootlwane”* in order to make letsopa to be soft and ready for pottery. She argued that the heritage of *dinkgwana* is fading away due to the influence of modern culture.

In addition, there is now a challenge of accessing letsopa due to modern development of housing. According to Mme Rrapekenene, most of the letsopa is found in countries such as South Africa. Earthenware pottery making is facing extinction because there are only four Masters Potters discovered, two of which are elderly, for instance, there are only two elders that the researcher identified who have the skill for pottery and one of them is Mme Mmapula Rrapekenene in Kgwarape. There is also another elder who stays few distance from Mme Mmapula and her name was Mme Mokula but she could not participate in the project due to personal reasons. Very little is known about taboos of pottery making, and there is a need to document this craft.

Mme Rapekenene argues that knowledge and art of making pottery is not a common but a specialised knowledge which often comes as a gift from the ancestors. It was normally an art practised by old woman who transmitted this to the young generation. She shared her dream of pottery making with the researcher. According to her, one night she had a dream where there was lot of big pottery that was loaded in a train for selling. The train was travelling for long distance. She indicated that when she woke up in the morning, she started to develop a passion which was guided by her vision of making pottery. She argued that making big pots is something that makes her happy, but she also enjoys making small pottery and even those that interface knowledge of Bakgatla -Baa- Kgafela and western knowledge. Mme Rrapekenene indicated that there different types of pottery such as:

- *Setsaga- nkgwana e tona* - big pot
- *Dinkgwana tsa Dikgafela* - pot for thanksgiving ceremony
- *Nkgwana ya metsi* - pot for water storage
- *Nkgwana ya ting ya bojalwa* - pot for traditional beer
- *Nkgwana ya go ya nokeng* - pot for collecting water at the river
- *Tsagana- e bidisetsa ting ya bogobe, e apaya mo isong* - pot for cooking porridge
- *Lenyetane ke phatlo e e thubegileng ya nkgwana* - broken pieces of pot
- *Nkgwana ya sedimo* - pot for deities

According to Mme Rrapekenene some people use pottery of ancestors to conduct rituals of a murdered person at the graveyard. The rituals are called cleansing the grave of murdered person. The earthenware of ancestors were also used for rainmaking ceremonies. According to Mme Rapekenene, pottery of ancestors plays various role, for instance, they farmer used to erect this pottery in the four corners and in the middle of the the farm as a strategy of ensuring that rain will not pass his or her farm which will result in bad harvesting periods.

Bakgatla also used the same pottery of ancestors to repel or chase away sefako which may cause damage to the crops. They used medicine which they called Mmutswabutswane or Maphutha to chase away hail. The following figures shows pictures of moshalakane, the different types of pottery, especially those that depicts the symbols of celestial bodies.



Figure 6. 8: Letlapa la moshalakane
Picture by M Koitsiwe, 07 December 2017



Figure 6. 9: From left is picture A of dinkgwana showing the phase of the moon facing down. The other picture is of the full moon
Pictures by M Koitsiwe, 07 December 2017



Figure 6. 10: From left is picture of dinkgwana with stars such as kopadilalelo, mphatlalatsane or naka. The other picture on the right is molalatladi or Milky Way.



Figure 6. 11: Picture of bloompot showing celestial bodies.

Pictures by M Koitsiwe, 07 December 2017

6.5 Discussions of the empirical findings

6.5.1 Views on African indigenous astronomy

This section discusses the empirical findings derived from the study communities. Section A of the interview schedule dealt with the understanding of the nature and types of African indigenous astronomy found in the selected study communities. In addition, the participants had to indicate their own perspective and understanding of the concept indigenous astronomy (*bolepa-dinaledi*). They were also asked if there was any indigenous astronomers (*balepa-dinaledi*) in their community today. The participants were also asked to explain the use of indigenous astronomy in their community. Therefore, this section presents the participants's understanding of indigenous

astronomy, its relation to culture, language and how it was transmitted from one generation to another.

Interviews with IK experts showed that the Bakgatla -Baa- Kgafela had greater understanding, holistic knowledge and developed oral traditions about the night sky. A very large majority of indigenous knowledge experts indicated that they have knowledge and understanding of the term indigenous astronomy. The majority of IK experts in Moruleng and Mochudi called indigenous astronomy “*bolepa-dinaledi*”. The response from the participants indicates that Bakgatla -Baa- were very much observant of the night sky. In addition, the majority of the IK experts indicated that this knowledge actually exists within the community but it is actually facing extinction due to many reasons which includes modernization and civilization.

The common definitions that emerged from the participants were that - *bolepa dinaledi* is:

- Knowledge about the stars, moon, sun and other constellations that is unique to the Bakgatla. (ke kitso e e kgethegileng ya *bolepa-dinaledi*).
- Knowledge of the night sky transmitted by elders to the young using oral tradition.
- Local science of the night sky of Bakgatla and is part of their everyday life.
- Knowledge acquired from “*Lowe*”.

From the above definitions provided by IK experts it can be argued that *bolepa-dinaledi* is knowledge that is special and it is not the thing of the past due to the fact that they still apply it on their day to day survival. The above statement is supported by Baki (2006) who argues that most African societies have developed their unique indigenous astronomical knowledge.

One of the major lessons learnt from the participants `s definition and perspective of the term indigenous astronomy is that it is not limited only to the academic literature. According to the interviews conducted with the participants, indigenous astronomy encompasses the language, worldview, philosophy, culture, traditions and it is unique to a community. It was also interesting to learn that this knowledge is regarded not just as meagre or simple understanding of the night sky, but it is actually special and a science in its own right. Most of IK experts indicated that indigenous astronomy was transmitted orally by elders during evening session or *maitiso*.

Interviews and focus group discussions with IK experts indicated that there are plenty of celestial bodies in the night sky such as stars, moon, sun and other constellations. Based on responses from

the participants, no one has ever mentioned the difference between stars and planets, they were generally called *dinaledi*. This was not only unique to the Bakgatla as indicated by Junod (1927) that the Tsonga made no distinction between stars and planets, both were simply referred to as “*tinyeleti*”.

The majority of IK experts indicated that *bolepa-dinaledi* is a science of Bakgatla in terms of understanding the night sky and its relation to human beings. The IK experts argued that they used naked eye to learn about *bolepa-dinaledi* due to the fact that there was no sophisticated technologies such as telescopes. The dark night sky provided a good view of the stars and other constellations. Authors like Tema (1985) states that Basotho - Batswana Cosmology (STC) conceptualized “*gaLoowe*” as closely associated with the elements of nature, such as wind, rain, hail and lightning. Therefore, the study argues that Batswana used their natural knowledge to understand the night sky, the cosmos and this knowledge was acquired informally.

The word *telescope* (from the Ancient Greek *tele* "far" and *skopein* "to look or see"; *teleskopos* "far-seeing") was coined in 1611 by the Greek mathematician Giovanni Demisiani for one of Galileo Galilei's instruments presented at a banquet at the Accademia dei Lincei (Sobel, 2000 & Drake, 1978). However, despite lack of sophisticated equipments, the Bakgatla -Baa- Kgafela, like many other African indigenous communities were able to identify, name, characterise certain stars using the naked eye.

With regard to how *bolepa-dinaledi* is applied in the community, the participants indicated that it is used day to day survival and in variety of ways, such as in navigation, agriculture, calendar making, prediction of natural disasters, time keeping, rain making. For instance, the majority of IK experts indicated that the star known as *mphatlalatsane* is used to track time and the different phases of the moon were used to track the reproductive cycle of woman.

The above is supported by Fabian (2010) that people use stars for time reckoning and temporal planning during a specific night, month, season or year, as a medium, much like an artist's canvass, onto which culturally significant images may be projected, and as models or for guidance in culturally relevant ways. Alcock (2014) adds that stars as elsewhere in Southern Africa were important in agricultural cycles and on daily lives.

Interviews with IK experts revealed that indigenous astronomy is broad and is significant for their survival. In addition, it is important to note that the IK experts in the study were also aware that indigenous astronomy is not just about the night sky. They argued that some of the stars and astronomical events are also visible or can be observed during daytime.

The above statement was also confirmed in literature by Fabian (2001) that stars are present in the daytime, but they are rendered invisible to the naked eye due to the sun's brighter luminance. The Venda people also believed that the stars (*maledi*) were suspended from the sky (*makholi*), and they were invisible during the day due to brightness of the sun (Stayt, 1931). Mutwa (2003) argue that one of the least - known facts about the black peoples of South Africa is that they possessed amazing knowledge of the cosmos, solar system and even dimensions unknown to man.

The above was also confirmed by IK experts in the study that nowadays, many people, especially the young generation spent most of the evening time inside the house either watching television or on bed, hence knowledge of indigenous astronomy is relatively unknown to them. But those who are attentive, passionate about culture and careful observers know more about celestial bodies.

Rre Piet Koitsiwe, an IK expert in Mochudi argued that he used to observe stars during the daytime, when the sky is clean, sun is hot and scorching. Rre Piet Koitsiwe stated that he used to sit under the *Mopipi* tree (Shepherd's tree) at midday and observe stars such as *kopadilalelo* and *kgogamasigo*. There is also a village called *Mopipi* located in Central District of Botswana, next to Makgadikgadi Pan.

The IK experts in Mochudi and Moruleng indicated that stars were children of the sun and the moon (*dinaledi ke bana ba ngwedi le letsatsi*). Interviews with IK experts showed that the moon is a symbol of the woman and the sun epitomise a man. Symbolically, the IK experts indicated that the Bakgatla have knowledge of the mutual relationship of the cosmos and human beings.

This is different from the position by Clegg (1986) and Breutz (1969) that the Batswana regarded the stars as the spirit of the dead. The challenge with the position of Breutz and Clegg is that, it is confusing to understand the Batswana they are referring to due to the fact that Batswana are found in Namibia and South Africa. In addition, there is no Setswana nomenclature that refers to the word "spirit" among the Batswana.

Batswana are geographically spread and even though they have the same culture, there are very few differences, most of them (Batswana) are found in South Africa, while others are also found in Botswana and Namibia. According to argument by Clegg, these studies were conducted among the Batswana in 1982-1985 by students from University of Botswana. However, it would have been important to indicate whether his (Glegg) data was gathered from Bakwena, Bakgatla -Baa-Kgafela or Bakgatla -Baa- Mmanana. The argument is that researchers tend to generalise, especially when conducting studies among the Batswana and make confusing, often misleading conclusions.

Interviews and focus group discussions with IK experts revealed that there are about twenty (20) stars that are known among the Bakgatla -Baa- Kgafela. Some of the stars mentioned by IK experts in the study communities were discussed and reviewed in the literature by authors such as (Glegg, 1986). Interviews and focus groups with IK experts also confirm and agree with the literature with regard to some of the names, meaning of stars and other constellations published in previous research.

However, what makes this study different from other previous work on the same subject is that, past work was conducted by non-indigenous researchers who lacked the relational ontology, hindered by language barriers, utilised Eurocentric lenses and often came to questionable conclusions. In addition, there is numerous Setswana nomenclature on celestial bodies which were not mentioned, or fabricated, misinterpreted to a certain extent in previous work done by various experts in this field.

Additionally, the participants indicated that there are very few people, especially researchers from institutions of higher learning who have passion and interest in documentation and preservation of *bolepa-dinaledi*. One of the strongest points that was learnt in this study and has also been highlighted in previous research was raised as part of the problem statement was that African indigenous astronomy is a thin area in terms of research, despite this challenge, stargazing across the world continues to be of vital importance on a day to day basis.

In addition, IK experts argued that further research on African indigenous astronomy should be encouraged in order to provide the community's holistic understanding and ensure that this knowledge is preserved and promoted. The above was clearly explained by Mme Grace Masuku in Moruleng that there is a need to explain using our own lenses, worldview, epistemologies and avoid the approaches from the West. The majority of IK experts also embraced the idea of the interface of

African indigenous astronomy and modern astronomy to ensure that there is a window of acceptance and bridging the gap between the two knowledge systems.

The participants in interviews and focus group discussions indicated that among the Bakgatla -Baa-Kgafela, there is no distinction between and concepts such as astronomy and astrology. Participants argued that this concepts are foreign disciplines and based on Western philosophy. The fact emphasised in the above statement is that among the Bakgatla -Baa- Kgafela, knowledge of the stars, sun, moon and other constellations is not compartmentalized like in modern education system. Mme Ntikoe Motlotle from Mochudi pointed that knowledge of *bolepa dinaledi* is holistic, based on peoples` culture, worldviews, language and was often disguised behind all sorts of colourful fairytales and legends.

As a researcher, I also share the same sentiments by the IK experts in Mochudi and Moruleng on African indigenous astronomy. Most of the IK experts indicated that they learnt *bolepa-dinaledi* from their parents and grand parents. As a researcher, I also learnt from my grandmother as a young boy from the humble beginning. I developed the enthusiasm on cosmic knowledge from childhood. I was inspired by knowledge of celestial bodies by Grandmother Mmamodiagane Tladinyane who I regard as the embodiment of excellence. She is my mother`s mother and she passed away while I was a young boy but she left me with the heritage that I continue to cherish and embrace. My memory serves me well and I recall that she used to informally and in an entertaining approach, to narrate, and sing local songs especially about the celestial bodies around the fireplace known as "*leiso*" in Setswana or "*eziko*" in isiXhosa. The grandmother made it her own task to observe with us different stars, their meaning, significance and how to differentiate them.

The story of celestial bodies did not just start and end in the fireplace, when I started university, I found that students, especially those specializing in physics and mathematics were being taught by orthodox and western trained professors the science of the stars, moon, and other constellations called astronomy. In my own view this was almost similar to what my grandmother taught during evening sessions at home.

The only difference is that my grandmother used the Batswana worldview, *nonc:latures*, oral traditions and this was informal, educational but fun due to the fact that it was done during leisure times. I then developed the interest of translating the native information into modern books so that

our children can be able to know what the moon, sun, stars, comets, seasons, calendars, and constellations means in their own culture, language and worldview.

The above was emphasised by Mme Masuku that “a motswana child and parent, used to sit around the fireplace. According to Mme Masuku, the fireplace was not just a place for cooking and warming ourselves during cold nights. The symbolic meaning of a fireplace is that it is also a platform for social engagement, sharing and imparting of knowledge among old and young generation.

The parent would be looking up in the sky and explaining to the child what they are seeing. There are different types and meaning of stars. Nowadays, there is the widening intergenerational gap between the old and the young and this is one of the causes of moral decay. Most of the young generation, do not have good moral behaviour, because they do not know themselves, they have lost their being. The elders do no longer sit around the fireplace with the children. Sharing folktales and idioms. All these things are not taught inside the house but outside around the fireplace.

The majority of IK experts in Moruleng and Mochudi lamented that African indigenous astronomy is facing extinction, due to the fact that we are attracted to foreign things instead of rebuilding ourselves. Mme Masuku said “*Bana ba rona ba elela le noka*” which means that our children are swept by the river because as parents we are not grounded in our epistemologies and worldviews. We need to develop community based programmes such as “*Ikitse*” which means know thy self. However, the IK participants argued that all is not lost, and that there is a need to retrieve this knowledge from the elders before they go away with the knowledge.

One of the lessons in this study is that IK participants in Mochudi and Moruleng provided a link between indigenous astronomy and heritage sites. Based on the reviewed literature there is actually not study that provides the link between heritage and astronomy. The participants responded that there are few isolated heritage sites or sacred sites in Botswana and South Africa which have astronomical significance.

An example is that the rain stone / rock from Moruleng, was used to stir rain, while in Mochudi there is a Phuthadikobo hill where there are huge rocks which provides a good astronomical view similar to a modern observatory. According to participants in Mochudi, Matsieng near that Rasesa village is one of the sites which is significant to the Bakgatla with regard to indigenous astronomy

and cosmology. Hence, the study argues that there is a need to conduct more research on the link between indigenous astronomy and heritage. The following section provides the views of IK experts on celestial bodies.

6.5.2 Views on selected celestial bodies

6.5.2.1 The case of kopadilalelo

Interviews and focus group discussions with IK experts indicated that brighter stars such as kopadilalelo were important to night sky observers among the Bakgatla in the study community, this means that there were major stars and constellations that were culturally specific. The star known as *kopadilalelo* in Setswana is normally called the evening star or Venus in modern astronomy.

Alcock (2010) points that among the Tsonga, the evening star was called *Gumbashilalelo, Nkata wa hweti or khwekhweti*, while the Venda called Sirius, an evening star known as *khumbela tshilalelo* (asking for supper). Among the amaZulu and amaSwati, the evening star is called *isiCelankobe* (Alcock, 2010). Norton (1909) indicates that Basotho refers to the evening star as *sefalabohoho* which means to crust scrapping. This was supported by Ambrose (2009) that the evening star is known as *sefalabohoho* (pot scrapper) which means that Venus is seen after supper when it is time to clear the crust from the pots.

Based on the interviews and focus group discussions with IK experts in the study communities and literature reviewed on the significance of the evening star among African indigenous communities, a conclusion can be reached that there is a common element among diverse African people with regard to the knowledge of the stars and other constellations. There is a common element of the evening star which symbolizes the gesture of people asking for food in the evening or preparation of food.

Interviews and focus group discussions with IK experts showed that among the Bakgatla -Baa-Kgafela it is a symbol of of time to start preparing dinner this is the rationale why it was called *kopadilalelo* because the word “*dilalelo*” is about evening food. IK experts showed that *kopadilalelo* is also used to determine the time for people to prepare to eat and sleep later. According to the IK experts, winter season is the appropriate time to view *kopadilalelo* in the dark evening. During the winter season it appears out in the sky in the late hours due to the fact the sun

sets before it appears. But during summer it appears quickly, while the sun is still up or just when the sun has set.

The majority of IK experts in interviews pointed that the reasons for this is that the winter nights are very long, and summer nights are short, hence *kopadilalelo* is not consistent in order of appearance during summer and winter. During winter, the sun sets early and in summer the sun sets later. The above views by the IK experts is not far fetched and also supported by Bohren (1989); Saha (2008); Guenther (2005) & Bonnell (2005) that in modern astronomy, the time of sunset or sunrise varies throughout the year, and is determined by the viewer's position on Earth, specified by longitude and latitude, and elevation.

The two seasons of the year are summer and winter, and the sky is different during the different seasons. If you look at the sun in summer, it rises and sets differently from the winter sun. In winter, the day is shorter and the sun is appearing in other continents where it is summer, on the opposite side of the equator, and this is the reason for short days in summer. Even the stars are like that, they set in the direction of sun set and they rise where the sun rises.

Interviews with IK experts showed that the symbolic and cultural meaning of *kopadilalelo* among the Bakgatla -Baa- Kgafela and other Batswana cultural groups it relates to woman and their skill or procedures of food preparation. IK experts indicated that by the time woman in the community finish cooking the evening meals, *kopadilalelo* is appears and visible to the naked eye in the night sky. According to focus groups discussions with IK experts it was also time measuring star, hence stars had multiple and diverse meaning.

Kopadilalelo means that woman should be ready to prepare food for the household, so that when it is time for “*dilalelo*” or dinner / supper, and when this star shines very bright while people are eating to indicate happiness and joy due to the fact that food is vital for survival. The majority of IK experts showed that with regard to time of appearance, this particular star can be seen as from 17:45 in the evening, especially during winter season and it shines bright up in the sky when the sun sets. Interviews with IK experts showed that nowadays there are street lights at night, and it becomes a challenge to view the sky. The above view was expressed by Rre Moeketsi, an IK expert in Moruleng that The stars was a source of light, however, due to modernization, the extreme lights from electricity makes it impossible to view the night sky.

According to Rre Moeketsi, the Batswana diety known as *Lowe* did that purposefully because He wanted His people to have light. He created *Kopadilalelo* so that it can be a source of light, not only significant for the food or cooks. It was important to light up the way so that people can see where they are walking / going. Interviews with Rre Moeketsi showed that during the old days Bakgatla - Baa- Kgafela used to have equipments which were used to light up the way with, like “seketekete” lamps but they were not as effective and bright as *kopadilalelo*.

Interviews with IK experts showed that *kopadilalelo* appears at all seasons of the year and never vanish away. Sometimes the moon can appear black and then vanish until the next day, but this *star* is always there, it never disappears whether it is in summer or winter it is always visible in the night sky. The only difference between the two seasons is the sun. If you look at the sun in winter, 18:00 in the evening is already dark, it is night time whereas in summer, the sun is still up there. During winter at around 17:00 the sun is already setting, and if you are vigilant / attentive you can notice that *kopadilalelo* is already up at around 16:00. When it is time to go to bed, *kopadilalelo* also set / rest.

Focus group discussions with IK experts in Moruleng showed that *kopadilalelo* is symbolically known as the amazing, often appears to be dancing, shines brighter, like sparkles and fades away towards the end. According to Mme Joyce Pule from Moruleng, it is a talking star which conveys important message to the community. It is different from other stars, it is brighter than all the other stars. It is a star of miracles.

In modern astronomy, Venus has different phases. The extreme crescent phase of Venus can be seen without a telescope by those with exceptionally acute eyesight, at the limit of human perception (Campbell, 1916; Reinhardt, 1929; Williams, 2005; Goines, 1995 & Goines, 1992). The phases of Venus are alleged to have been seen in Mesopotamian times by priest-astronomers. Ishtar (Venus) is described in cuneiform text as having horns (Goines, 1995). However, other Mesopotamian deities were depicted with horns, so the phrase could have been simply a symbol of divinity (Campbell, 1916; Reinhardt, 1929; Williams, 2005; Goines, 1995 & Goines, 1992).

The star called *kopadilalelo* is Venus, when it sets it will appear again in the morning the next day. It is true, *kopadilalelo* is a sign of dawn, and modern astronomy has also confirmed this knowledge. Rre Gouwe in Moruleng states that African indigenous communities due to lack of scientific equipments used to think that they are two stars, but it is a star and when it falls / sets, it doesn't

mean that it is gone, it will appear gain on the other side. Knowledge of the celestial bodies is valuable and significant to the Bakgatla -Baa- Kgafela.

It is important that there must be research on African indigenous astronomy to provide deeper understanding and explanation. There is a need to explain using our own lenses, worldview, epistemologies that are different from the West. These stars we are talking about, have been documented in the past by anthropologist and missionaries using Eurocentric approaches and methodologies.

For instance it is written that there is a star called kopadilalelo with which when a girl child sees it, then they know that it should be time to prepare dinner. However, kopadilalelo have a deeper and broad meaning that goes beyond preparation of food. Western anthropologists, researchers and field workers lacked the right and appropriate lenses, had language challenges and did not have a holistic understanding of African cultures and ways of knowing.

The argument here is that, there is research conducted in the past on African indigenous astronomy, however, most of this research was conducted unethically and using inappropriate methodologies. This is confirmed by scholars such as Linda Smith and Prof Bagele Chilisa on decolonising research methodologies. The documentation, preservation, promotion and protection of African indigenous astronomy is paramount.

It is crucial to take advantage of the prospects of modern science and technology and devise strategic approaches of preserving of astronomical heritage. It is crucial to write our own books in local languages. These books, need to be used to impart our knowledge into the mainstream. These days, children love to read. They do not like to be told folktales. If we take our knowledge and write it in book, it will be easy to reach them. They will be able to read it.

Kopadilalelo, it is a messenger, the Bakgatla -Baa- Kgafela understands and knows their meaning and significance in the community. It gets excited when it starts going down and seeing people, even the people get happy when they see the light. It is happy because it has accomplished its mission/ mandate and then it sets. When the sun is still up, it is not visible but once the sun go down and there is darkness then it shines brightly. It shines so brightly to show its natural beauty. It is a worker, and it works, just like all the other stars in the night sky.

Interviews with IK experts showed that the star called *kopadilalelo* appears to be huge and brighter in summer unlike in winter in the night sky. It expresses different messages to the community members, for instance in summer it sends messages for the woman to prepare dinner, and it also conveys messages to men that it is time to start washing the seeds to prepare them for ploughing season.

Rre Moeketsi an IK expert in Moruleng emphasised that *Kopadilalelo* was used to determine the year of drought or good harvest in the olden days. He argued that, he is one of the lucky ones who were taught and developed passion to learn about the cosmos. The above is supported by Alcock (2014) that among the Batswana, the absence of *kopadilalelo* during the ploughing time was an early warning system for drought, if the same star was visible during ploughing there is good harvest.

6.5.2.2 The case of mphatlalatsane

Mphatlalatsane is also known as the morning star or Venus. It shines brightly and it appears in the east before sunrise and it signalled the time for the men to go and work for their children among Bakgatla -Baa- Kgafela. It also indicates time for the woman to also wake up and go weed the gardens. *Mphatlalatsane* clears sleep on everything except for the cattle. When it turns 17:00 a cow sleeps. *Mphatlalatsane* starts to emerge at 3:00 in the morning while it is still very dark for people to see. At around 3:00 am the cows are still sleeping so there is nothing visible but at around 4:00am, it is time for them to wake up and go to graze.

Some people used to praise it and say that it *mphatlalatsane*, the morning star, we knew that it is dawn when we saw it. It can mislead you *mphatlalatsane*, when you see it, you might think that it is morning and time to go to the fields. As you walk, it walks with you and then suddenly it disappears. When it disappears then you know that it is morning and the star has set / rested. It can mislead you to think that it is morning only for you to meet ghosts along the way to the fields.

One of the elders argued that it used to be *mosupatsela* or the navigator. *Mphatlalatsane* starts by clearing everything that is in the sky because it is morning. When it is dawn, the stars also go to hide / rest. *mphatlalatsane* clears them away. When it disappears then it is dawn. It does not mean that they disappear completely but is just that they are no longer visible. They are waiting for the *mphatlalatsane* to rest as well.

There are mythologies about the morning star such as in christianity, Lucifer was referred to as the morning star, Jesus and mother of Jesus were also known as the morning star. Alcock (2010) argue that the Tsonga also held the morning star with high esteem, especially during the time of the year for opening of circumcision school in winter. Venus was important to initiation activities among the Tsongs, while among the Batswana, it was also used by travellers in the morning hours due to its bright light. Ambrose (2009) points that among the Basotho the morning star was also known as *mphatlalatsane* from *phatlalla* (to come inot full view). This is not suprising due to the fact that the Batswana and Basotho share almost the same nomenclature, worldview and cosmology.

In conclusion, Venus often known as the evening star and morning star is a planet. The English word for planet is derived from the Greek *planes* or wanderer. The solar system is comprised of several planets and only five are visible to the naked eye and Venus is one of them. However the participants in this study do not have a fragmented understanding of indigenous celestial bodies and did not have the Setswana nomenclature for planets. Instead planets and stars were all refered or categorised as *dinaledi* and they made distinctions between different celestial phenomena. The above is confirmed by Fabian (2001) that detailed published information on planetary observation in indigenous communities is sporadic.

6.5.2.3 The case of kgogamasigo.

Interviews and focus groups with IK experts in Moruleng and Mochudi showed that *kgogamasigo* is a big and bright star that appears from the east. Information gathered form IK experts indicated that the names of different stars represents their duties, the time of appearance. *Kgogamasigo* it appears during the night and is used to calculate time among the Bakgatla -Baa- Kgafela.

According to Mme Rrapekenene *Kgogamasigo*, in Setswana indigenous astronomy tells us that it comes out at 20:30 in the evening. It means that it pulls the night because it appears at 20:30 until midnight. That is how it pulls the night and it undresses the sun. After 12:00 it shifts to the other side, going to rest, or it set like other stars. The main purpose of *kgogamasigo* is of dragging the night.

It is important to know *kgogamasigo* in detail, especially in terms of its socio cultural significance. According to the views of IK experts, *kgogamasigo* travels throughout the night, it pulls through all night, and when it shifts to the other side then it means that it is about to be dawn as it sets down. The holistic understanding of celestial bodies is incomplete without knowledge of the seasons

which they appear. It appears during the month of *motsheganong* (May); *seetebosigo* (June) and July. The months go with the seasons. Among the Bakgatla -Baa- Kgafela stars were used to predict rain, seasons and to predict year of amine or good harvesting.

Kgogamasigo is a star which appears at 08:30 and when it rises it is an indication that it is time to for people to go sleep. Rre Rasepae pointed that whether you are a boy or a girl who likes to spend the evening with others, when it rises it tells you that it is time for you to go home and sleep, it is midnight. All those who will be sleeping at night are the children of “*maganapitso*” and that time now belongs to the grandparents to play at night.

Rre Rasepae pointed by the time *Kopadilalelo* sets, it means that the entertainment is over and now it is time for everyone to go home and sleep, soon it will be dawn, and then another star will rise. *Kgogamasigo* when it appears, it means that all the young boys and girls who wanted to wait for evening entertainment with the adults must go home and sleep.

The above information that has been collected through interviews and focus groups discussions correlates or connects with literature reviewed from scholars such as Alcock and others. According to Clegg (1986) this star is probably Arcturus or perhaps Sirius or one of the constellations of Orion. On the other hand T.P Copper seem not to agrre with the position by Clegg and argues that the star under might be Spica. Certain scholars such as Brown (1968) agree with Clegg and he gives tha name Arcturus to *kgogamasigo*.

The traditional name *Arcturus* derives from Ancient Greek (*Arktouros*) and means "Guardian of the Bear", ultimately from (*arktos*), "bear" and (*ouros*), "watcher, guardian". It has been known by this name since at least the time of Hesiod (Rogers, 1998) and it is one of the brightes stars. Spica is one of the 20 brightest stars in the night sky and analysis of its parallax shows that it is located 250 ± 10 light years from the Sun (van Leeuwen, 2007).

6.5.2.4 The case of naka

Naka which is often referred to as the “Horn” is a star which appears during the month of *motsheganong* (May) in winter and it rises at around 18:00. It is visible to the naked eye just before the month of *motsheganong* (May) comes to an end and is frequently seen during *seetebosigo* (June) when winter is in its peak. According to IK experts during the end of winter, *naka* will cross from the south to the north. It is a celestial body which is associated with cold wind.

According to Mme Joyce Pule in Moruleng its wind is the one that whistles, the one which makes people to sleep early in winter. She further stated that *Naka* when it appears on the 15th of May, then the wind starts burning and when the days go by and it reaches the 25th of May, it then starts scorching. On the 15th of May, it starts to scorch and by the 25th of May that's when it is burning, and then when we enter the month of June then its harshness is reduced due to the fact that it is about to pass through and now it releases the final scorching. The water during that times turns into *dikgapetla* or ice due *Naka*. According to the IK experts, as the end of winter approaches, it appears at 2:00 in the morning, with harsh wind. The horns are made for piercing.

It is fundamental to explain from the perspective of the IK expert why this star is called *naka*. Batswana says that a name is someone's sake. When Batswana say "*leina lebe seromo*" this star is called *naka* because of the fierceness of the cold that is associated with it. The cold pierces through the body like a spike or a horn of a cow. That is the reason why it is called a horn. According to IK experts Batswana named this star, a horn knowing very well that it is associated with a piercing wind, it scorches the plants, the trees and herbs.

Mme Ntikoe from Mochudi points that during the end of the winter season, most woman starts to show signs of pregnancy. The rationale is that the star called *naka* is a symbol for procreation due to the fact that at this time of the season, everyone is curled up, even the animals reproduce during this time. The Bakgatla -Baa- Kgafela have a saying which says "*makuku a naka tsa kgomo*" in the early hours of the morning. It means that it is only clear for you to see the whiteness of the horns on a sleeping cow. *Naka* was not only important among the Bakgatla -Baa- Kgafela.

Medupe (2005) points that *naka* was associated with initiation ceremonies for boys among the Northern Basotho. Monning (1983) also indicates that the Pedi also observed the appearance of *Naka*. According to Snedegar (1995) the Venda people referred to *naka* as *nanga* and any one who saw it first would blow the phalaphala horn from the hill top and among the amaZulu as *inKhwenkwezi* and *Kkwekheti* to the Tsonga meaning the brilliant star. This star was also known among the amaXhosa and Lobedu people and it was associated with good fortunes.

Kunene (1981) described *khwenkwezi* as the star which was used to determine time among the Zulu. This is also confirmed by collected data from the Bakgatla -Baa- Kgafela who used *naka* to determine or predict the time or season for winter. This is also confirmed by Snedegar (1995) that

Naka was said to break up the year and to burn up anything green in nature and is heralded the winter season and the browning of the veld.

6.5.2.5 The case of selemela

The views of IK experts in Moruleng and Mochudi showed that *Selemela* is regarded with high esteem among the community members. According to Mme Joyce Pule, *Selemela ke sekgotlho sa dinaledi* which means that it is the group of stars and can also be used as name of a person among the Bakgatla -Baa- Kgafela. This is confirmed by Snedegar (1995) that African indigenous communities have a particularly strong tradition of observing the Pleiades. Some people viewed at it as a group of six or seven stars, for instance, among the Shona, it is called *Chimutanhatu*, simply the six and another *Chinyamunowmwe*, the seven (Snedegar, 1995).

Stayt (1931) also reported that the Venda have riddles that indicate that they had an idea of six stars. However, in this study, the IK experts did not mention the number of this stars, but they all agreed that it is a group of stars in the night sky. Hence the conclusion that the Bakgatla -Baa- Kgafela had knowledge about constellations and asterism is not far fetched. Evidence from the study revealed that Bakgatla referred to this asterism as *sekgotlho* or *leswagaripana la dinaledi* which means group of stars.

According to the participant in the study, the appearance of *Selemela*, especially in summer, it is an indication for the community to start ploughing. It means that men and woman should wash the seeds (*go tlhatswa dipeo*) and prepare the yokes for ploughing. *Selemela*, is a group of small stars, which is not easy to count using the naked eye.

Participants in the study communities showed that they have aesthetic beauty, bounces, and they dress the sky beautifully, they appear on one spot, even in winter season. *Selemela*, appears at any time and is most visible when there is no moon as they are dancing / bouncing. *Selemela* means that the earth is full of nutrients and it is gestating. It means that rain, grass, trees and everything which needs to be planted, has to grow from the soil.

Based in literature reviewed and data collected from the study communities, it is interesting that despite language differences, colonial artificial borders, divide and rule strategy, *Selemela* is well known among Batswana, Venda, amaZulu, Khoisan people and throughout Africa. *Selemela*, is an agricultural indicator it relates to what a Motswana calls food security in nowadays terms. Most of

the indigenous peoples even those outside of Africa including the whites they have a name for it. In modern astronomy is known as the Pleiades which is an asterism.

The Bakgatla -Baa- Kgafela have a cultural knowledge of the stars which aid them in time calculation and each star performs its duty. Some of the IK experts interviewed indicated that it is possible to observe certain stars during the day, for instance, they argued that if you can lay under the *morula* tree and look up, you will have a beautiful view of stars, especially the brighter and bigger ones. The only challenge with viewing the stars during the day is that they are hindered by the light from the sun.

An interview with Rre Rrasepae from Moruleng points that when a particular star appears during a particular season, it appears at a particular time. It was created that way and it can never change. It rises from that side and it makes people to be mindful of these things and to do them with care. Rre Rrasepae pointed that as from May, June and July, it is the hunting season. When it turns August then hunting stops due to the fact that the animals will start to mate.

Animals are related to seasons just like celestial bodies. When the season changes to spring, we are looking at *Selemela*. The soil is fertile, and the plants are growing. If you can pay attention, from August, or rather end of July, small plants, grass, wild fruits, vegetables starts to grow. Everything starts to bloom just to show that now the earth is good and Motswana man can start to plough. In other words, we call this season spring. It reminds us that each one of can plant anything they please.

The strong tradition of observing the pleiades in African was captured very well by authors such as Stayt (1931) providing the Venda perspective, while McCosh (1979) provided the perspective of the Zimbabwe who described as cluster of small stars. Von Sicard (1966) considered it likely that the Arab traders introduced the tradition of observing the pleiades in a calendrical sense to the Swahili. In Kiswahili, the pleiades are called *Kilimia* the “Digging stars”. Among the Bakgatla - Baa-Kgafela, *Selemela* are associated with the rainy and cultivation season.

It is important to note that the pleiades are observed in Central, Southern and Eastern Africa, however, the interpretation differs slightly according to the culture and traditions of the people. Many African indigenous communities used the same title and they also developed oral traditions in order to inculcate its significance and meaning.

Among Batswana is called *Selemela*, Venda is *Tshilimela*, Zulu is *isiLimela*, Tsonga is *Xirimelɔ*, Nyasa of Malawi is *Lemila*, the Karanga called it *Chiremera* and they were regarded as agricultural indicators. However, other communities such as the amaXhosa had a different understanding of this asterism and they associated it with *abakwetha initiation* ceremonies (Hodgson, 1982). *Selemela* has a cultural meaning not only for the Batswanas but to all the nations mentioned above.

Among the Bororo this stellar phenomenon is also well known and used to gauge the passing of time during the night, but also serves as seasonal timing of significant cultural activities such as the coming of age ritual called *Akiri-doge Ewure Kewude* or the Burning of the Feet of the Pleiades (Fabian, 2001). Among the Bororo, planting time and beginning of rains coincided with the Pleiades (Fabian, 2001, 1992).

Urton (1981) presents rich details of runa stellar lore from Misminay in the Andes, he points that the Pleiades are important and used primarily to determine when planting should commence and as a pre planting indication of how good the coming year's crop will be. For the Eastern Timbira the position of Pleiades is used to predict rainy seasons and when to clear land for planting (Nimuendaju, 1946) while the Tapirape of central Brazil use the Pleiades to forecast both rainy and dry seasons (Wagley, 1983, 1977).

The Tupinamba of Brazilian coast likewise used this group to predict the coming rains (d'Abbeville, 1963 (1614)). Among the Barasana of the upper Amazon the Pleiades cycle is related not only to seasonality but to synchronizing with it the complex cycle of male initiation (Hugh-Jones, 1979). Among the runa of the central Peruvian Andes, the Pleiades are called "Storehouse" and are related to the cycle of maize cultivation (Urton, 1981).

The above serves as a sample is a testimony to prove that the Bakgatla -Baa- Kafela in the study community more or less share the cross cultural views with other indigenous communities in Africa and the world at large with regard to knowledge of asterisms and constellations. Hence, a conclusion can be made that there is cross-cultural significance and symbolic meaning of celestial bodies among indigenous communities.

6.5.2.6 The case of dintsa le dikolobe

Interviews conducted with IK experts in the study communities showed that the stars called *Dikolobe* appears during the autumn seasons and they will be visible until the month of

motsheganong (May). IK experts in the study communities shared the view that *dikolobe* appears at the time when maize and sorghum will be ripe. Mme Joyce Pule states that *dikolobe* has babies “*dikolojwane*” which are a cluster, but they appear in groups of three, they help us to predict the year. They are normally three and sometimes there are *dikolojwane* next to them.

The above view is supported by Snedegar (1995) that *dikolobe* (pigs) are the three stars of the Orion Belt, they are called *impambano* (cluster of things) in Zulu tradition, while the Karanga called them “*nguruve*” or wild pigs. The IK experts in Mochudi and Moruleng referred to this asterism as *dintsa le dikolobe*. Alcock (2014) supports the above view and points that among the Batswana, Orion is known as *dintsa le dikolobe* and its reference to the three dogs (Orion’s Belt) which are perceived to be chasing the three pigs (Orion’s sword).

The analogy of the *dintsa le dikolobe* (dogs chasing the pigs) means that the Bakgatla have socio-cultural symbolic meaning of animals, their reproductive seasons which is linked with indigenous astronomy. This was attested by Rre Mogotsi who points that this stars indeed they are called *dintsa le Dikolobe*. According to Rre Mogotsi this stars are associated with a hunter or hunting. Rre Mogotsi argued that they were taught by the elders in Setswana about this particular celestial bodies. The Bushman also have narratives of celestial bodies associated with hunting. Merriam (1974) agrees with the above and indicates that even among the Songye people of Zaire the Belts stars are *pibwe na mbwa na nyama* (a man, a dog and animal).

The association of rising of asterism and the appearance of new pigs is a very interesting aspect. Interviews and focus group discussions with IK experts showed that they knew the reproductive behaviours of animals such as wild pigs and they used them in order to interpret and understand the celestial bodies. In Shona language, the three celestial dogs are called *Mbwa* and were closely associated with the wild pigs. The study agrees with Snedegar (1995) that the motif of these stars chasing or hunting each other was a current among diverse African people and it provides evidence of the transmission and transformation of folk information in Africa.

Among South Africans the Orion Belt and Sword formed an asterism (Snedegar, 1995). In modern observational astronomy asterisms are different from constellations. In this study, the IK experts did not make any difference between the definitions of asterism and constellations, but one can make conclusion that they were aware of group of stars in the night sky. Asterisms were known in many early civilizations.

6.5.2.7 The case of *kgora le tlala*

According to IK experts in the study communities' in the past celestial bodies were used to predict the year of drought / famine and good harvesting. This was very important among the Bakgatla, due to fact that they relied on planting of crops and livestock keeping. The Bakgatla used the two celestial bodies known as "*kgora*" (Large Magellanic Cloud) which signify (good harvest, plenty of food) and '*tlala*' (Small Magellanic Cloud) signify drought or famine.

Interviews with IK experts showed that the two celestial bodies (*kgora le tlala*) follows *dintsa le dikolobe* and they form a large enclosure with the Milky Way. Mme Ntikoe Motlotle states that *kgora* is always on the right hand side and *tlala* is always on the left hand side of the night sky. According to Mme Ntikoe Motlotle *tlala* symbolises drought that is why it is faint looking. IK experts during focus group discussions showed that the appearance of *kgora* shining brightly, it socio-cultural symbolic meaning is prosperity and happiness in the community due to fact that it is an indication that hunger "*tlala*" will disappear.

Mme Masuku showed that on top of the Milky Way there are these two stars (*kgora le tlala*) which we use to predict the year. The year of drought is predicted with the appearance of a bright "*tlala*", and the good year is predicted when *tlala* becomes dark and *kgora* shines brightly. The information from the participants in this research confirm the position raised by Medupe (2005) that the two bodies, Large and Small Magellanic Clouds are two satellites galaxies of the milky Way. The reason according to Medupe (2005) is that there is a considerable amount of dust in the air during the periods of drought. The Small Magellanic Cloud is less visible than the Large Magellanic Cloud in these conditions, and was consequently associated with drought.

Once the drought season pass, then we will be rejoicing in harvest. When it is a year of drought, you will see the grass, trees and plants in general looking faint and dry. During the years of *kgora*, the plants and trees are happy and green. After the drought, we experience massive amounts of rainfall which causes floods. *Kgora le tlala* are visible to the naked eye and they are galaxies like the Milky Way.

6.5.2.8 The case of *molalatladi*, *motshe wa godimo*, *serogabolopo*

The IK experts in the study communities shared their view about *motshe wa godimo* (rainbow), *molalatladi* (Milky Way), *serogabolopo* (unidentified star) and the differences between the three phenomena. This was very important in the study due to the fact that some literature reviewed has

done very little with regard to clarifying the distinctions between the above mentioned three celestial bodies. Some of the literature has actually created confusion, and misrepresentations about *molalatladi*, *serogaboloko*, *motshe wa godimo*.

One of the findings of the study which the research did not come across in the reviewed literature was the name of the celestial bodies called *magwasigwasi*. This name of *magwasigwasi* was actually mentioned by IK experts in Mochudi. The researcher identified that not even a single IK expert in Moruleng made mention of the name *magwasigwasi*. However, the IK experts in Mochudi indicated that *magwasigwasi* is another nomenclature for *selemela* which is a group of stars.

The participants in the study showed that the Milky Way is one of the most observed and interesting phenomena in the night sky. In modern astronomy it is a galaxy or often referred to as the city stars which appears at night and does not have colour. The participants in the study argued that during spring season, the Milky Way turns around and faces the West, while its tail is facing the East and during the winter season, the Milky Way crosses in front of the moon but in summer it turns and faces the moon.

According to Watson (1983) the Northern Basotho referred to the Milky Way as *molalatladi* which means the sleeping place of lightning bird. Among the Zulu it is called *umThala*. For the Xhosa it was called *Um-nyele*, meaning the raised bristles along the back of the sky (Snedegar, 1995). Kuper (1986) one of the titles for the Swazi king the king pillar of traditional Swazi society, is called the Milky Way.

Faye (1923) points that a Zulu regiment enrolled by King Mpande bore the nicknamen *umtala wezulu*. Clegg, (1986) among the Batswana, *molalatladi* is also called *molalakoko*. However, this study cannot confirm the nomenclature mentioned by Glegg due to the fact that the participants in the study communities did not mention the name *molalakoko*.

Among the Batswana *Motshe wa godimo* is called the rainbow and it normally appears after the rainfall. The rainbow has three colours and it is also one of the interesting phenomena in the sky with its aesthetic beauty. According to the participants in Mochudi *motshe wa godimo* means that before we all came there were our forefathers who came before us whom we now refer to as ancestors. Those are the ones who were telling people that the rain has stopped by way of *motshe*

wa godimo. When you see it you knew that the rain has stopped and now you can hobble the cattle in preparation for ploughing.

Among the Bororo a rainbow was likened to a giant Anaconda for which they had a great deal of respect (Fabian, 2001). The snake and rainbow connection occurs elsewhere in South America. To the west of the Bororo, runa in the Peruvina Andes consider rainbow to be a ginat, two - headed serpents, whose arching bodies connect their heads located in two springs.

Among the Equitorial Eastern Tambira of Brazil, the rainbow is called “person of the rain” and is perceived to have its own resting in the open mouths of two sucuriju snakes, which themselves yields rain and may also be an avenue by which snakes ascend to the sky (Nimuendaju, 1946). It seems to be viewed by these people as a sign that the rain has come to an end. Not much is recorded from the participants in the study community about the rainbow but they differentiated it from the Milky Way.

The study has identified that numerous published literature on celestial bodies and belief system of Batswana, confuse the Milky Way and rainbow as if they are one and the same thing. In this study, a conclusion has been made that the Bakgatla -Baa- Kgafela indigenous astronomy has cross cultural significance.

The IK experts in the study area indicated that *serogabolopo* is a cousin / brother to “*motshe wa godimo*”. They indicated that it is smaller and it does not end. It has colours which look like a rainbow but it is not a rainbow. The symbolic meaning of *serogabolopo* is rain. It was used by the community members to predict rain.

Serogabolopo is half the size of *motshe wa godimo*. This was also confirmed by Breutz (1969) that rain is due when *serogabolopo* reaches zenith. *Serogabolopo* comes from the two words *roga* (to swear or insult) and *baloga* (to blurt out). In modern astronomy there is a full and partial rainbow, which means that the explanation from the participants with regard to *motshe wa godimo* and *serogabolopo* makes sense.

6.5.2.9 The case of sedumedi

Among the Bakgatla -Baa- Kgafela in Mochudi and Moruleng, some of celestial phenomena were linked to traditional leadership. For instance, *sedumedi* is a biggest star in the sky which symbolizes

the death of a traditional leader in the community. It announces a death of a King. Mme Joyce Pule narrated her experience of *sedumendi* as follows:

“This is a true story during the summer season in 1958. It was in the evening at around 19:00 it emerged here and it fell over there with a huge light. It shot through to the West and fell down. It was in 1958 when Kgosi Molefi passed away in Botswana. After it fell, we heard a sound of a door opening and then suddenly another sound like the door is shutting! The next day, we were told of the passing of Kgosi Molefi. I am telling you the truth, I experienced this about *Sedumedi*. It was announcing the passing of a King. A King is not just anybody. But there are other people who can be announced by this star. They are there people of God’s image who can be announced by this star”.

From the above narrative, it is evident that the Bakgatla were aware of regular stars in the night sky, constellations, and appearance of meteor showers, shooting stars and comets. Fabian (2001) meteors are often called shooting or falling stars which are bits of interplanetary debris, such stone or metal ores, in our solar system that ignite from the friction of collision with our atmosphere and appear briefly, if occasionally brilliantly, as a flash light in the night sky. A comet is much more distant and occasional feature of the night sky, a ball of frozen matter and gas, that becomes visible and displays a characteristic tail as it burns while nearing the sun in its orbit (Fabian, 2001).

Comets appears unexpectedly, they are bright and unpredictable phenomena in the solar system and they fall into two distinct groups (Mack, 1987). There are over 100 short period comets, they are faint and not visible in amateur equipments. The second class comprises of long period comets which are numerous and brighter (Mack, 1987). Comets consist of three basic parts, a nucleus, a coma and a tail (Mack, 1987).

From the data collected among participants, *sedumedi* was regarded as a big star visible in the night sky. It has a long tail and it makes a lot of sound when it goes down. It is normally linked to the death of traditional leader in the community. The information collected from the community corroborates with the explanation provided in literature by Fabian (2001), Mack (1987) and Snedegar (1995). The Bakgatla -Baa- Kgafela had a belief that celestial bodies, natural environment and human beings had a reciprocal relationship.

It makes sense that the Bakgatla -Baa- Kgafela when they talk about *sedumedi*, they are actually refers to a comet in modern astronomical terms. In addition, the participants in the study community could differentiate between the shooting stars and the comet. Shooting stars were regarded a lucky star or a symbol of good fortune or luck among the community, while comets were belived to symbolize death of a traditional leader as verified by participants in the study.

6.6 Ngwedi le dithuto tsa mainane

The lunar mythology or *ngwedi le dithuto tsa mainane* was very important among the Bakgatla. Mack (1987) points that the moon is the only natural satellite of the Earth. According to modern astronomy, the moon was formed billions of years ago and there are theories including explanations of this formation. It is one of the brightest celestial bodies visible to the naked eye and have also influenced the development of lunar astronomy.

The Soviet Union and the United States are well known for conducting lunar programmes in the 1950s and made controversial and often contested claims of reaching the moon using spacecrafts. Modern lunar astronomy has developed the geological understanding of the foundation of moon, its internal construction and history.

In order to ascertain weather the participants were familiar with the indigenous lunar mythology, they were asked questions about the nature of the moon and its changing phases. Participants in the study indicated that there are mythologies about the moon which is knowledge transmitted during the evening by the fireplace.

Mme Joyce Pule in Motlhabe narrated as follows: We used to see a man pulling a tree branch. A man pulling a tree branch inside the moon. And then we would ask what he was doing inside the moon? They would tell us that it was a man who committed a sin long long time ago and he was punished by making him to pull that tree branch inside the moon. That is what we were told when we grew up. The above narrative is similar to the one by Rre Mogotsi as follows:

Go ya kitso ya bolepa-dinaledi jwa Sekgatla, go na le setshwantsho sa monna mo ngwedding. Monna yo o sikere selepe. Selepe se se dule le go bonala ka fa morago. Monna o, o goga letlhaku.

English version

According to the indigenous astronomy of Sekgatla, there is a there is picture of a man in the moon. This man is carrying an axe. This axe appears at the back. This man is dragging a tree branch.

The above narrative about the mythology of the moon by Mme Joyce Pule and Rre Mogotsi is not a far fetched idea. Interviews with IK experts in the study community indicated that the moon is personified as the woman. This was also confirmed by Leeuw (2007) reference to the moon are deeply woven and common in Setswana. The moon is used to represent a woman in the wall murals of Batswana homes (Leeuw, 2007). The moon is a symbol of light, life, happiness and compassion just like the woman among Batswana.

The Proto-Indo-European religion, the moon was personified as the male god. The ancient Sumerians believed the moon was the God Nanna who was the father of Inanna, the goddess of the planet Venus and Utu, the god of the sun. In Greeco- Roman Mythology, the sun and moon are represented as male and female, respectively (Helios / Sol and Selene / Luna). The above testimony and the views of the participants in this study regarding the mythology of the moon is a living testimony that astrological views of the moon have also a cross cultural significance. This mythologies have been in existence since the time of “Lowe” in case of Bakgatla and since the Bronze Age or time immemorial among various cultures.

Cross culturally, the nature and relationship between sun and moon, and even their gender is different. Among the Quecha-speaking, the sun is perceived as male and woman as moon (Fabian, 2001). In contrary, other cultures portray the moon as male and sun as female. In a nutshell, this study agrees with Leeuw (2007) that the Batswana, including the Bakgatla -Baa- Kgafela in the study communities were fascinated with the moon, such as is displayed in their wall paintings and language, must indicate some knowledge of its cycles.

6.7 Ngwedi le pelegi

The moon was also associated with the reproductive health of woman and young girls. IK experts in the study argued that in the olden days, there were no modern clinics, hospitals offering maternal health. According to the participants, old woman used to teach young girls using the phases of the moon in order to determine their reproductive health. This has also been proved by various literature.

Mme Joyce Mmamotlhatlhedi point that when the moon sets / gets dark it is speaking. It is speaking to the woman, to young girls. When it rises from this side, it is speaking to the girls not woman. When it appears with a small curve, it is speaking to the young girls. It is cursing the young girls.

When it appears from that side and then stays for 7 days, and then after 7 days the girls will be clean and then the boys can enjoy themselves.

The moon has special significance for woman among various cultures including Bakgatla -Baa-Kgafela. This is also similar to the Cahuila of California that the moon is associated with the menstrual cycle and special instructions for girls and woman relevant to menstruation and pregnancy (Bean, 1992). Cross culturally, woman used to gauge their periods using the phases of the moon. The moon is one of significant celestial body among the Bakgatla as attested by the participants.

According to Mme Masuku: “the moon has diverse meaning and it is also connected to pregnancy in Setswana. The grandmothers used to teach the young girls about it so that they know themselves. Nowadays, the young girls of today do not know themselves. They just walk around in the streets, they don’t even know when they are going on their menstrual periods. They just get surprised when it happens. They do not understand themselves. But I think we can teach them rather than being taught by nurses and doctors only. A girl child of then, used to be respectful when they are on their periods they didn’t just walk around in the streets. They would stay at home until the periods ends. They were not even allowed to go to the cattle kraal. It means that when she crosses between the cattle then the cows will miscarry their infants. That is why she was only allowed to be home and not go anywhere because she would endanger the cows and even the goats and all the animals. They are not supposed to walk on top of a girl’s footprints when she is on her periods”.

The above narrative by Mme Masuku indicates the significance of the moon with regard to health and reproductive cycle of young girls or women. This knowledge is found among old Grandmothers who have been teaching young girls in the absence of modern health practitioners and midwives. The following section is about the lunar calendar.

6.8 The lunar calendar

One of the questions in the interview schedule was to find out about the use of the phases of moon as the basis for calendar making. Most of the participants indicated that the moon is a calendar for black people and it different from the English / western calendar. It goes according to its own method. When it emerges / rises this side then the English calendar is usually ahead of it. And when it rises from this side then the English calendar is behind and the moon is ahead of it.

The above is supported by Medupe (2010) that Africans used various calendar systems such as the lunar, while others combined the observation of the moon and stars. According to Medupe (2010), the traditional calendar of the Dogon people of Mali and that of many South African peoples is based on observation of the phases of the moon. The study argues that the influence of modern astronomy and especially the introduction of the Modern calendar system on indigenous time reckoning. The following section is about *ditlha tsa ngwaga*.

6.9 Ditlha tsa ngwaga

Ditlha tsa ngwaga or seasons of the year also played a very important role among the Bakgatla - Baa- Kgafela. IK experts showed that there are four seasons of the year using their own Setswana nomenclature which includes *mariga*, *selemo*, *letlhafula*, *dikgakologo*. During *mariga*, all things, especially the flora dries up and dies. This is the season for winter and cold season. The celestial body associated with this season is called *senakane* and *naka*. This season starts normally from May to August, depending on the hemisphere.

On the other hand, *selemo* is the season associated with cultivation, planting and plenty rain is expected in this season. It is associated with hot weather conditions. Most of the celestial bodies are visible in this season. As indicated in the empirical findings of the study, some seasons include *letlhafula* and *dikgakologo*. Different significant events, ceremonies were held during various seasons of the year, for instance, initiations schools were normally conducted during the winter season.

Most of the IK experts in the study also indicated that the beginning of the year, is probably after *mariga* (winter) season, which is *lwetse* (September). This is supported by Medupe (2010) that, the coming of the rains after the dry winter season, marked the renewal of the year, therefore, New Year starts around September. This is similar to the Ethiopians who also celebrate their new year in September and the Basotho in August. This is contrary to the Gregorian calendar, which indicates that January is New Year.

Among the Bakgatla -Baa- Kgafela, the concept of time is not perceived as a commodity like in Western countries. Time was calculated by using celestial bodies such as the sun and stars. Therefore, there is a relationship between celestial bodies and time among the Bakgatla -Baa- Kgafela. Time is culturally specific and based on events and activities in the community. For

instance, there is the time for planting, harvesting which is also determined by the appearance of particular celestial bodies.

6.10 Ngwao le bolepa - dinaledi

Astronomical heritage or *ngwao le bolepa-dinaledi* is evidence relating to the practice of astronomy and to social uses and representations of astronomy. The study found that the Bakgatla- Baa- Kgafela in Mochudi and Moruleng have tangible and intangible astronomical heritage which needs to be well documented using their own language. This includes history of a site, heritage sites such as *modipe* hill and *letlapa la Ramono*, calculation of calendars, architecture, artefacts which have astronomical connotations.

The study argues that indigenous research, documentation as well as education, public awareness of the astronomical heritage of Bakgatla -Baa- Kgafela is an important step that needs to be taken in order to ensure conservation and protection. Moreover, heritage experts, astronomers and policy makers need to undergo a paradigm shift and take proactive steps to recognise the prominence of astronomical heritage and their significance in communities. The following section is on *bokhutlo ba go fetlha pula*.

6.11 Bokhutlo ba go fetlha pula

Bokhutlo ba go fetlha pula or the end of rainmaking ceremonies is one of the evidence that shows the decline or fading away of indigenous astronomy in the study communities. The participants in the study communities revealed that the traditional leader played a very significant role in terms of rainmaking ceremonies. The traditional leader was the custodian of culture, traditions and customs of the Bakgatla -Baa- Kgafela. One of the responsibilities of the traditional leader was to work with “barok ba pula” rainmakers to ensure that there is rain in the community.

However, due to modernization and the influence of missionary activities, traditional beliefs about rainmaking have been marginalised and the people who used to practice these skills have completely disappeared. Most of the rainmakers who possessed the skill of rainmaking including the traditional leaders had a wealth of knowledge about celestial bodies. In fact they also used their local astronomical knowledge and African Traditional Medicine to conduct ceremonies of rainmaking.

The study argues that the tradition of rainmaking disappeared with time due to the fact that the relationship between the rainmakers and traditional leaders was affected by many reasons such as

the influence of Christianity among the Batswana. Furthermore, the domination of Western astronomy and modern systems of weather prediction marginalised and regarded African ways of doing things as unscientific and irrelevant in the new era.

6.12 Conclusion

Chapter six has addressed one of the objectives of the study which focused on the artistic significance of African indigenous astronomy. From the time of “*lowe*”, the Bakgatla -Baa- Kgafela used their different forms of art including oral art to transmit and promote knowledge of celestial bodies. African indigenous astronomy was passed down from older to young generation using the local language and oral traditions such as poems and songs.

The study has documented numerous songs and poems among the study communities which have indigenous astronomical significance. Most of this songs and poems are on various celestial bodies such as the sun, moon, stars and other constellations. This oral traditions were recorded in local Setswana language and later translated to English and contextual commentary provided. This chapter also discussed the heritage sites that are found in the community which have astronomical significance.

Not much has been discovered with regard to architecture and indigenous astronomy. The study has identified that this is one of the art which is slowly fading away in the study communities. There are no longer people in the communities who are decorating traditional homestead with celestial bodies designs. Previous study titled “The Decorated Homes in Botswana” by Elinah and Sandy Grant (1995) proves that the Batswana had geometric designs and *lekgapho* designs on the traditional homestead which was normally an art practice by woman. There are few illustrations in the publication by Sandy and Elinah Grant (1995) which indicates evidence of designs of celestial bodies on traditional homesteads of Batswana. This is one of the art which is fading away including the art of pottery making and rainmaking ceremonies.

CHAPTER SEVEN: CHALLENGES AND PROSPECTS OF AFRICAN INDIGENOUS ASTRONOMY

7.1 Introduction

African indigenous astronomy is a new and unexplored field, which poses complex challenges and prospects with regard to its promotion and development. The researcher observed that past studies on indigenous knowledge of the stars and constellations were conducted by mainstream institutions, science councils, including academia, archeologists, anthropologists and missionaries from outside the indigenous communities.

Thus far, these studies have not taken into account the importance of investigating the artistic significance of African indigenous astronomy, astronomical heritage of Botswana including the challenges and prospects of this wealth of knowledge. The investigations were conducted without the active participation of indigenous knowledge experts as well as by Western researchers, using Western methodologies, paradigms and language.

It is on the basis of this consideration that this chapter discusses the Bakgatla -Baa- Kgafela community members' perspectives on the challenges and prospects facing the promotion of indigenous astronomy. The chapter is divided into the following sections: challenges facing the promotion and development of indigenous astronomy and prospects of promotion and development of indigenous astronomy.

7.2 Challenges of African indigenous astronomy

IK experts in both study communities indicated that *bolepa-dinaledi* is important knowledge however, it is facing challenges of extinction due to the fact that it is orally transmitted and mostly held by elders. Interviews and focus group discussions with IK experts revealed that African indigenous astronomy is transmitted through songs, poems, riddles and idioms which are mostly in Setswana nomenclature and not written down. Most of this oral traditions were performed during the evening or at appropriate times. There is a saying that "if it is not written down, that means it never existed". The study argues that valuable indigenous astronomy of Bakgatla- Baa- Kgafela has been sporadically documented and not harnessed to fit into the current scientific framework.

Secondly, one of the challenges that emanated from the study is that, the IK experts raised the fact that there is general lack of interest among the community, especially the young generation who tend to regard this knowledge as the thing of the past with no relevance in the modern times.

Contrary to this, there seems to be interest in modern astronomy and use of sophisticated equipments such as telescopes.

Thirdly, this knowledge is endangered due to the fact that Africans, especially Batswana have adopted the Western ways of doing things and they are acculturated. For example, most of the Batswana in the study communities do not know the name of celestial phenomenon in their own language and let alone the socio-cultural symbolic meaning. However, they are familiar with some of the celestial bodies in English language.

Most of the participants in the study lamented that nowadays people do not spent time outside of the houses anymore, immediately when the sun sets, they go inside the house. Elders do no longer share information with the young. There are no evening sessions where elders sit with the young generation to transmit and teach them the different types of stars.

Fourthly, one of the challenges of African indigenous astronomy is the intergenerational gap between the elders and young generation. In the past, the IK experts were responsible to transmit the knowledge to the younger generation and they were the custodians. However, nowadays, this is no longer the case due to combination of factors.

Fifthly, the Bakgatla -Baa- Kgafela are living in the areas which often are faced with heavy rains, winds and other natural disasters. In the past, the community used some of the celestial phenomenon as early warning systems against natural disasters. Nowadays, many people in the community do no longer have the skills and know-how to use local indigenous astronomical knowledge to predict rains and other natural disasters.

Finally, the growth and development of African indigenous astronomy is hindered due to the hegemony of modern scientific astronomy which is mainstreamed in the education system while the latter is marginalised and regarded as unscientific and irrelevant. The study suggest that community based and educational projects on *bolepa-dinaledi* needs to be introduced in order to attract the young generation to this discipline. These could be some of the strategies to avert the above challenges.

7.3 Prospects of African indigenous astronomy

With regard to the prospects of African indigenous astronomy, it is important to indicate that although this knowledge was and is still valuable and relevant, there has to be efforts of interfacing it with other astronomy from other parts of the world. The interfacing of African indigenous and modern astronomy could yield positive benefits for both the IK experts, local communities, research institutions and science councils.

Secondly, developing interest and raising awareness among various stakeholders and the youth in general will assist in demystifying and shifting the thinking with regard to the lack of interest and scepticism.

Thirdly, research needs to be encouraged in this area with an aim of shifting the mindset and ensure that indigenous astronomy plays a role in the global knowledge economy and the new era of astronomy. In conclusion, African indigenous astronomy is still relevant in issues of agriculture, natural disaster management and this knowledge could be revisited in terms of policy to ensure its effectiveness.

7.4 Conclusion

The above chapter presented the challenges and prospects of African indigenous astronomy. The study argues that the main challenge with regard to indigenous astronomy is the fact that this knowledge lies with the IK experts who are mostly elders and lack of systematic research and documentation will contribute towards its extinction. The young generation regards this knowledge as the thing of the past with no relevance to the current way of life. It is important to ensure that institutions such as Phuthadikobo and Mphebatho museum collaborate with universities, science councils and education institution to develop programmes and projects that can promote this knowledge. The concept of “*maitiso*” an evening gathering with the elders around the fire place needs to be encouraged in local communities. The concept of *maitiso* can also be used as an approach in indigenous research. This method or approach is cost effective, use friendly and effective in ensuring the validity, reliability and trustworthiness of data.

CHAPTER EIGHT: CONCLUSION AND RECOMMENDATIONS

The study focused on African indigenous astronomy of Batswana in Mochudi (Botswana) and Moruleng (South Africa). The main aim of the study was to investigate, analyse and document African indigenous astronomy of Bakgatla -Baa- Kgafela in Mochudi and Moruleng. The objectives of the study were formulated and presented in chapter one. The study argues that from the time of “Lowe” the Bakgatla -Baa- Kgafela observed the appearance and movements of celestial bodies. However, the domination of modern astronomy and the influence of modernization pose a threat to the existence of African indigenous astronomy.

The rationale for selecting Bakgatla -Baa- Kgafela in this study is based on the fact that they share the same totem, history, traditions, culture, traditions and language. They also trace their origin to one lineage. The study therefore argues that the Bakgatla -Baa- Kgafela in the study communities have a rich indigenous astronomy which is often overlooked. During the time of apartheid regime in South Africa and the hegemony of Britain in Botswana, this knowledge had not been given the attention it deserves.

One of the problem statement that guided this study is that African indigenous astronomy is a thin area in research. However after careful review of literature, the study concludes that there is available and published research on this topic, however, such research is scattered, peripheral and most of it was conducted by foreign researchers, anthropologists and missionaries. Although previous research provided the basis for this study, an observation was made that most of this published work is misleading, contradictory, inaccurate and documented in foreign languages such as English.

In addition, despite lack of sophisticated equipments such as the telescope, the Bakgatla -Baa- Kgafela have a scientific and systemic approach towards celestial bodies. They have a special and symbiotic relation with the cosmos which plays an important role in their daily life. Hence, the study concurs with current literature that astronomy is the oldest of all sciences and this also applies to the Bakgatla -Baa- Kgafela in the study communities. Among the Bakgatla, the night sky was an interesting experience which was observed mainly during “*maitiso*” or the evening fire with the elders, without the aid of modern telescopes.

The sources of data in this study were mainly “*baitseanape ba kitso ya tlhago*” or IK experts including the existing and relevant published research on African indigenous astronomy. The traditional councils, IKS unit, officials and researchers from Mphebatho and Phuthadikobo museum also played a role in identification of participants in this study. The role of “*baitseanape ba kitso ya tlhago*” was pertinent in this research due to the fact that they are the organic intellectuals, sources and custodians of this knowledge.

Therefore, the study argues that the future of African indigenous astronomy is in the hands of *baitseanape ba kitso ya tlhago* in collaboration and partnership with other relevant stakeholders such as research institutions and science councils. The study also showed that Bakgatla -Baa- Kgafela use of the Setswana nomenclature is at the core of knowledge of celestial bodies. Hence, this knowledge need to be documented, researched in indigenous languages and later translated to other languages.

The findings of the study revealed that, generally, the Bakgatla -Baa- Kgafela both in Mochudi (Botswana) and Moruleng (South Africa) have a rich indigenous astronomical knowledge. This knowledge was used in agriculture, reproductive health, navigation, time calculation, calendar making, rainmaking, thanksgiving ceremonies and natural disaster management. Furthermore, indigenous sayings or oral traditions such as songs, poems were used as vehicles to transmit knowledge of celestial bodies to the young generations. The elders used stories and mythology to teach the young about indigenous astronomical knowledge.

The evidence and examples provided in this study can be used to demonstrate that indigenous astronomy is relevant in modern times and can be interfaced with modern astronomy. Indigenous astronomy is not just knowledge in the minds of the elders, it is often hidden and expressed in the arts such as pottery making and architecture. Bakgatla -Baa- Kgafela used to make pottery and build traditional homestead with decorations of celestial bodies. However, this art is also fading away due to the fact that there are few elders in the community who possess this skills of pottery.

Within the study communities, there are heritage sites which have astronomical significance and needs to be restored and preserved. Astronomical heritage is also one of the themes which emerged in this research. In summation, the domination of Western knowledge marginalised the role of indigenous astronomy in the community. Despite this marginalisation, the Bakgatla -Baa- Kgafela in Mochudi and Moruleng village, like other African indigenous communities, preserved this

knowledge for their day to day survival. Community members in the study community were given the opportunity to express their knowledge of indigenous astronomy found in the community in their own language. The study summarises the following aspects from the community's perspective:

- i) The knowledge of stars and other constellations in the community was used for understanding and predicting seasonal weather changes, food security (hunting, gathering, farming), calendars, human reproduction, rainmaking, healing practices and navigation.
- ii) The Bakgatla -Baa- Kgafela community members possessing knowledge of Setswana indigenous astronomy were mostly the IK experts who are elderly and with no formal educational qualification. In addition, woman participants in the study communities seemed to be the one who are knowledgeable on indigenous astronomical knowledge because this had been orally conveyed for generations through local proverbs, songs, myths and stories. They were eager to share this knowledge with the youth and promote it for posterity.
- iii) The Bakgatla -Baa- Kgafela had a wide knowledge of stars and other constellations, expressed in local names such as "*Selemela*", "*Mphatlalatsane*", "*Dikolobe*", "*Naka*", "*Kgogamasigo*", "*Molalatladi*" ("*Molawagodimo*") etc. These stars had specific meanings, uses and significance to the community's livelihood.

8.1 Recommendations

It is on the basis of the above findings that the following recommendations are offered:

- i. African Indigenous astronomy is an interesting field which needs to be adequately documented. Systematic documentation of this wealth of knowledge will not only benefit the indigenous communities but also other relevant stakeholders. From the findings of the study it is clear that this knowledge was transmitted orally, hence it is in danger of extinction if not systematically captured and stored. There are various strategies of documentation which can be used including the use of modern science and technology such as videos, films, photos, etc. Resources, like textbooks and journals, need to be developed.
- ii. From the findings of the study, African indigenous astronomy like indigenous knowledge systems was subjected to Western research methodologies and methods. Hence, the study recommends the decolonisation of research methodologies and development of theoretical frameworks which are relevant and appropriate. These studies should be conducted using

indigenous research methodologies, ways of knowing, languages and from the perspectives of the relevant communities.

- iii. There is a need to develop a critical mass of African indigenous researchers and scientists to conduct holistic indigenous research on African indigenous astronomy. Hence, the study recommends further research to be conducted in order to gain more knowledge this area.
- iv. The government, in collaboration with local communities, education institutions, policymakers and other stakeholders should develop partnerships and networks in order to preserve, protect, promote and develop African indigenous astronomy.
- v. The integration of African indigenous and modern astronomy is also recommended. This two systems are unique, have different approaches, however, there is a room for co-existence. No knowledge is a solution on its own, hence opening a window of acceptance of the other ways of knowing is crucial to ensure inclusivity, complementarity as opposed to competition and domination.

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ANNEXURES

**ANNEXURE A: LETTER OF PERMISSION TO CONDUCT
RESEARCH**



NORTH-WEST UNIVERSITY
YUNIBESITHI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
MAFIKENG CAMPUS

**FACULTY OF NATURAL & AGRICULTURAL SCIENCES
INDIGENOUS KNOWLEDGE SYSTEMS CENTRE**

Private Bag X 2046, Mmabatho

South Africa, 2745

Tel: (018) 389 2453

Fax: (018) 392 5775

Web: <http://www.nwu.ac.za>

To: Whom it May Concern

10/11/2017

Dear Sir/Madam

PERMISSION TO CONDUCT RESEARCH: M KOITSIWE (16126564)

This communique serves to confirm that Mr Motheo Koitsiwe is a registered student at the IKS Centre, North West University, Mafikeng campus, Faculty of Natural and Agricultural Sciences is (Student No: 16126564). He is currently working towards a Doctoral degree in Indigenous Knowledge Systems and planning to complete at the end of December 2017. Mr Koitsiwe's research is titled "African Indigenous Astronomy of Batswana in Botswana and South Africa". The study communities chosen for this research are the Bakgatla -Baa- Kgafela in Mochudi (Botswana) and Moruleng (South Africa). The two communities were selected due to the fact that they share the same philosophy, thoughts, cultural history and traditions. Mr Koitsiwe has been given permission by NWU to collect data at the Bakgatla -Baa- Kgafela, Moruleng, Moses Kotane Region, North West Province and in Mochudi (Botswana) therefore, would like to modestly request your assistance in this regard.

Regards.

Prof A.M Masoga

Supervisor

0837580321

Prof JSS Shole

Co Supervisor

0824917188

**ANNEXURE B: LETTER OF RESPONSE FROM BAKGATLA-
BAA-KGAFELA IN MOCHUDI (BOTSWANA)**

"IPELEGENG BAKGATLA"

KGOTLA KGOLO YA BAKGATLA
P.O. BOX 50 MOCHUDI
BOTSWANA



TEL: (+267) 5777415
5777209
FAX: (+267) 5777216
E-MAIL: kgafela@botsnet.bw

SEDIBELO MOLLO SE A FSWA SE A TSHOLOGA

REF: TAC/7 II (140)

25TH October 2017

TO WHOM IT MAY CONCERN

BAKGATLA BA KGAFELA TRIBAL ADMINISTRATION

This serves to confirm the Bakgatla Tribal Administration on the 26th October 2017 granted permission to a request made by North West University IKS Centre to conduct a study on African Indigenous Astronomy of Bakgatla in Botswana.

The study is conducted by Mr Motheo Koitsiwe who is a University student. His intension is to conduct a research on African Indigenous Astronomy of Bakgatla in Botswana and republic of South Africa.

Please allow and assist him to conduct the said study.

Thank you.

SR
Segale B. Linchwe
KGOSI SEGALE B. LINCHWE



KGOSING • MABODISA • MOREMA • TSHUKUDU • MANAMAKGOTE

**ANNEXURE C: LETTER OF RESPONSE FROM BAKGATLA-
BAA-KGAFELA IN MORULENG (SOUTH AFRICA)**



**DEVELOPMENT
& WELFARE (Pty) Ltd**

BAKGATLA BA KGAFELA TRADITIONAL COUNCIL APPROVAL

This is to confirm that Bakgatla ba Kgafela Traditional Council approved a request received from North West University IKS Centre for Mr. M Koitsiwe who is studying towards Doctoral degree in Indigenous Knowledge Systems in the faculty of Agriculture, Science and Technology to do research study amongst some of Bakgatla ba Kgafela communities. His research topic is "African Indigenous Astronomy of Batswana In Botswana and South Africa". Our IKS Unit will assist with identification of knowledge holders with understanding of indigenous Astronomy.

Bakgatla ba Kgafela is looking forward to assist you.

Regards,

L Chabell

Stand 10117 | Makresjeng Section | Moruleng Boulevard
Northwest Province | Republic of South Africa
Tel: 014 556 7000 | Fax: 014 556 1718
Email: info@bbkta.co.za
Website: www.bbkta.co.za

ANNEXURE D: INTERVIEW GUIDE

Annexure One: Mametlelo ya Ntlha

Interview Guide for Indigenous knowledge experts:

Kaedi ya baltseanape ba kitso ya tlhago

Section A. The nature and types of indigenous astronomy

Karolo A: Sebopego le mefuta ya bolepa-dinaledi

1. According to your own perspective what is indigenous astronomy?
Go ya ka wena, bolepa-dinaledi ke eng?
2. Are there any indigenous astronomers in the community today?
A go na le balepa-dinaledi mo setšhabeng sa segompieno?
3. Can you explain the nature of indigenous astronomy?
A o ka tlhalosa sebopego sa bolepa-dinaledi?
4. What are the types of indigenous astronomy found in your community?
Ke mehuta efe ya bolepa-dinaledi mo setšhabeng sa gaeno?
5. Where did you learn indigenous astronomy?
O ithutile kae ka ga bolepa-dinaledi?
6. Who are the sources of indigenous astronomy?
O rutilwe ke bomang bolepa-dinaledi?
7. How is indigenous astronomy transmitted to the younger generation?
Bolepa-dinaledi e fetisediwe mo bašweng ka tsela efe?
8. What is the use of indigenous astronomy in your community today?
A bolepa-dinaledi bo na le mosola mo setšhabeng sa segompieno?
9. Do you look at the sky to predict the weather?
A o kgona go bonela pele maemo a bosa ka go lepa Loapi
If yes, what are you looking for and what does it predict?
10. Do you know other things about the sky?
A go dilo dingwe gape tse wena o di itseng ka ga Loapi?
11. What is the relationship between culture and indigenous astronomy?
Ngwao kgotsa mekgwa ya botshelo e gokagana jang le Bolepa-dinaledi?
12. How can we use indigenous astronomy to promote culture?
Re ka dirisa jang bolepa-dinaledi go tsweletsa ngwao?
13. What is the relationship between language and indigenous astronomy?
Puo e gokagana jang le bolepa-dinaledi?

Section B. The value and meaning of indigenous astronomy

Karolo B. Mosola le Bokao ba Bolepa - dinaledi

14. What is the value of indigenous astronomy in your community?
Bolepa-dinaledi bona le mosola ofe mo setšhabeng sa gaeno?
15. What is the meaning of indigenous astronomy in your community?
Bolepa-dinaledi bona le bokao bofe mo setšhabeng sa gaeno?
16. How is indigenous astronomy preserved in your community?
Bolepa-dinaledi bo somarehwa jang mo setšhabeng sa gaeno?
17. How is indigenous astronomy protected in your community?
Bolepa-dinaledi bo sirelediwa jang mo setšhabeng sa gaeno?
18. How is indigenous astronomy promoted in your community?
Bolepa-dinaledi bo rotloediwa jang mo setšhabeng sa gaeno?
19. What are the local names of stars?
A o ka bolela mefuta e e farologaneng ya dinaledi?
20. What is the meaning of each of the stars named above?
A o ka tlhalosa bokao jwa dinaledi tse o di buileng fa godimo?
21. What is the meaning of Selemela in Setswana?
A o ka tlhalosa bokao jwa Selemela ka Setswana?
22. When does it appear in the evening?
Selemela se tlhagelela leng mo maitsoeng?
23. In Setswana what is your understanding of the moon?
O tlhaloganya Ngwedi jang mo setsong sa Setswana?
24. Have you ever seen the moon during the day time and what does this mean?
A o kile wa bona Ngwedi motshegare, le go itse gore seo se kaya eng?
25. List the different phases of the moon?
Balakanya dipaka tse di farologaneng tsa Ngwedi?
26. What is the meaning of the different phases of the moon listed above?
Dipaka tse di farologaneng tse o di buileng fa godimo tsa Ngwedi di kaya eng?
27. Explain how you use the moon to calculate time?
Tlhalosa gore o dirisa jang Ngwedi go bala nako?
28. Explain how you use the moon to calculate calendars?
Tlhalosa gore o dirisa jang Ngwedi go bala matlha a ngwaga?

29. Name the different months according to Batswana.
Balakanya maina a dikgwedi tsa Batswana
30. Explain the meaning of different months according to Setswana.
Tlhalosa bokao ba dikgwedi tsa Setswana.
31. What are the different seasons that you know?
Bolela ditlha tse di farologaneng tsa ngwaga?
32. What is the meaning of different seasons that you know?
Bolela bokao ba ditlha tse di farologaneng tsa ngwaga?
33. Explain in Setswana a rainbow?
Tlhalosa motshe-wa-badimo ka Setswana?
34. What is the Setswana meaning of a rainbow?
Tlhalosa bokao ba motshe-wa-badimo ka Setswana?
35. What is a shooting star?
Motšhotšhonono ke eng?
37. What is the night sky?
Tlhalosa bokao ba loapi la bosigo?
38. Can you identify bright stars in the night sky?
A o ka supolola le go bolela maina a dinaledi tsa diphatsimang?
39. Do you have equipment such as sky map to see exactly what stars are being pointed out?
A lo na le ditlanelwana tse di tshwanang le mmepe wa loapi o o thusang go bona ka nepo gore go supolotswe dinaledi dife?
40. Do you have equipment such as laser pointer to see exactly what stars are being pointed out?
A lo na le ditlanelwana tse di tshwanang le tshupisi ya laser pointer go bontsha ka nepo dinaledi tse di supolotsweng?
41. Do you have any architectural structures that have indigenous astronomy?
A lo na le dikago dingwe tse di amanang le bolepa-dinaledi?
42. Do you have any artefacts that explain indigenous astronomy in your community?
A go na le dibetliwa dingwe tse di ranolang bolepa-dinaledi mo setšhabeng sa gaeno?
43. What is artistic significance connected to indigenous astronomy found in your community?
Bolepa-dinaledi bo ka nna le mosola ofe mabapi le botlhami/botsweretshi?
44. Do you use stories in indigenous astronomy?
A lo dirisa dinaane dingwe mabapi le bolepa-dinaledi?

45. Do you use songs in Setswana astronomy?

A lo dirisa dipina dingwe mabapi le bolepa-dinaledi?

46. Do you use proverbs in indigenous astronomy?

A lo dirisa diane dingwe mabapi le bolepa-dinaledi?

47. Do you use drama in indigenous astronomy?

A lo dirisa mofuta mongwe wa terama jaaka dithamalakwane dingwe mabapi le bolepa-dinaledi?

48. Do you know any heritage sites connected to indigenous astronomy in your community?

A go na le mafelo a boswa a a gokagangwang le bolepa-dinaledi?

ANNEXURE E: FOCUS GROUP DISCUSSION GUIDE

Annexure Two: Mametelelo ya Bobedi

Focus Group Discussions with IK Experts

Dipuisano le sethlopha sa baitseanape ba kitso ya tlhago

Section A. The nature and types of indigenous astronomy

Karolo A: Sebopego le mefuta ya bolepa-dinaledi

1. According to your own perspective what is indigenous astronomy?
Go ya ka wena, bolepa-dinaledi ke eng?
2. Are there any indigenous astronomers in the community today?
A go na le balepa-dinaledi mo setšhabeng sa segompieno?
3. Can you explain the nature of indigenous astronomy?
A o ka tlhalosa sebopego sa bolepa-dinaledi?
4. What are the types of indigenous astronomy found in your community?
Ke mehuta efe ya bolepa-dinaledi mo setšhabeng sa gaeno?
5. Where did you learn indigenous astronomy?
O ithutile kae ka ga bolepa-dinaledi?
6. Who are the sources of indigenous astronomy?
O rutilwe ke bomang bolepa-dinaledi?
7. How is indigenous astronomy transmitted to the younger generation?
Bolepa-dinaledi e fetisediwe mo bašweng ka tsela efe?
8. What is the use of indigenous astronomy in your community today?
A bolepa-dinaledi bo na le mosola mo setšhabeng sa segompieno?
9. Do you look at the sky to predict the weather?
A o kgona go bonela pele maemo a bosa ka go lepa loapi
If yes, what are you looking for and what does it predict?
10. Do you know other things about the sky?
A go dilo dingwe gape tse wena o di itseng ka ga loapi?
11. What is the relationship between culture and indigenous astronomy?
Ngwao kgotsa mekgwa ya botshelo e gokagana jang le Bolepa-dinaledi?
12. How can we use indigenous astronomy to promote culture?
Re ka dirisa jang Bolepa-dinaledi go tsweletsa ngwao?

13. What is the relationship between language and indigenous astronomy?

Puo e gokagana jang le Bolepa-dinaledi?

Section B. The value and meaning of indigenous astronomy

Karolo B. Mosola le Bokao ba Bolepa - dinaledi

14. What is the value of indigenous astronomy in your community?

Bolepa-dinaledi bona le mosola ofe mo setšhabeng sa gaeno?

15. What is the meaning of indigenous astronomy in your community?

Bolepa-dinaledi bona le bokao bofe mo setšhabeng sa gaeno?

16. How is indigenous astronomy preserved in your community?

Bolepa-dinaledi bo somarelwa jang mo setšhabeng sa gaeno?

17. How is indigenous astronomy protected in your community?

Bolepa-dinaledi bo sirelediwa jang mo setšhabeng sa gaeno?

18. How is indigenous astronomy promoted in your community?

Bolepa-dinaledi bo rotloediwa jang mo setšhabeng sa gaeno?

19. What are the local names of stars?

A o ka bolela mefuta e e farologaneng ya dinaledi?

20. What is the meaning of each of the stars named above?

A o ka tlhalosa bokao jwa dinaledi tse o di buileng fa godimo?

21. What is the meaning of Selemela in Setswana?

A o ka tlhalosa bokao jwa Selemela ka Setswana?

22. When does it appear in the evening?

Selemela se tlhagelela leng mo maitsiboeng?

23. In Setswana what is your understanding of the moon?

O tlhaloganya Ngwedi jang mo setsong sa Setswana?

24. Have you ever seen the moon during the day time and what does this means?

A o kile wa bona Ngwedi motshegare, le go itse gore seo se kaya eng?

25. List the different phases of the moon?

Balakanya dipaka tse di farologaneng tsa Ngwedi?

26. What is the meaning of the different phases of the moon listed above?

Dipaka tse di farologaneng tse o di buileng fa godimo tsa Ngwedi di kaya eng?

27. Explain how you use the moon to calculate time?

Tlhalosa gore o dirisa jang Ngwedi go bala nako?

28. Explain how you use the moon to calculate calendars?
Tlhalosa gore o dirisa jang Ngwedi go bala matlha a ngwaga?
29. Name the different months according to Batswana.
Balakanya maina a dikgwedi tsa Batswana
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A lo dirisa dinaane dingwe mabapi le bolepa-dinaledi?

45. Do you use songs in Setswana astronomy?

A lo dirisa dipina dingwe mabapi le bolepa-dinaledi?

46. Do you use proverbs in indigenous astronomy?

A lo dirisa diane dingwe mabapi le bolepa-dinaledi?

47. Do you use drama in indigenous astronomy?

A lo dirisa mofuta mongwe wa terama jaaka dithamalakwane dingwe mabapi le bolepa-dinaledi?

48. Do you know any heritage sites connected to indigenous astronomy in your community?

A go na le mafelo a boswa a a gokagangwang le bolepa-dinaledi?

ANNEXURE F: INFORMED CONSENT (MOCHUDI)



NORTH-WEST UNIVERSITY
YUNIBESITHI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
MAFIKENG CAMPUS

FACULTY OF NATURAL & AGRICULTURAL SCIENCES

INDIGENOUS KNOWLEDGE SYSTEMS CENTRE

Private Bag X 2046, Mmabatho

South Africa, 2745

Tel: (018) 389 2453

Fax: (018) 392 5775

Web: <http://www.nwu.ac.za>

INFORMED CONSENT FORM

Title of project: African Indigenous Astronomy of Batswana in Botswana and South Africa

Name of researcher: Motheo Koitsiwe

Researcher's institution: North West University, Mafikeng campus

Name of main supervisor: Prof M.A. Masoga

Name of co-supervisor: Prof J.S.S Shole

Purpose of the study: PhD IKS

PARTICIPANT INFORMED CONSENT

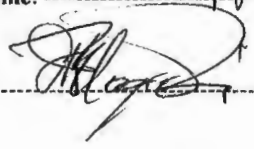
The purpose of the study and the extent to which I will be involved was explained to me by the researcher or another person authorized by the researcher in a language which I understood. I have understood the purpose of the study and the extent to which I will be involved in the study. I unreservedly agree to take part in it voluntarily. I understand that I am free to withdraw from the study at any stage at my own will. I am aware that I may not directly benefit from the study. I am made aware that my response will be recorded anonymously and that I may be video or audio taped for the purpose of this research.

Signed at Machuelo on the date 23-11-2017

By (full names) Joseph Mubung Mopedi

Address P/Bag 005 Machuelo

Witness name: Albert

Signature:  date 23/11/2017

Endorsed by the Supervisor/s

Name-----

Signature----- date-----

ANNEXURE G: INFORMED CONSENT (MORULENG)



NORTH WEST UNIVERSITY
YUNIBESITHI YA BOKONE-BOPHIRIMA
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Purpose of the study: PhD IKS

PARTICIPANT INFORMED CONSENT

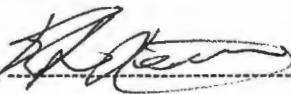
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Signed at Morweng
MANAMAKGOTHA on the date 06/10/2017

By (full names) KIBELO LINDA NELSON

Address HOUSE NO. 30067

Witness name: ROSEHM NOLOPAT

Signature:  date 6/10/2017

Endorsed by the Supervisor/s

Name-----

Signature----- date-----